Understanding and Applying the Concept of Sustainable Development to Transportation Planning and Decision-Making in the U.S.

by
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V.1

To Molly

For her love, patience, strength, and support during
the development of this dissertation

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Abstract

This research demonstrates that sustainable development is a multidimensional concept that should be approached in a transdisciplinary manner. Its objective has been to synthesize and integrate disparate and currently unconnected lines of thought that have not yet been applied in a systematic way to promote sustainable development and sustainable transportation. The primary contribution of this research is the theoretical development of a decision-support framework that identifies the tools and approaches that decision-makers could/should use to create policies and programs that transition society towards sustainability. These tools and approaches are either articulated or developed by the author throughout the dissertation. Specific ideas explored include a Rawlsian/utilitarian decision-making philosophy; a hybrid trade-off/positional analysis framework that is presented as an alternative to benefit-cost analysis; ecological vs. environmental economics; participatory backcasting; and ways to stimulate disrupting and/or radical technological innovation.

To identify gaps that exist between theory and practice, the approach embodied in the proposed sustainable transportation decision-support framework is compared with current metropolitan transportation planning and decision-making processes in the U.S. The framework is then used to consider how the U.S. federal government might move the nation's transportation system towards sustainability.

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1 Introduction

This research aims to encourage a way of thinking that supports the creation of policies for sustainable development. The research has two distinct strands, one that is general and one that is specific. The first considers the theoretical, historical, and political foundations of sustainable development and approaches the subject in a transdisciplinary manner - i.e., it is not constrained by disciplinary boundaries. It also articulates and develops a series of organizing frameworks through which policy interventions and instruments for sustainable development might be designed and integrated. The outcome of the first strand is the creation of a multidimensional approach towards understanding and acting upon sustainable development.

The second strand applies the concept of sustainable development to transportation, with an emphasis on the federal government's role in achieving sustainable transportation. By pulling together the organizing frameworks of sustainable development, a sustainable transportation decision-support framework is created. In an effort to understand the potential gaps between the current and what is considered by the author to be a more sustainable approach to transportation planning and decision-making, several important ideas from the proposed decision-support framework are compared with the current practices of Metropolitan Planning Organizations (MPOs). The second strand concludes by considering potential models that could enable a national strategy/policy for sustainable transportation to be developed. In addition, the actions that the U.S. federal government could/should take to move the nation's transportation system towards sustainability are identified.

The research is guided by the following three propositions:

- Sustainable transportation is directly linked to, and must be conceptualized within, the broader framework of sustainable development;
- The field of sustainable transportation is sufficiently understood for its objectives to be pursued through transportation legislation; and
- The proposed sustainable transportation decision-support framework provides the federal government (particularly the U.S. DOT) with a road map for developing policy that will move the transportation system towards sustainability.

In general, this dissertation should be considered as the first stage of a comprehensive and long-term research agenda. It presents the rationale for, and theory behind, an integrated and coherent set of tools and approaches that could be used to promote and operationalize the concepts of sustainable development and sustainable transportation. However, because the broad scope of the research has prevented the rigorous testing of the ideas presented, additional research is needed to assess how well the tools and approaches perform in practice.

1.1 Research Objectives

The objectives of this research are ambitious. They are to:

1. Understand and articulate the concept of sustainable development in general, and apply this concept to transportation;
2. Develop a decision-making philosophy and associated sustainable transportation decision-support framework that incorporates the objectives of sustainable development;
3. Develop a set of metrics that link sustainable development and sustainable transportation;
4. Assess Metropolitan Planning Organization (MPO) planning and decision-making processes to identify the extent to which the proposed decision-making philosophy and decision-support framework is reflected by MPO current attitudes and practices, and identify what would need to occur in order for MPOs to adopt the proposed philosophy/framework; and
5. Assess the federal government's role in transportation and develop a comprehensive set of actions that the federal government could/should use to promote a sustainable transportation system.

1.2 Dissertation Outline

The idea that the purpose of development is to meet human needs is central to the concept of sustainable development. However, while many texts endorse this idea, they often fail to provide a meaningful discussion of what 'meeting human needs' actually entails. Chapter 2 begins by defining human needs from both a philosophical and psychological perspective and shows how these relate to the idea of human development envisioned by the United Nations.

In addition to identifying a framework to consider human needs, Chapter 2 addresses the question of equity - a fundamental component of sustainable development. The discussion focuses on the appropriate role of government in ensuring that human needs are met in an equitable manner. Drawing upon social contract theory, a Rawlsian/utilitarian decision-making philosophy is developed to support decision-making for sustainable development. This 'pluralistic moral philosophy' considers both utilitarian concerns and individual rights and freedoms rather than relying on a single philosophical view for decision-making. First and foremost, it places *social equity* at the center of decision-making. Second, it supports the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society. Finally, it makes 'movement' towards a better *environment* a critical component of any new social arrangements. A core argument of this research is that outcomes which lean towards Rawlsian solutions are more likely to move a society towards sustainable development than purely utilitarian ones.

The latter half of Chapter 2 transitions to a focus on rapid technological change and globalization - two important factors that shape the decision-making environment for

sustainable development. A central idea in the sustainable development discourse is how inflexible, yet fragile ecological limits are with respect to human activity. The more rigid the limits, the more radical and painful the changes necessary for sustainability become. Given the inherent political difficulties in developing measures to curtail population growth and consumption, many argue that the easiest way to achieve a less environmentally destructive society is to focus on technological innovation. Thus, a number of important concepts are introduced that inform the technological fix paradigm. These include Kondratieff-waves of technological change, the 'I=PAT' formula, the 'factor X' debate, and the rebound effect or Jevons paradox. A particular emphasis is given to the process of technological innovation and the types of changes that are likely to be necessary to transform systems towards sustainable development. Here, the notions of sustaining and disrupting innovation are introduced and the traditional focus on the product domain is extended to include process, product-service, and system innovations.

An important argument of Chapter 2 is that if technology is to advance at a rate necessary to move society towards sustainable development, then a combination of a Schumpeterian and Rawlsian vision of technological development is needed. The Schumpeterian vision suggests that the *creative use of government intervention* (with a focus on both demand and supply-side policies) is a more promising strategic approach for achieving long-term sustainable transformations in technological systems than a focus on policies that promote short-term economic gains. The basic premise is that an evolutionary (laissez-faire) approach to innovation may proceed too slowly to adequately address problems such as climate change and toxic pollution. The Rawlsian vision advocates that any government intervention should ensure that new social arrangements - or investments in new technological systems - make the least advantaged members of society relatively better off. In the context of this thesis, this means a more sustainable future.

Chapter 2 concludes by looking at how technological change *and* globalization might affect development in industrialized and developing nations. The discussion is structured by considering the impact of rapid technological change and globalization through four broad lenses - [1] industrial globalization, [2] the international division of labor, [3] the creation of purchasing power, and [4] technology-enabled capital mobility.

In summary, Chapter 2 articulates a concern for a global future and begins to develop a number of important ideas and frameworks that are used in subsequent chapters.

Chapter 3 presents a comprehensive historical review of the concept of sustainable development. By tracking key events, international conferences/conventions, influential publications, and U.S. legislation from the 1960s to the present day, it has been possible to trace sustainable development from the formation of the U.S. environmental movement in the 1960s, through the rise of international concern for the environment and 'eco-development' in the 1970s, to its final emergence in the 1980s/90s. During this period, the drivers of sustainable development incorporated - to varying degrees and at different times - what have been identified by the author as four different environmental concerns:

1. The disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being;
2. The rapid use of finite resources and energy supplies;
3. The direct impacts of toxic pollution on human health and the health of other species; and
4. The disruption of the global climate.

The first, third, and fourth environmental drivers of the concern for sustainable development are connected with the unintended effects of human development/growth while the second deals with increasing shortages of resources needed to fuel development/growth.

Chapter 3 shows that the concept of sustainable development was, and continues to be, shaped by intense political and academic debates that are informed by important national and international events. These political debates have primarily occurred between industrialized and developing nations that have adopted very different positions on both the causes of unsustainable development and potential solutions. Similarly, the academic debates have focused on the merits of a variety of models and theories established to explain the factors that lead to unsustainable development and generate possible solutions. Both of these debates influenced the first rigorous attempt to define sustainable development, which was undertaken by the Brundtland Commission.

Throughout Chapter 3, sustainable development is viewed as consisting of five elements:
1. Peace and security;
2. Economic development;
3. Social development that includes employment with adequate purchasing power;
4. National governance that ensures peace and development; and
5. Environmental protection.

This conceptualization is consistent with major multinational treaties and the missions of international institutions and presents the 'international view' of sustainable development.

Chapter 3 concludes by looking at the concept of globalization. The discussion provides a context for the ideas presented in Chapter 2 and attempts to address the question of whether globalization presents an opportunity for, or is an impediment to, transitions towards sustainable forms of development.

Chapter 4 provides an overview of what is understood by sustainable development and presents a series of organizing frameworks through which policy interventions and instruments for achieving sustainable development can potentially be designed and integrated. Building on the history and analysis in Chapter 3, it begins by discussing the multidimensional concept of sustainable development using a series of metaphors and discourses. These ways of thinking pull the vast and fragmented literature on sustainable development into a manageable set of fundamental ideas and positions. Following this review, sustainable development is conceptualized in the context of *rapid technological*

change and *globalization*. The argument is made that technology plays an important role in connecting the environment, society, and the economy. For example, technology is the medium through which:

- An economy (the production of goods and services that satisfy needs and wants) interacts with the environment;
- Labor and capital are combined in production (technology is thus an important determinant of the nature of work);
- People are able to enhance their quality of life (e.g., by using technology for mobility purposes, etc.); and
- Competitiveness can be achieved (technology plays an important role within an economy in helping industries and firms produce an adequate level of high quality goods and services).

Similarly, the forces of globalization can affect policy decisions for sustainability. Both developed and developing countries are increasingly subject to influences and constraints derived from their participation in the international economy. This has relevance for two reasons: [1] policy-making in a highly dynamic and interconnected environment is significantly more difficult than in a stable, isolated one; and [2] globalization may act to exacerbate unsustainable, or improve sustainable, trajectories in the areas of environment, economy, and society.

Given the multidimensional nature of sustainable development, an agenda for change is by definition one of system change. Within this context it is argued that government has a crucial role to play in ensuring that a nation and its citizens adopt development patterns that support the basic principles of sustainable development. By moving beyond markets and acting as a trustee for minority interests, future generations, and new technologies - and by encouraging (or guiding) innovation through coordinated (or even better integrated) regulatory, industrial, employment, and trade policy - governments can establish a dynamic environment in which transformations towards sustainability become a real possibility. Having established the important role of government in moving towards sustainable development, the remainder of Chapter 4 sets out the value-laden philosophical bases of different approaches or lenses used to develop policy. These are:

- Environmental and resource economics and hybrid trade-off/positional analysis as an alternative decision-support tool;
- Ecological economics;
- Processes of technological innovation and the role of government in stimulating system transformations towards sustainable development;
- Trade, and international and national/regional markets, as drivers of change;
- Financing for sustainable development; and
- Stakeholder participation and the use of participatory backcasting to identify pathways towards sustainable development.

The hybrid trade-off/positional analysis framework - which includes the Rawlsian/utilitarian decision-making philosophy - is presented as a valuable decision-support tool for sustainable development. In addition, the idea of a 'strong' Porter hypothesis (first formulated at MIT in the late 1970s) - i.e., the use of more stringent

environmental regulation to encourage disrupting innovation - is put forward as a useful way to stimulate system innovations and improve national competitiveness.

Chapter 5 transitions to the selection of indicators to measure progress towards sustainable development. The chapter provides some structure to the extensive literature on sustainable development indicators and introduces a revised framework of national indicators based on the work of the UN Commission on Sustainable Development (UNCSD). This modified set of indicators is referred to as the 'Hall-revised UNCSD indicator framework.' The rationale for focusing on the UNCSD indicator framework is that [1] the stated purpose of the framework is to *harmonize* national-level indicator initiatives and [2] it aligns with four of the five elements of sustainable development articulated in Chapter 3. The revisions to the UNCSD framework were informed by key elements discussed in Chapters 2, 3, and 4.

Having conceptualized sustainable development in Chapters 2, 3, and 4, Chapter 6 shifts the focus of the dissertation towards transportation. It reviews and develops the concept of sustainable transportation, presents a decision-support framework that encourages the creation of transportation policies/programs that support sustainable development, and presents a set of national-level sustainable transportation indicators developed using the Hall-revised UNCSD indicator framework.

With regards to sustainable transportation, the author makes the argument that the prevailing focus is constrained by transportation-centric views that tend to be less cognizant of the wider issues. By exploring the interconnections between the transportation system and the economy, a broader perspective is introduced that considers the transportation system through the lens of sustainable development. The author concludes that it is important and necessary to consider the development of transportation policies and programs from both a sustainable development (i.e., holistic) and sustainable transportation (i.e., transportation-centered) perspective. To help integrate the two approaches, an addition to the prevailing definition of sustainable transportation is recommended.

Building upon this new understanding, a decision-support framework is created that shows how the major organizing frameworks and lenses of sustainable development (introduced in Chapters 2 and 4) can be brought together to form a multidimensional decision-support framework to guide the creation of sustainable transportation policies/programs. This proposed framework provides a clear indication that the creation of a more sustainable transportation system may in some cases require the adoption of a revised value system and a new approach to decision-making for transportation.

Finally, Chapter 6 concludes by showing how the Hall-revised UNCSD indicator framework can inform the creation of a national set of sustainable transportation indicators. The final section also discusses how a set of indicators of sustainable transportation could be used in a trade-off matrix.

Chapter 7 focuses on understanding the potential gaps between the current approach to transportation planning and decision-making and the approach embodied in the proposed sustainable transportation decision-support framework. To this end a questionnaire was developed to assess the extent to which several important ideas from the framework were reflected in current Metropolitan Planning Organization (MPO) attitudes and practices. The questionnaire was sent to transportation professionals in MPOs across the U.S.; the results are analyzed and discussed in this chapter.

In addition to the MPO questionnaire, Chapter 7 documents feedback and information obtained from meetings with several important organizations/agencies in Washington, D.C. to discuss the questionnaire and, more generally, the proposed decision-support framework.

Since it was not feasible to cover all aspects of the proposed framework, the questionnaire focused on four important ideas: [1] the Rawlsian/utilitarian decision-making philosophy; [2] the hybrid trade-off/positional analysis framework; [3] the four environmental drivers of the concern for sustainable development; and [4] the 'strong' Porter hypothesis. In addition, the questionnaire sought to discover how much attention MPOs pay to transportation policy goals. In total, 148 people (14% of the target group) answered the entire questionnaire.

The results from the questionnaire were mixed. In some cases the ideas included in the proposed framework fell outside the MPOs' current planning and decision-making processes; in others, the MPOs were using similar ideas/concepts to those in the framework. An encouraging aspect of the results and feedback from the questionnaire and the meetings in Washington, D.C. was that transportation decision-makers felt there was a real need for new ways of thinking and for tools that support decision-making for sustainable development/transportation.

Chapter 8 continues to explore the transportation decision-making environment, but shifts the focus from the regional to the federal level. Whereas Chapters 2, 4, 5, and 6 adopt a theoretical approach to conceptualizing and addressing problems related to sustainable development/transportation, Chapter 8 adopts a 'real world' approach to creating a national strategy for sustainable transportation. The chapter begins by taking a broad look at the evolving role of federal government in the delivery of transportation services from the 1930s until today. This historical context of the federal role in transportation is followed by an overview of the structure of federal government and the decision-making environment within which transportation policy is developed. Specific attention is given to identifying different models that might enable a national sustainable transportation policy to be established. These are referred to by the author as the *Consolidation of Congressional Committees*, the *Moynihan Model*, and the *U.S. DOT Reinvention Model*.

Next, Chapter 8 looks at current federal policies and programs that support elements of sustainable transportation and reveals a lack of integration between initiatives and a modal - rather than multimodal - approach to transportation. Further, there is a specific bias towards highways within the core federal transportation programs that promotes

automobility. Given these observations, Chapter 8 concludes by considering the federal government's *future* role in achieving sustainability in transportation.

By assuming that a national strategy for sustainable development will remain illusive in the short-term, the final section of Chapter 8 discusses opportunities for an enlightened U.S. DOT to lead efforts towards sustainable transportation. Since the major barrier to this objective is the lack of integrated decision-making within the federal system, careful consideration is given to how the U.S. DOT could lead federal regulatory efforts to overcome problems of *horizontal, vertical, spatial,* and *temporal integration* to promote sustainable transportation. In addition, a set of comprehensive actions that the federal government could/should take to promote sustainable transportation is presented using the structure of the sustainable transportation decision-support framework.

Chapter 9 provides a synthesis of important conclusions from this research. The first part of the chapter addresses a number of fundamental questions. These focus on why there has been limited progress in the U.S. on moving towards sustainable transportation; the tools, approaches, and strategies that can be used to develop a sustainable transportation strategy; and the potential barriers to achieving sustainable transportation and how these can be overcome. This section is followed by an executive summary of unique contributions and future work.

Finally, Table 1.1 provides a road map for the dissertation. To aid navigation, the table identifies and references the critical ideas and concepts that are discussed and developed throughout this dissertation.

Table 1.1: A Dissertation Road Map - Critical Ideas and Concepts and Their Location in the Dissertation

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
History and Background	Major technological transitions (*Section 2.3*)	Emergence of the concept of sustainable development (*Sections 3.2 through 3.4 - all subsections*)		Indicator development during the 21st Century (*Section 5.4*)	The development of the concept of sustainable transportation (*Sections 6.2.1 and 6.2.2*)	The Metropolitan Planning Organization (MPO) (*Section 7.1*)	The evolving role of the federal government in transportation (*Section 8.1*) The transportation decision-making environment (*Sections 8.2 and 8.3.2.3*)
Human Needs	Meeting human needs *(Section 2.1*) Philosophy of ethics and the good life (*Section 2.1.1*) Psychology of human needs (*Section 2.1.2*) Human development (*Section 2.1.3*) Income and well-being (*Section 2.1.4*) Conclusion (*Section 2.1.5*)				Transportation and human needs (*Section 6.2.4.3*)		

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
Equity	Philosophy of ethics and the good life (*Section 2.1.1*) Justice as fairness (*Section 2.2.1*) Equality of opportunity/ capabilities (*Section 2.2.3*)				Transportation and equity considerations (*Section 6.2.4.4*) A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)		Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)
FRAMEWORKS							
Conceptualizing Sustainable Development	Meeting human needs (*Section 2.1*)	Influential publications (*Sections 3.3.1, 3.3.2, 3.3.4, 3.4.2, and 3.4.3*) Influential conferences (*Sections 3.3.3, 3.4.4, and 3.4.5 - all subsections*)	Metaphors and discourses (*Section 4.1.1*) Definitions (*Section 4.1.2*) Conceptualizing sustainable development (*Section 4.1.3*)				

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
FRAMEWORKS cont.							
Conceptualizing Sustainable Transportation					Conceptualizing sustainable transportation (*Section 6.2 - all subsections*)		Federal legislation and programs that support sustainable transportation (*Section 8.3.2.1*) The PCSD's approach to sustainable transportation (*Section 8.3.2.2*)
Sustainable Transportation Decision-Support Framework					Sustainable transportation decision-support framework (*Section 6.3*)	Extent to which the sustainable transportation decision-support framework is reflected by MPOs' attitudes and practices (*Sections 7.2.3 through 7.2.7 - all subsections - and Sections 7.2.9, 7.3, and 7.4*)	Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
FRAMEWORKS cont.							
Rawlsian/ utilitarian Decision-making Philosophy	The social contract and the Theory of Justice (*Section 2.2.1*) The Rawlsian/ utilitarian decision-making philosophy (*Section 2.2.2*)		Visualizing a Rawlsian outcome (*Section 4.1.4*) The hybrid trade-off/positional analysis framework (*Section 4.2.1.5*) Stakeholder participation (*Section 4.2.6*)		Principles of ethical transportation policy (*Section 6.2.4.4*) A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)	Extent to which MPOs are Rawlsian and stakeholders are utilitarian (*Section 7.2.3 - all subsections*) Extent to which specific groups receive benefits from transportation planning and decision-making (*Section 7.2.4 - all subsections*) Assessment of the suggested third principle of justice (*Section 7.2.6 - all subsections*) Conclusions (*Section 7.2.9*)	Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
TECHNOLOGICAL CHANGE AND GLOBALIZATION, INDICATORS, AND INTEGRATION/CO-OPTIMIZATION							
Technological Change/ Innovation	Rapid technological change (*Section 2.3*) Sustaining and disrupting innovation (*Section 2.3.1*) Technology, society, and sustainable development (*Section 2.3.2*) The technology debate (*Section 2.4*) Technological optimism (*Section 2.4.1*) Technological change and globalization (*Section 2.5*)		Using a Trade-off Matrix for Technology Assessment (*Section 4.2.1.6*) Role of government in stimulating technological innovation (*Section 4.2.3 - all subsections*) Static vs. dynamic efficiency (*Section 4.2.3.3*) The 'strong' Porter hypothesis (*Section 4.2.3.4*) Trade, and international and national/regional markets, as drivers of change (*Section 4.2.4*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)	The perception of the Porter hypothesis (*Section 7.2.7 - all subsections*) Washington, D.C. consensus on the 'strong' Porter hypothesis (*Section 7.3*)	The evolving role of the federal government in transportation (*Section 8.1*) Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
TECHNOLOGICAL CHANGE AND GLOBALIZATION, INDICATORS, AND INTEGRATION/CO-OPTIMIZATION cont.							
Globalization	Technological change and globalization (*Section 2.5*)	Globalization as a new dimension of sustainable development (*Section 3.4.6*) What is globalization? (*Section 3.5.1*) Role of government and international organizations in a global economy (*Section 3.5.2*)	Trade, and international and national/regional markets, as drivers of change (*Section 4.2.4*)		The transportation system and the economy (*Section 6.2.3*)		The evolving role of the federal government in transportation (*Section 8.1*)
Indicators				Indexes and indicator frameworks of sustainable development (*Section 5.5 - all subsections*) Hall-revised UNCSD indicator framework (*Section 5.7 - all subsections*) *Appendix A*	A sustainable transportation indicator framework (*Section 6.4 - all subsections*) *Appendix B*		

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
TECHNOLOGICAL CHANGE AND GLOBALIZATION, INDICATORS, AND INTEGRATION/CO-OPTIMIZATION cont.							
Integration/Co-optimization		Transition from conventional to sustainable development (*Section 3.1.1*)	Role of government in sustainable development (*Section 4.1.4*) Trade-off and positional analysis (*Section 4.2.1.4*) Integration of government interventions (*Section 4.2.3.8*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)	Barriers to sustainable development/ transportation and the integration of decision-making across government organizations (*Section 7.3*)	Factors preventing the creation of a national policy on sustainable development (*Section 8.3.1.1*) and sustainable transportation (*Section 8.4 - all subsections*)
ORGANIZING FRAMEWORKS							
Environmental and Resource Economics			Environmental and resource economics (*Section 4.2.1*)				

Critical Ideas and Concepts	**Chapter 2** *Concern for a Global Future*	**Chapter 3** *Emergence of the Concept of Sustainable Development (SD)*	**Chapter 4** *Concepts and Organizing Frameworks for Addressing SD*	**Chapter 5** *Measuring SD*	**Chapter 6** *Sustainable Transportation (ST)*	**Chapter 7** *Perceptions of Transportation Planners/ Decision-makers*	**Chapter 8** *The Federal Role in Achieving ST*
ORGANIZING FRAMEWORKS cont.							
The Hybrid Trade-off/ Positional Analysis Framework			The hybrid trade-off/positional analysis framework (*Sections 4.2.1.4 through 4.2.1.7*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*) Incorporating ST indicators in the trade-off matrix (*Section 6.4*)	Extent to which core elements of the hybrid trade-off/positional analysis framework are considered by MPOs (*Section 7.2.5 - all subsections*)	Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)
Ecological Economics	The technology debate (*Section 2.4*)		Ecological economics (*Section 4.2.2*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)		Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)
DRIVERS/ACTORS							
The Role of Government in Stimulating Technological Innovation	Sustaining and disrupting innovation (*Section 2.3.1*) Technology, society, and sustainable development (*Section 2.3.2*)		The role of government in stimulating technological innovation (*Section 4.2.3 - all subsections*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)	The perception of the Porter hypothesis (*Section 7.2.7 - all subsections*) Washington, D.C. consensus on the 'strong' Porter hypothesis (*Section 7.3*)	Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)

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DRIVERS/ACTORS cont.							
Trade, and International and National/ Regional Markets, as Drivers of Change			Trade, and international and national/regional markets, as drivers of change (*Section 4.2.4*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)		Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)
Financing for Sustainable Development			Financing for sustainable development (*Section 4.2.5*)				
Stakeholder Participation	The Rawlsian/ utilitarian decision-making philosophy (*Section 2.2.2*) Technology, society, and sustainable development (*Section 2.3.2*)		Stakeholder participation - scenario analysis and participatory backcasting (*Section 4.2.6*)		A sustainable transportation decision-support framework (*Table 6.8, Section 6.3*)	Extent to which MPOs use a backcasting approach when developing their transportation plans (*Section 7.2.5 - all subsections*)	Sustainable transportation and the federal role (*Table 8.3, Section 8.4.2*)

2 Concern for a Global Future

As we move into the 21st Century, we do so in a world of significant technological progress, industrialization, and globalization. Our current standard of living is based upon these drivers of modern progress. Energy systems supply power to our homes, places of work, and general environment so we no longer need to be concerned about how to generate light, power our computers and TVs, and heat or cool our living, working, and recreational environments. When we become ill, we find an abundance of modern drugs that can ease or cure our suffering, maintaining or improving our physical and emotional well-being. Global financial and commodity markets hum to the tune of trillions of dollars a day to supply our investment and consumption needs. The agricultural sector, through mechanization and other technological and biological advances, has been able to supply our growing sustenance requirements. Telecommunications systems have enabled friends, families, businesses, organizations, and governments to communicate verbally, as well as visually, across thousands of miles. Combine this with our modern transportation systems, and we remove the notion of the frontier. Even the deepest oceans are now being explored by scientists.

Having achieved such enormous progress, why then should we be concerned about the future of humankind on a global scale? The answer is quite simple; just over one billion people have any meaningful access to the resources and quality of life described above. The rest of the world's population - some five billion people who live in less developed regions - have only a taste of what this lifestyle might be like (Durning 1992; 1994; UNDP 2003). Such inequality is leading towards a world of growing disparity between industrialized and developing nations. In effect, the communities of less developed regions are held captive to the needs and wants of industrialized nations, whose living and consuming habits are in many ways condemning billions of people to a lower (material) quality of life. Put simply, if each member of the global community were to live the lifestyle of the average American, holding technology constant, we would need the resources of four more planet Earths (Wilson 2002). It is clear that a global drive to reach the Westernized view of the good life, without a drastic change in production processes and consumption patterns, will soon bring us up against ecological limits, forcing us to rethink what we mean by a secure and fulfilling lifestyle.

These introductory paragraphs present a highly simplified and polarized view of the world in which there are those who *have* and those who *have not.* While this might well be the case at the extremes, there is clearly a continuum of positions in between. The central argument of this thesis is that if we are interested in the well-being of current and future generations, we should not only be *concerned* for the future of the world, we should be actively searching for new ways to enable individuals, communities, and nations to live a sustainable life.

Hence, this research arises out of a concern for the global future. If present trends continue and the structural forces driving them remain substantially unchanged, there is a strong possibility that within a few generations the world will be incapable of sustaining

the human population at an adequate level of material well-being and health, and that it will lack sufficient and equitable opportunities for the realization of human potential. These trends include persistent (and often growing) inequalities between and within nations (including the U.S.), and persuasive evidence that we are living beyond our ecological means.

Further, the social and political environment in which policy responses to these trends must be made is a difficult one. It is defined by globalization and rapid technological change - a set of conditions that shortens the necessary response time for policy, restricts national policy options, and possibly exacerbates distributional inequality and ecological damage. This chapter sets out these concerns.

2.1 Human Needs

> "*The major problems of the world today can be solved only if we improve our understanding of human behavior*" (Skinner 1974).

During the mid 1970s, the idea that the purpose of 'development' was to develop *things* (e.g., transform resources into commodities/products) was virulently rejected and redefined to focus development on satisfying the needs of *humankind.* In particular, the 1974 Cocoyoc Declaration placed basic human needs at the center of development efforts and stated that "[a]*ny process of growth that does not lead to their fulfilment - or, even worse, disrupts them - is a travesty of the idea of development.*"[1] The following year the Dag Hammarskjöld Foundation (1975) articulated a similar position on the objective of development, in *What Now: Another Development.* It called for the "[d]*evelopment of every man and woman - of the whole man and woman - and not just the growth of things, which are merely means*" (ibid, p. 5). Further, the report emphasized the importance of satisfying the basic needs of the poor as well as the universal "*needs for expression, creativity, conviviality, and for deciding ...*[one's] *own destiny*" (ibid, p. 5). It continues, "[d]*evelopment is a whole; it is an integral, value-loaded, cultural process; it encompasses the natural environment, social relations, education, production, consumption and well-being*" (ibid, p. 5).

In 1987, over a decade later, the World Commission on Environment and Development (WCED) published *Our Common Future*, which again placed 'human needs' at the center of concerns for 'sustainable' development.

> "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*
>
> - *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*

[1] The *Cocoyoc Declaration* can be viewed at http://www.southcentre.org/publications/conundrum/conundrum-06.htm#P719_166711 (accessed on 04/08/06).

- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs*" (WCED 1987, p. 43).

The WCED conceptualization of sustainable development, built upon the development vision articulated in *What Now: Another Development*, made an influential case for "*the need to integrate economic and ecological considerations in decision making*" (WCED 1987, p. 62). The basic notion was that social and economic development must not undermine the natural environment upon which they are based. Hence, sustainable development "*requires views of human needs and well-being that incorporate such non-economic variables as education and health enjoyed for their own sake, clean air and water, and the protection of natural beauty*" (ibid, p. 53).

In concert with both the Cocoyoc Declaration and *What Now: Another Development*, *Our Common Future* spoke to the different needs of developed and less developed nations. For developing nations, the "*principal development challenge is to meet the needs and aspirations of an expanding ... population. The most basic of all needs is for a livelihood: that is, employment*" (WCED 1987, p. 54). It follows that employment - "*the opportunity to satisfy ... aspirations for a better life*" (ibid, p. 44) - will lead to the satisfaction of basic human needs for food, clothing, shelter, etc. However, some expressed concern that the needs of people in less developed nations are much broader than employment and must "*include the right to preserve their cultural identity, and their right not to be alienated from their own society, and their own community*" (ibid, p. 31).

For developed nations, the focus was not on meeting basic human needs for food, clothing, shelter, per se, but instead centered on the ecological consequences of an overindulgent lifestyle. "*Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. ... Perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire*" (WCED 1987, p. 44). Interestingly, both the Cocoyoc Declaration and *What Now: Another Development* expand the WCED's view of human needs (in relation to developed nations) to include the physiological and psychological consequences of over-consumption.

The above discussion provides strong evidence that understanding the fundamental needs of humans is essential if we are to develop strategies to transition towards more sustainable forms of development.

As a consequence of influential publications such as *Our Common Future*, the current discourse on sustainable development tends to center on trade-offs among economic development and environmental and social goals. Areas of contention frequently arise during such discussions, since the *goals* of each nation, group, or individual - which are based upon their *needs* - are often at odds with each other. Hence, if we are concerned for

human kind then we need to understand the basic needs that are inherent to human nature and also those which are a product of the socialization of humans.

A key argument of this thesis is that the satisfaction of needs should drive economic and (democratic) political systems. Borrowing the language of modern economics, we understand that a rational person will maximize his/her 'utility function' when making a decision to buy a product or service to satisfy a need. It follows, therefore, that societal demand is the canonical ensemble of everyone's individual utility function.[2] With regards to the political system, we satisfy our political needs by voting for the politician or political party that is most likely to support our lifestyle and beliefs. When the votes are aggregated, the candidate/party whose views align more closely with the needs and wants of society should be elected.[3] Indeed for many, free markets and democracy are intertwined.[4]

This demand-side notion that our needs drive economic and political systems raises an interesting question about how change is likely to occur in practice. If we make decisions based upon our individual needs, then it can be argued that a society is only likely to address unsustainable activities once the individual is negatively affected. Neoclassical economics argues that each person should act in his/her own interests and let the market allocate resources accordingly. But this assumes that each person is receiving perfect, or good, information and is able to make informed, rational decisions.[5] It also assumes that the 'invisible hand' of the market will generate outcomes that maximize social welfare.[6] In this framework, the role of government should be to ensure that markets work, and if necessary, redistribute wealth out of concern for equity through a progressive tax system.

Many have argued that a reliance on the market is likely to result in over-consumption and environmental harm due to inadequate consumer information. Manno (2002) argues

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[2] In a developed country, a consumer is a very sophisticated concept, but in a developing nation where no markets exist, the people cannot be called 'consumers' in an organizational sense. However, needs' satisfaction drives even the most primitive economic system of exchange and commerce.

[3] This statement assumes that there is sufficient diversity between the political candidates to present an individual with a *real* choice. It also assumes that a large enough proportion of a society will vote so that it is possible to accurately gauge societal demand.

[4] For a critique challenging this notion, see George Soros, *The Capitalist Threat*, in The Atlantic Monthly, February 1997, Vol 279, No. 2, pp. 45-58, http://www.theatlantic.com/issues/97feb/capital/capital.htm (accessed on 04/08/06).

[5] A recent survey by the American Association of Retired Persons (AARP 2004) asked the question whether spending power is all that an individual requires to achieve 'consumer sovereignty' - i.e., the successful selection of a product or service. The survey concluded that consumers - aged 45 and over and who represent 52% of consumer spending - are finding it increasingly difficult to use their spending power effectively, due to: [1] "[l]*ess time and more decisions*;" [2] the "[i]*ncreasing complexity of products and services*;" and [3] "[l]*ow levels of financial literacy*" (ibid, pp. 2-3). Hence, many are unable to exercise consumer sovereignty since they are not receiving good information and, therefore, cannot make informed, rational decisions. To solve this problem, AARP calls upon business and government to improve the quality of consumer information, to increase financial literacy, and to increase options for banking and credit in segmented markets that often suffer from predatory financial practices.

[6] One criticism of a utility-oriented system is that it does not incorporate concern for others. People vote their interests in the marketplace, but people do not express (in the market) their valuation of other people, relationships, and global equity and security. The market exists to satisfy individual, not social, wants.

that the present industrial capitalist system of incentives and disincentives is invariably directed toward increasing levels of consumption. The environmental problems associated with increasing consumption are further compounded by the fact that as commodity chains grow in length, become more complex and more international, the spatial and social distance between production and consumption is widened (Conca 2002; Princen 2002). The result of this *distancing effect* is that consumers lack the information and incentives to behave in a more sustainable manner even if they wish to do so.

Before discussing economic and political systems further, it is important for us to take a closer look at the concept of basic human needs. The above discussion - as with many discussions on sustainability - uses the term 'human needs' with a limited explanation of what this might actually encompass.[7]

To adequately address the topic of human needs, we first turn to the domain of philosophy and then to psychology. The former looks at the question of the *life worth living* and the latter, emerging from philosophy, attempts to formulate the fundamental *needs* which motivate human behavior towards this goal. Understanding the various philosophical meanings of a life worth living is important, since it will ultimately enrich our view of basic and higher human needs.

2.1.1 Philosophies of Ethics and the Good Life

The philosophical meaning of the term *ethics* is far broader than society's use of the term today, which is to delineate the moral choice between right and wrong behavior.[8] Sahakian and Sahakian (1966) argue that in the systems of many philosophers the notion of the good life - i.e., the life worth living, or the life that is satisfying - was seen as being more important than moral choice. The preoccupation of these philosophers was to discover life's greatest good - the *summum bonum*. The notion was that a right act was one which enhanced the realization of the greatest good, and a wrong act was one which diminished its realization. Sahakian and Sahakian (1966, p. 31) conclude that ethics can be defined as the "*study of right conduct and the good life.*" They also highlight an important distinction between *personal* and *social* ethics. The former is concerned with the moral code applicable to the individual against which his/her behavior is judged, and the latter focuses on moral theory concerned with groups - i.e., the study of what constitutes a good society or state. Both types of ethics are discussed (to varying degrees) below.

The ancient Greek philosophers believed that the good life resides in *virtue*. Socrates (469-399 B.C.) was interested in *true virtue*, which, like good health, is the same for

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[7] The reader familiar with this material may wish to move to section 2.1.3.

[8] "*The term moral has a dual meaning: the first has to do with the ability of a person to understand morality as well as his capacity to make moral decisions; the second has to do with the actual performance of moral acts*" (Sahakian and Sahakian 1966, p. 31). If we consider the first use of the term *moral*, it can be contrasted with *amoral* - i.e., the inability of a person to distinguish between right and wrong. The latter use of the term *moral* can be contrasted with *immoral* - i.e., when a person's actions run against moral principles.

everyone. He argued that virtue is knowledge and that a person who knows what is right will do it, since no human ever desires what is bad.[9] His notion was that if people acted inappropriately, by stealing, lying, hating, etc., it was because they did not understand the full consequences of their actions. Hence, knowledge frees a person from ignorance and enables him/her to make right decisions. Socrates believed that virtue is identical to happiness and that a person who acts for his/her own good will ultimately be happy and live a good life.

In contrast, Plato (427-347 B.C.) identified four central virtues present in the ideal state or person - *justice*, *wisdom*, *courage*, and *moderation*.[10] Plato believed that individual human beings are not self-sufficient and, therefore, to overcome life's challenges, humans gather into communities for the mutual achievement of common goals.[11] The *ideal state*, then, consists of three distinct classes - *rulers*, *soldiers* (these two classes are known as the guardians), and the *people*. Collectively, the guardians are those individuals responsible for the governance and protection of the state. Plato then assigned three of the virtues to a class of society - i.e., wisdom to rulers, courage to soldiers, and moderation to the people.[12] If each class performs its own role holding true to its virtue, the city/state will exhibit the harmony that is the virtue of justice.[13] Hence, the four virtues ensure society works together for the common good, or the *well-being*, of the city/state.

Aristotle (384-322 B.C.), a student of Plato, also disagreed with Socrates in regards to his belief that *knowing* what is right means that a person will *do* what is right. Aristotle believed that an individual's *weakness of will* affects his/her moral conduct, meaning that acts of wrongdoing can be made with the full knowledge of the potential consequences.[14] He believed that the attainment of the good life or happiness was the result of *Self-Realizationism* - the ability to realize one's potentialities, character, or personality

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[9] See to Plato's *Meno dialog* - a discussion between Meno, Socrates, a slave of Meno, and Anytus - to read Socrates' views on the origins of our moral knowledge (written 380 B.C.), translated by Benjamin Jowett, http://classics.mit.edu/Plato/meno.html (accessed on 04/08/06).

[10] See Plato (360 B.C.) *The Republic*, translated by Benjamin Jowett, http://classics.mit.edu/Plato/republic.html (accessed on 04/08/06).

[11] See to the following web site for a discussion by Garth Kemerling of why we form societies, http://www.philosophypages.com/hy/2g.htm#origins (accessed on 04/08/06).

[12] *Rulers* must have the virtue of *wisdom* to understand reality and facilitate impartial judgments about it. *Soldiers* must have the virtue of *courage* to enable them to protect the state by following orders. *People* must have the virtue of *moderation*; they must follow the leaders and not pursue their private interests, repressing personal wants for higher purposes. Refer to the following web site for a discussion by Garth Kemerling of Plato's view of the three virtues of wisdom, courage, and moderation, http://www.philosophypages.com/hy/2g.htm#virtues (accessed on 04/08/06). A much later formulation of "communitarianism" is discussed shortly.

[13] Plato defined the virtue of *justice* as the harmonious function of *society* or of the *souls* within an individual. Plato described three souls: *rational* (our intellect), *spirited* (our will), and *appetitive* (our desire). The concept of *souls* will later inspire a great interest in the philosophy of human nature in the Western tradition. Refer to the following web site for a discussion by Garth Kemerling of Plato's view of the virtues in human souls, http://www.philosophypages.com/hy/2g.htm#souls (accessed on 04/08/06). Note: Most discussions of justice in today's society focus on the Rawlsian notion of justice as fairness.

[14] Refer to the following web site for a discussion by Garth Kemerling of the weakness of will, http://www.philosophypages.com/hy/2s.htm#cont (accessed on 04/08/06).

(Sahakian and Sahakian 1966).[15] To Aristotle, the person who has the greatest potentialities and is able to actualize this potential has the brightest prospect of happiness. Conversely, the person whose potential remains unfulfilled will ultimately be frustrated and unhappy. Aristotle believed virtue was found in *habitual moderation* and listed twelve important virtues, which he placed between extremes (Table 2.1). The concept is that a rational person will always exhibit moderation and will avoid extreme behavior.

Table 2.1: Aristotelian Virtues

VICE OF DEFICIENCY	VICE OF MODERATION	VICE OF EXCESS
Cowardice	Courage	Foolhardiness
Insensibility	Temperance	Licentiousness
Illiberality	Liberality	Prodigality
Meanness	Magnificence	Vulgarity
Humility	Magnanimity	Vanity
Lack of Ambition	(Unnamed)	(Over) Ambitiousness
Impassivity	Gentleness	Irascibility
Self-Depreciation	Truthfulness	Boastfulness
Boorishness	Wittiness	Buffoonery
Quarrelsomeness	Friendliness	Obsequiousness or Flattery
Shamelessness	Modesty	Bashfulness
Maliciousness	Righteous Indignation, Justice (the sum of all Virtues)	Envy

Source: Sahakian and Sahakian (1966, p. 36).

Aristotle saw friendship as an important virtue and feature of the good life, for "*without friends no one would choose to live, though he had all other goods*" (Aristotle, 350 B.C., Book VIII, Chapter 1).[16] Along with the cultural traditions of ancient Egyptians, which taught that wealth does not bring happiness, this is one of the earliest written recognitions that wealth and material goods do not lead to the good life and happiness.

Two other systems of philosophy that are worth mentioning are *hedonism* and *utilitarianism* (Sahakian and Sahakian 1966). Hedonism, in an ethical sense, is most closely associated with the ancient Greek philosopher Epicurus (342-270 B.C.). It is a system of philosophy in which the primary aim of individuals is to maximize pleasure or happiness. Hence, the search for pleasure and the avoidance of pain are its primary objectives. There are several types of hedonism; some focus on momentary sensual pleasures, while others focus equal attention on spiritual pleasures as well.

Utilitarianism shares some features with hedonism. The hedonistic utilitarianism of Jeremy Bentham[17] and John Stuart Mill[18] maintains that all moral judgments should aim to achieve the greatest good for the greatest number - this is also known as the greatest

[15] Aristotle believed that at birth an infant is a *potential* person, and it is only through converting his/her potentialities into actualities that the infant will be able to realize the full potential of the person he/she is to become (Sahakian and Sahakian 1966).

[16] Refer to following web site for W. D. Ross's translation of *Nicomachean Ethics*, by Aristotle, 350 BC, http://www.constitution.org/ari/ethic_00.htm or http://classics.mit.edu/Aristotle/nicomachaen.html (accessed on 04/08/06).

[17] Refer to Bentham (1970). The original version of this text was published in 1781.

[18] Refer to Mill (2002). The original version of this text was published in 1863.

happiness principle. If the philosophy is applied to an individual, it follows that a person will select the solution that provides him/her with the greatest happiness or utility.[19] Utilitarianism is a normative theory to the extent that it focuses on understanding which human actions are right and which are wrong.

The above discussion highlights a broad range of ways in which we can consider what constitutes the *good life*. For example, one could argue that the good life or well-being can be achieved through:

- simply taking actions which you know to be right (Socrates);
- knowing your place in society and acting in accordance with the virtue (i.e., wisdom, courage, or moderation) of your class (Plato);
- the self-realization of your potentialities, character, and personality and through habitual moderation (Aristotle);
- maximizing pleasure and happiness by searching for pleasure and avoiding pain (Epicurus); or
- making moral decisions which aim to achieve the greatest good for the greatest number of people (Bentham and Mill).

Hence, an individual's view of what constitutes the good life will have a strong influence on his/her behavior within society, including his/her actions within economic and political systems.

Not discussed above, but equally important, is the role of religion in shaping how an individual or society seeks to live a good life. If we look at Judaism, Christianity, and Islam, one could argue that a good life is one that God would have us live (Michaelis 2000).[20] A critical question remains, however. Does nature exist to serve humanity, or vice versa?[21]

Michaelis (2000) argues that there are two aspects to Western society's view of the good life. First, there is a commitment to ensure that everyone has access to the good life. Second, modern society is reluctant to impose any one view of the good life on its citizens. The idea is that each individual has the right to create and pursue her own vision of happiness. It is worth mentioning, though, as Michaelis does, that in most other societies the good life is only attainable for a minority who no longer live the normal life of working and maintaining a household.

Central to the Western view is that an individual is free to follow her own desires in her own way. No one can question her actions if no law is broken, since it is her right to live life her way. The problem, however, is that without a well-balanced education (the virtue of knowledge) or appropriate guidance (from the moral code of society), there is a

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[19] In the realm of neo-classical economics the phrase 'utility' has a specific meaning - it measures the happiness or satisfaction an individual receives from a *product* or *service*.

[20] Similarly, religions such as Hinduism and Buddhism portray the good life as the path that should be followed to achieve Moksa (the liberation from the cycle of rebirth) or Nirvana (the release from the illusion that we exist) (Michaelis 2000).

[21] See Hessel (2002) for an insightful discussion of the role of religious vision and ethical values in achieving sustainable development.

tendency for the individual to focus only on his/her immediate needs or wants to the detriment of himself/herself and society.[22]

Capra (1996) presents a similar framework to Aristotle's virtues, which he uses to discuss Western industrial culture (Table 2.2). Capra suggests that the tendencies of *self-assertion* and *integration* - neither of which is intrinsically good or bad - are both essential aspects of all living systems. And the key to a good, or healthy, life is to establish a dynamic balance between both tendencies. He argues that the Western industrial culture has overemphasized the self-assertive and neglected the integrative tendencies. Further, Capra (1996) argues that the self-assertive values of competition, expansion, and domination are generally associated with men, who (in a patriarchal society) tend to be favored and receive economic rewards and political power. Therefore, while creating a more balanced value system is difficult, it is especially so for men.

Table 2.2: Capra's Self-Assertive and Integrative Tendencies

Thinking		**Values**	
Self-Assertive	***Integrative***	***Self-Assertive***	***Integrative***
rational	intuitive	expansion	conservation
analysis	synthesis	competition	cooperation
reductionist	holistic	quantity	quality
linear	nonlinear	domination	partnership

Source: Capra (1996, p. 10).

In the U.S., the problems associated with the Western industrial culture led to the creation of the *communitarian* movement. This movement believes that "*the pendulum has swung too far toward a preoccupation with individualism. Too many people shirk their communal and civic responsibilities. Special interest groups have gotten out of hand. Moral agreement has crumbled.*"[23] To address these problems, communitarians are searching for effective ways to restore social and moral consensus without imposing a set of behaviors and values on society - an approach that resonates with the Western view of the good life. Their central philosophy is to restore social responsibilities and a commitment to community through a dynamic, ongoing "*communitarian quest for balances between individuals and groups, rights and responsibilities, and among the institutions of state, market, and civil society.*"[24]

Michaelis (2000) provides additional support to the communitarian philosophy by arguing that human motivation appears to result as much from our own knowledge of the good life as it does from belonging to a community of people that share a common conception of the good life. Hence, *social* ethics - a moral code of conduct - are likely to play an important role in motivating human behavior.

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[22] A simple distinction between a human *need* and *want* is that the failure to satisfy a need leads to progressive, and sometimes irreversible, human malfunctions, whereas the failure to satisfy a want leads to little more than frustration (Ekins and Max-Neef 1992).

[23] Source: The Communitarian Network, the *Communitarian Quarterly*, http://www.gwu.edu/~ccps/rcq/rcq_index.html (accessed on 04/08/06).

[24] Source: The Communitarian Network, *Within History*, http://www.gwu.edu/~ccps/platformtext.html (accessed on 04/08/06).

The purpose of this section is not to define what the life worth living should be, since this will ultimately be influenced by individual personalities and beliefs and by societal and cultural values. Rather, it is to provide a frame of reference for the next section, which looks more closely at how human needs, or desires, motivate behavior. Understanding how an individual's needs are satisfied is important when considering ways to meet our current human needs and those of future generations. As Schmuck and Schultz (2002, p. 10) note, "[t]*he specific challenge to psychology is to explore how non-sustainable as well as sustainable behavior results from individual, cognitive, and emotional processes. The knowledge gained from this research may then be applied to induce or to support sustainable development.*"

2.1.2 The Psychology of Human Needs

> "*Naïve statements on needs, participation and environmental compatibility are espoused in many papers ... But whose needs are going to be met and whose needs are not; who will participate and who will not; and which lobbies, interest groups, and economic and political entities will be hurt by environmental compatibility?*" (Farvar and Glaeser 1979, p. 1).

This section presents a basic discussion of how needs or desires motivate an individual's behavior.[25] By understanding the psychology of human behavior, it will be possible to develop strategies/programs that will not only be more effective in communicating the vision of sustainable development to the public, but will assist society in adopting new behaviors that will help realize a more sustainable future (McKenzie-Mohr 2002). Or to put it another way, devising sustainable strategies without taking the psychological basis for behavior into account is not likely to be very successful.

The concept of human needs has traditionally been used in two distinct ways (Ryan 1995). The first and most common definition of a need is connected to virtually any *motivating force*, such as one's desires, goals, wants, or values. Within this group, the term *need* is also used in a loose manner in expressions such as "I need new shoes" or "I need a new automobile." When used in such a way, an individual is using the term 'need' to express a strong desire. The second definition of a need refers to *physiological needs*[26]

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[25] An interesting concept to consider when following the discussion is that your *personal consciousness* will help *you* decide whether you agree or disagree with the ideas being put forward. What you feel, understand, think, and do is based upon your *subjective* view of reality, which is shaped by factors such as experience, education, and societal and cultural values. Hence, your interpretation of the text is likely to be different from someone else's. The desire to understand human consciousness and its relationship to our behavior is *the* motivation for the field of psychology, which is the science of behavior and mental processes. While the complexity of this topic makes it difficult to formulate universally accepted ideas, during the past century psychologists have been able to develop theories that can help us understand why people *might* be behaving the way they do. There is also a strong motivation to look at humans through needs, since it "*enables us to build a bridge between a philosophical anthropology and a political option*" (Max-Neef et al. 1989, p. 26).

[26] Human physiology is the study of vital functions in man. More generally physiology is the science of the normal functions and phenomena of living things.

- the nutrients or conditions which are essential for our survival as humans, such as food, water, and shelter. Using these two definitions, it is possible to generate endless lists of needs, especially if the loose definition of a need is invoked. However, if the criterion of a need is focused on necessity for growth, the potential list of needs is rapidly reduced.

Human needs or desires motivate behavior. Boeree[27] groups the concept of *motivation* into four broad areas:

- **Biological motivations** - those which are organically driven, such as our need for food and water, and hedonistic needs such as pain-avoidance and pleasure;
- **Social motivations** - the need for acceptance, attention, and approval which influence forms of self-esteem;
- **Personal motivations** - those which are based upon the experiences of the individual resulting in habitual behavior, defense mechanisms, and personality styles; and
- **Higher motivations** - which come in two forms:
  1. *competence motivation* - a desire to learn, attain competence/mastery, and be creative; and
  2. *altruistic motivation* - a concern for society, and a need for compassion and love.

The failure to differentiate the various types of human needs has created confusion in the realm of politics, especially when it comes to discussions about sustainable development. While it is possible to scientifically define biological motivations (our need for food and water, etc.) the other types of motivation cannot easily be defined. The problem is further compounded by the fact that within the field of psychology, *behaviorists* (e.g., B. F. Skinner), *psychoanalysts* (e.g., Sigmund Freud), and *humanists* (e.g., Abraham Maslow), for example, approach the topic of human needs from different perspectives.[28] Hence, "*human needs are discerned differently according to the ideological and disciplinary lens of the viewer*" (Max-Neef et al. 1989, pp. 17-18).

When thinking about how human needs change, it is possible to do so in a *developmental* (infant to adult) and *non-developmental* (functioning individual)[29] context. Sigmund Freud was the first psychologist to advance the theory that human needs are the neurological representation of physical needs, and that these needs change as a human develops.[30] Freud's developmental ideas were later advanced by Erik Erikson who gave them an intuitive nature and basis in reality. Erikson (1963) developed eight stages to the human life span, from infancy to late adulthood.[31] During each stage of development it is

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[27] Refer to George Boeree's *The Ultimate Theory of Personality, Motivation,* http://www.ship.edu/%7Ecgboeree/conclusions.html (accessed on 04/08/06).

[28] Refer to George Boeree's *General Psychology, Motivation,* http://www.ship.edu/%7Ecgboeree/genpsymotivation.html (accessed on 04/08/06).

[29] The *functioning individual* refers to an individual who is self sufficient, i.e., is able to take action by herself and is not reliant on care givers to satisfy her needs.

[30] Refer to George Boeree's *Personality Theories, Sigmund Freud,* http://www.ship.edu/%7Ecgboeree/freud.html (accessed on 04/08/06).

[31] Erikson's (1963) eight stages of human development are based on social development throughout the lifespan. At each stage there is a development task, and it can have either a positive or a negative outcome.

clear that an individual's needs change. For example, a baby's needs are entirely satisfied by its parents, but as the baby transitions to a child, to an adolescent, and then finally to an adult, he/she will develop an identity and take on more responsibility for satisfying his/her own needs. Hence, human needs change as we transition through our various stages of physiological and psychological development.

An alternative view to Freud and Erikson is presented by Abraham Maslow. Instead of trying to understand how needs change as an individual *grows*, Maslow (1943) developed a theory of human motivation which can be used to analyze the *functioning individual*. Maslow's theory consists of a hierarchy of needs (Figure 2.1) and is based upon the notion that as an individual's lower level needs are satisfied, new needs emerge that require fulfillment.

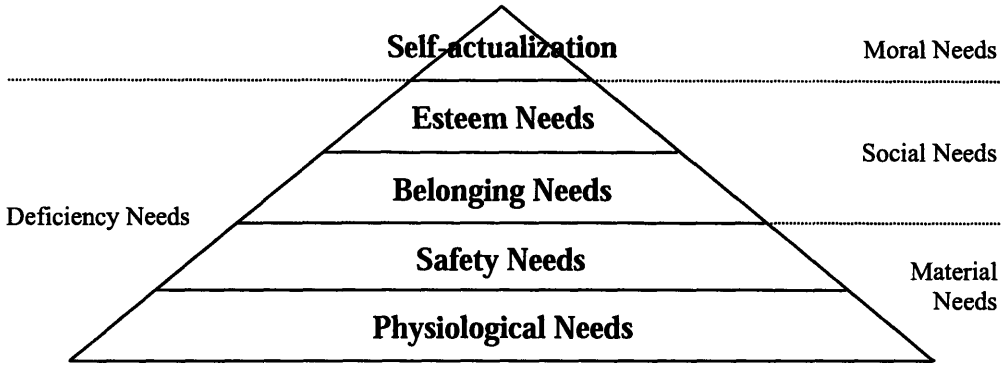

Figure 2.1: Maslow's Hierarchy of Needs

First are the *Physiological* needs, the fundamental biological need for homeostasis,[32] which includes the need for oxygen, water, vitamins, minerals, and also non-consumption needs such as sleep and pain avoidance. Second are the *Safety* needs; once the physiological needs are relatively well satisfied, an individual will become a safety-seeking mechanism, looking for safe accommodation/shelter, stability, and protection. Having adequately satisfied the physiological and safety needs, a third layer of needs emerges. These are the *Belonging* needs - the need for love, affection, and belongingness.

The stages are listed as follows, with a brief explanation of the positive outcome: [1] trust vs. mistrust (a sense of predictability and trust in the environment); [2] autonomy vs. shame and doubt (encourages independence and self sufficiency, promoting self-esteem); [3] initiative vs. guilt (a child learns to initiate activities and develops a sense of responsibility toward others, becoming self-confident); [4] industry vs. inferiority (the development of a sense of pride and competence); [5] identity vs. role confusion (the development of a sense of self and identity that will form commitments to future adult roles); [6] intimacy vs. isolation (the development of a sense of connectedness and intimacy with others); [7] generativity vs. stagnation (an individual has an unselfish concern for the welfare of the next generation); and [8] integrity vs. despair (an individual experiences a strong sense of self-acceptance and meaningfulness in accomplishments). The outcome from each value conflict is not determined once each stage has been traversed; it arises again during each subsequent stage of development. In addition, the objective of development is not to eliminate the negative outcomes, but to establish a balance between the two extremes.

[32] "*Homeostasis refers to the body's automatic efforts to maintain a constant, normal state of the blood stream*" (Maslow 1943, p. 372).

Next are the *Esteem* needs, which are classified in two subsidiary sets: [1] the need for strength, achievement, adequacy, confidence, and freedom (known as the higher needs); and [2] the need for prestige, recognition, attention, and appreciation (known as the lower needs). The fifth need is for *Self-actualization* and is different from the four other needs. This stage refers to the need for self-fulfillment, the desire for an individual to achieve self-actualization, to reach his/her potential (whatever that potential might be) - e.g., an artist, musician, teacher, etc. Maslow argues that people who have satisfied all five levels of need can be called "*basically satisfied people, and it is from these that we can expect the fullest (and healthiest) creativeness*" (Maslow 1943, p. 383).

While psychologists disagree with certain aspects of Maslow's theory,[33] it does provide us with a useful way of thinking about how environmental and societal factors might influence an individual's behavior. This is especially important when considering differences in the needs of people in developed versus developing nations. In addition to using Maslow's hierarchy of needs to assess humans, researchers have applied this theory to a variety of research areas. An interesting example is a paper by Collins et al. (1997) which expands Maslow's hierarchy of needs into a framework for approaching the human dimension in ecosystem management.

In contrast to Maslow's theory, Max-Neef et al. (1989) argue that all human needs must be understood as an inter-related and interactive system.[34] Apart from sustenance needs, which are essential to human life, there are *no* hierarchies in this system. Max-Neef et al. question the lack of any real discussion of the difference between human *needs* and the *satisfiers* of those needs. In particular, they ask *what* the fundamental needs are and *who* determines these? To help answer this question, Max-Neef et al. present a 36 cell matrix which organizes human needs into existential (*being, having, doing,* and *interacting*) and axiological (*subsistence, protection, affection, understanding, participation, idleness, creation, identity,* and *freedom*) needs (Table 2.3). Within this framework, needs are seen as having a two-fold character: as deprivation and as potential.[35]

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[33] A general criticism of the hierarchy of needs is that people do not necessarily satisfy their needs in the order that Maslow promulgated. For example, it is possible for individuals to achieve various aspects of self-actualization without satisfying their lower needs. In Maslow's defense, he did recognize this problem and stated that a "*more realistic description of the hierarchy would be in terms of decreasing percentages of satisfaction as we go up the hierarchy of prepotency*" (Maslow 1943, p. 388). Maslow was also criticized for his scientific methodology - i.e., the selection of a small number of self-actualized people against which Maslow came to his conclusions. While this does present a problem, Maslow's intention was not to scientifically define the theory, but rather to generate interest in this area of research. A final critique worth mentioning relates to Maslow's constraints on self-actualization, which he believed only two percent of the human species will achieve. In contrast, Carl Rogers used the phrase to describe the built-in motivation in every life form to develop its potential. Rogers saw babies as the best example of human self-actualization whereas Maslow believed that the young rarely achieved self-actualization. For a critique of Maslow's hierarchy of needs refer to George Boeree's *Personality Theories, Abraham Maslow,* http://www.ship.edu/%7Ecgboeree/maslow.html (accessed on 04/08/06).

[34] For a detailed discussion of Max-Neef's theory of 'Human Scale Development,' see Max-Neef (1991).

[35] *Deprivation* refers mainly to physiological needs - e.g., an individual has an acute physical need for water or food. *Potential* refers to those needs which engage or motivate an individual - e.g., the need to understand is a potential for understanding.

Table 2.3: Matrix of Needs and Satisfiers [36]

FUNDAMENTAL HUMAN NEEDS	BEING (Qualities)	HAVING (Things)	DOING (Actions)	INTERACTING (Settings)
SUBSISTENCE	physical and mental health	food, shelter, work	feed, clothe, rest, work	living environment, social setting
PROTECTION	care, adaptability, autonomy	social security, health systems, work	co-operate, plan, take care of, help	social environment, dwelling
AFFECTION	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
UNDERSTANDING	critical capacity, curiosity, intuition	literature, teachers, policies educational	analyse, study, meditate, investigate	schools, families universities, communities
PARTICIPATION	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	associations, parties, churches, neighbourhoods
LEISURE	imagination, tranquillity spontaneity	games, parties, peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
CREATION	imagination, boldness, inventiveness, curiosity	abilities, skills, work, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences
IDENTITY	sense of belonging, self-esteem, consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
FREEDOM	autonomy, passion, self-esteem, open-mindedness	equal rights	dissent, choose, run risks, develop awareness	anywhere

Source: Max-Neef et al. (1989, p 33).

Using Max-Neef's classification of human needs (Table 2.3), we find that food and shelter are not seen as needs, they are instead *satisfiers* of the fundamental need for subsistence. Likewise, having the ability to express opinions, to cooperate, or to dissent are satisfiers for the need to participate. In addition, there is no one-to-one correlation between needs and satisfiers. Needs may require more than one type of satisfier to be met and, conversely, a satisfier may help realize several needs at once. From this framework, Max-Neef et al. make the following two claims. "*First: Fundamental human needs are*

[36] The article from which this table was extracted can be viewed at the Dag Hammarskjöld Foundation's web site, http://www.dhf.uu.se/pdffiler/89_1.pdf (accessed on 04/08/06). Note on table columns: "*The column of BEING registers attributes, personal or collective, that are expressed as nouns. The column of HAVING registers institutions, norms, mechanisms, tools (not in a material sense), laws, etc. that can be expressed in one or more words. The column of DOING registers actions, personal or collective, that can be expressed as verbs. The column of INTERACTING registers locations and milieus (as times and spaces). It stands for the Spanish ESTAR or the German BEFINDEN, in the sense of time and space. Since there is no corresponding word in English, INTERACTING was chosen 'a faut de mieux*" (Max-Neef et al. 1989, p 33).

finite, few, and classifiable. Second: Fundamental human needs ... are the same in all cultures and in all historical periods. What changes, both over time and through cultures, is the way or the means by which the needs are satisfied" (Max-Neef et al. 1989, p. 20).

What Max-Neef et al. argue is that it is the economic, social, and political *systems* which adopt different methods for the satisfaction of the same human needs. Hence, a critical aspect to their theory is that individuals, groups, and cultures develop the *actions* and *value systems* that will be used to realize their needs. Understanding and describing these value systems is ultimately subjective,[37] which presents a problem since the Western view of development tends to be based upon objectivity - i.e., the view that we should deal with facts or conditions without distortion by personal feelings or interpretations. Max-Neef et al. argue that social and economic relations, which are defined by historical and cultural circumstances, need to be viewed with both subjectivity *and* objectivity. Hence, "*satisfiers are what render needs historical and cultural, and economic goods are their material manifestation*" (Max-Neef et al. 1989, p.29).

An important outcome of the above discussion is that individuals, communities, and societies decide upon the satisfiers to their needs. This is critical since it enables us to re-interpret the concept of poverty, which has traditionally been defined by economics with reference to income. Max-Neef et al. argue that "*we should speak not of poverty, but of poverties. In fact, any fundamental human need that is not adequately satisfied, reveals a human poverty*" (Max-Neef et al. 1989, p. 21). Hence, it follows that poverty can be found in all nine of the axiological needs, e.g., poverty of sustenance, of protection, etc. These poverties lead to confusion, isolation, frustration, and general psychological distress, which ultimately manifest themselves through "*pathologies*" such as war, racism, hunger, etc.

Max-Neef's insights into the human condition contain a valuable message. If we rely only on an economic frame of reference, we will ultimately not be able to satisfy our needs. Therefore, our research, strategies, and policies need to be developed using a *transdisciplinary* approach.[38]

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[37] "*The ways in which we experience our needs, hence the quality of our lives is, ultimately, subjective. It would seem, then, that only universalizing judgement could be deemed arbitrary. An objection to this statement could well arise from the ranks of positivism. The identification which positivism establishes between the subjective and the particular, though it reveals the historical failure of absolute idealism, is a sword of Damocles for the social sciences. When the object of study is the relation between human beings and society, the universality of the subjective cannot be ignored. Any attempt to observe the life of human beings must recognize the social character of subjectivity. ... Yet there is great fear of the consequences of such a reflection. Economic theory is a clear example of this. From the neo-classical economists to the monetarists, the notion of preferences is used to avoid the issue of needs. This perspective reveals an acute reluctance to discuss the subjective-universal. This is particularly true if it is a question of taking a stand in favour of a free market economy. ... Whereas to speak of fundamental human needs compels us to focus our attention on the subjective-universal, which renders any mechanistic approach sterile*" (Max-Neef et al. 1989, pp. 28-9).

[38] "*Transdisciplinarity is an approach that, in an attempt to gain greater understanding, reaches beyond the fields outlined by strict disciplines. While the language of one discipline may suffice to* ***describe*** *something (an isolated element, for instance) an interdisciplinary effort may be necessary to* ***explain*** *something (a relation between elements). By the same token, to* ***understand*** *something (a system as*

In 1991, Doyal and Gough published *A Theory of Human Need*, in which they attempt to identify "*those characteristics of satisfiers which apply* ***to all cultures***" (Doyal and Gough 1991, p. 157, emphasis added). The basic premise is that these 'universal satisfier characteristics' are "*those properties of goods, services, activities and relationships which enhance physical health and human autonomy in all cultures*" (ibid, p. 157). Doyal and Gough argue that physical survival (i.e., good health) and personal autonomy (i.e., the ability to act in a self-directed manner and to participate) constitute the most basic human needs, and they "*must be satisfied to some degree before actors can effectively participate in their form of life to achieve any other valued goals*" (ibid, p. 53).

The universal satisfier characteristics are described as being a bridge between universal human needs and those which are culturally and socially determined. Thus, Doyal and Gough (1991) name them 'intermediate needs,' and their list of these needs[39] includes the need for:

- food and water and an appropriate nutritional intake;
- housing and adequate shelter, basic services, and space per person;
- a non-hazardous working environment;
- a non-hazardous physical environment;
- appropriate and accessible health care;
- security in childhood;
- significant primary relationships;
- economic security;
- physical security;
- appropriate and accessible education; and
- safe birth control and child-bearing.

While the above list may not be fully comprehensive and is somewhat ambiguous, a fact acknowledged by the authors, it does provide a basis from which the satisfaction of (intermediate) needs across cultures can be assessed. By developing a series of indicators to measure intermediate needs, Doyal and Gough were able to obtain some insight (which was somewhat hampered by the availability and reliability of data) into the difference between the satisfaction of basic needs in developed and developing nations. Their analysis revealed that people living in affluent nations are more likely to be able to satisfy their basic needs than people living in poor nations. However, it also showed that there are differences within these groups as well.[40] One of the most salient conclusions from their analysis is that the relationship between mean income and need satisfaction is complex and nonlinear. It depends on the distribution of wealth within and between nations and between genders. Addressing these distributional issues will need to be assessed within the context of individual freedom and state control. Hence, there needs to be a willingness on the part of all nations to engage in discussions and the analysis of the

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interpreted from another system of higher complexity) requires a personal involvement that surpasses disciplinary frontiers, thus making it a transdisciplinary experience" (Max-Neef et al. 1989, p. 18).

[39] See Doyal and Gough (1991), Table 3.1: Suggested indicators of intermediate need-satisfaction.

[40] See Doyal and Gough (1991), Table 3.2: Substantive need-satisfaction in the Three Worlds.

connection between freedom, regulation, and control if and when radical changes to our social and physical systems become necessary (Haland 1999).

A final concept, which provides a more condensed view of human needs than that presented by Max-Neef et al. and Doyal and Gough, is self-determination theory (SDT). SDT is a "*macro-theory of human motivation concerned with the development and functioning of personality within social contexts.*"[41] Therefore, it is *not* concerned with physiological needs, such as our desire for sustenance.

SDT is based upon the assumption that [1] people (as active organisms) have an instinctive tendency for psychological growth and development, and [2] that this human tendency requires nutrients and support from the *social environment* to function effectively, without which psychological growth will not occur.[42] Hence, SDT predicts human *behavior*, *experience*, and *development* by studying the active organism (the individual) within its social context.

Ryan and Deci (2000b) state that the first SDT assumption is based upon a phenomenon known as *intrinsic motivation*[43] - the natural human inclination to explore, to learn, to seek out novelty and challenges, and to realize one's potentialities. They argue that intrinsic motivation is essential to cognitive and social development and that it is *the* source of an individual's enjoyment and vitality throughout life. There is a similarity between Ryan and Deci's formulation of intrinsic motivation and Aristotle's notion of self-realizationism. The second SDT assumption refers to the social environment, which either supports or inhibits one's intrinsic motivation. Specifically, three essential needs (or social and environmental factors) for psychological growth and well-being have been identified (Ryan 1995; Ryan and Deci 2000a; 2000b). These are:

- **Competence** -- satisfied through social-contextual events such as feedback, communication, and rewards (note: feelings of competence will only increase intrinsic motivation if accompanied by a sense of autonomy);
- **Autonomy** -- satisfied through the feeling that one's behavior is self-determined; and
- **Relatedness** -- satisfied through a secure relational base, which refers to supportive relationships with one's family, friends, or colleagues.

To help combine the many theories presented so far, we can turn to the work of Tim Kasser. By integrating the work of humanistic thinkers such as Maslow (1954) and SDT thinkers such as Ryan and Deci (2000b), Kasser (2002, p. 24-25) creates four sets of needs that can be used to assess the basic motivation, functioning, and well-being of humans:

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[41] Source: University of Rochester, Department of Clinical and Social Sciences in Psychology, *Self Determination Theory, An Approach to Human Motivation and Personality,* http://www.psych.rochester.edu/SDT/theory.html (accessed on 04/08/06).

[42] Supra note 41.

[43] The opposite to intrinsic motivation is extrinsic motivation. *Extrinsic motivation* refers to behavior that is *externally regulated* - i.e., an action is performed to satisfy or comply with an external demand (Ryan and Deci 2000b).

- **Safety, security, and sustenance** - "*These are the needs we have for food on our tables, a roof over our heads, and clothing to protect us from weather – the essentials of life.*"
- **Competence, efficacy, and self-esteem** - To satisfy these needs we must "*be capable of doing what we set out to do and of obtaining the things we value.*"
- **Autonomy and authenticity** - It is human nature to "*constantly strive for increased freedom and more opportunities to experience life in a self-directed manner.*"
- **Connectedness** - Humans have a strong desire to be intimate and close to others. "*We need to feel that we belong and are connected with others' lives, be it as parents, friends, neighbors, or coworkers.*"[44]

If Kasser's (2002) essential human needs are considered along with Max-Neef's (1989) notion that the satisfiers of needs are defined by economic, social, and political systems, we now have a framework from which discussions about human needs can progress. For example, one can state that our well-being and quality of life increase when our needs for sustenance, competence, autonomy, and connectedness are fulfilled and decrease when they are not. Of course, our interpretation of whether or not a need has been fulfilled will be influenced by societal and cultural values. If such values nurture basic psychological needs, it is likely that the social fabric of a community will strengthen, which in turn will facilitate the well-being and integrity of individuals within that community (Ryan 1995).

By highlighting some important insights from the previous section on the *Philosophies of Ethics and the Good Life*, we can raise some fundamental questions about the future of human well-being (or happiness). An important insight, which is reinforced in this section, is that the attainment of a *life worth living* depends upon whether an individual adheres to his/her own moral code and that of the society and culture within which he/she lives. In Western cultures, each individual has the right to create and pursue his/her own vision of happiness and there is a commitment to ensure that everyone has access to the good life (Michaelis 2000). But, as identified in this section, the good life (achieved by satisfying our needs) is culturally defined by our history, culture, and economic, social, and political systems. A growing problem with the Western (American) culture - as identified by the communitarian movement - is that the relationship between individuals and groups, rights and responsibilities, and among the institutions of state, market, and civil society is out of balance. This imbalance means that personal and social ethics are also out of balance, resulting in a preoccupation with individualism. A study by the Harwood Group,[45] indicated that a large number of Americans "*believe materialism, greed, and selfishness increasingly dominate American life, crowding out a more meaningful set of values centered on family, responsibility, and community. People express a strong desire for a greater sense of balance in their lives - not to replicate material gain, but to bring it more into proportion with the non-material rewards of*

[44] Kasser (2002) uses the term *connectedness* instead of the term *relatedness*, as espoused by Ryan and Deci (2000b). Also, Kasser does not make any assumptions about the relative ordering or potency of these four types of needs in motivating behavior.
[45] Now known as the Harwood Institute, http://www.theharwoodgroup.com/ (accessed on 04/08/06).

life."[46] The study also highlighted a deep-seated struggle between the desire to keep up with the Joneses and obtain a high level of financial security and material comfort, and the right to live as one chooses. Hence, an individual is paralyzed and cannot speak out against materialistic tendencies, since doing so contradicts the belief that people should have the freedom to make their own decisions.

Having discussed the theories of some prominent behaviorists, Freudians, and humanists, there is a clear message that human needs cannot be fulfilled if there is a preoccupation with the self and a lack of connectedness within a community.

In summary, Figure 2.2 attempts to provide a visual representation of the conceptual framework developed above.[47] It shows that throughout our lifetime we are at the center of significant forces. The top arrow represents the influence that history, culture, and our economic, social, and political systems have on shaping the satisfiers to our needs - which are displayed to the left of the center arrow. We internalize these influences through *learning*, which is guided by our families, friends, media, markets, etc. The bottom arrow represents evolution, genetics, and biology that influence our *physiological* needs such as sustenance. Our temperament, instincts, health, etc., all stem from our genetic make-up, which tells us how to instinctively respond to a situation (emotionally and physically) or signals (e.g., through neurotransmitters) when we need food, water, or rest. To the right of the figure is the good life, the *summum bonum*. The good life is culturally defined and will influence each individual through those factors represented by the top arrow.

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[46] Source: The Harwood Group, *Yearning for Balance Views of Americans on Consumption, Materialism, and the Environment*, July 1995, http://www.iisd.ca/consume/harwood.html (accessed on 04/08/06).

[47] Figure 2.2 is based on an original figure by George Boeree that visualized how an individual is at the center of two types of forces which influence and affect our psychological and physiological state. Source: George Boeree, *The Ultimate Theory of Personality*, http://www.ship.edu/%7Ecgboeree/conclusions.html (accessed on 04/08/06).

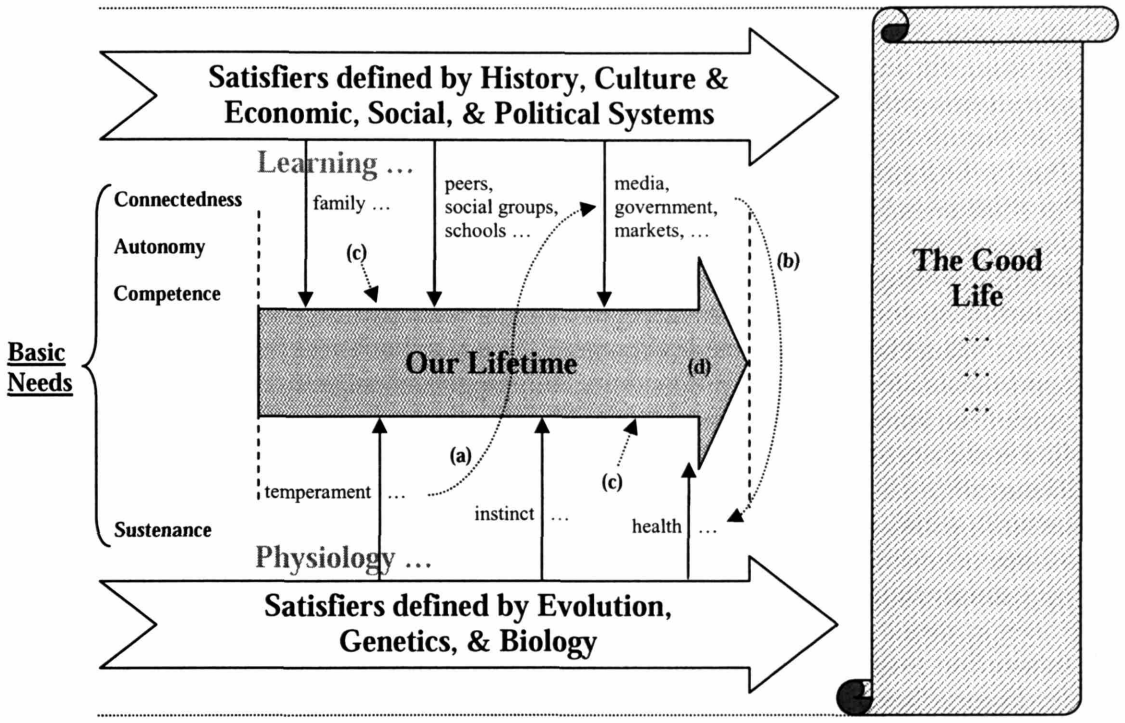

Figure 2.2: Visualization of Human Needs, the Satisfiers of Those Needs, and One's Overall Satisfaction with Life[48]

The (a) and (b) arrows indicate how our physiology influences learning and vice versa. The (a) arrow represents how our temperament is likely to influence how we react to an advertisement or the loss or gain of money on the stock exchange. For example, if a person has an aggressive temperament, the loss of money might result in a violent outburst of aggression. The (b) arrow represents how advertisements or government information might have a positive or negative effect on our health. For example, if a series of advertisements entices an individual to eat fast food for a long period of time, that person is likely to face health problems due to a poor diet. The (c) arrows represent random physiological or experiential influences. For example, a person might be involved in a car accident or hear an influential thinker present a new theory, both of which might influence his/her life in some unknown manner. The last arrow shown on the diagram is (d), which represents our own choices. This refers to our own desire to live *our* life *our* way in a self-directed manner.

2.1.3 Human Development

The objective of this section is to transition from philosophy and the psychology of human motivation to the more tangible reality of *human development* as described by the United Nations (UN). The connection between these concepts is the idea that human

[48] Supra note 47.

development is the result of an intrinsic motivation to realize one's full potential and to live a good life. The following discussion examines the definition and drivers of human development and assesses whether the UN's current development paradigm has the potential to move us towards a high level of subjective well-being (SWB).[49]

The 1995 UN Human Development Report (HDR) defines *human development* as a "*process of enlarging people's choices*" (UN 1995, p. 11).[50] More specifically, it discusses the following three core choices (or opportunities) for people: [1] to lead a long and healthy life; [2] to acquire knowledge; and [3] to have access to sufficient resources to be able to obtain a decent standard of living. Other opportunities described as being highly valued by society include economic, social, and political freedom, and opportunities for creativity, productivity, enjoying personal self-respect, and for guaranteed human rights. Hence, human development is seen as having two sides. The first is the establishment of human *capabilities*, such as improved health and knowledge. The second is how people put these acquired capabilities to use, such as being active in cultural, social, and political affairs. The UN's use of the term 'choices' in defining human development is deliberate, since it raises the question of whether a person has the opportunity to improve his/her current situation.[51]

In an effort to quantify dimensions of human development, in 1975 the UN established the Human Development Index (HDI), which was first published in the (somewhat controversial) Human Development Report of 1990 (UN 1990). The HDI consists of three indicators: [1] life expectancy at birth; [2] educational attainment;[52] and [3] real GDP (or income) (UN 1995). The HDI is obtained by taking a simple average of the three indicators. For example, if a country were to obtain an HDI of 1, then all of its

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[49] The measurement of subjective well-being (SWB) has been the focus of a substantial amount of research by psychologists and social scientists over the past 30 years. Diener and Suh (2000) argue that *subjective well-being* (SWB) is a useful measure through which it is possible to judge successful living. The notion is that measuring whether people feel *happy* and *satisfied* with life is a good proxy for assessing whether they are living in accord with *human nature* (Kellert and Wilson 1993). Diener and Suh (2000) highlight a few important methodological issues relating to the measurement of SWB that are worth mentioning. First, initial measurements of SWB do seem to be comparable across individuals and societies. Second, the translation of the questions used to measure SWB into different languages does not seem to affect the research results. However, further research is called for. Third, even though there some positive results, there are still many methodological problems associated with measuring well-being across cultures. For example, the numeric scales used in the questionnaires might be interpreted differently by different cultures. The selection of an indicator (or index) to measure predictor variables such as freedom or equality is extremely difficult. Also, it is not yet clear what type of information each culture is using when responding to the questions. While there are clearly problems with measuring SWB, the initial results presented by Deiner and Suh (2000) are very informative.

[50] The full report can be viewed on the UN Human Development Report Office web site, http://hdr.undp.org/reports/global/1995/en/ (accessed on 04/08/06).

[51] The following section will take a more detailed look at Amartya Sen's (1992) discussion of inequality. In particular, it will focus on the difference between *achievement* and *freedom* to achieve, and on the concept that one's capability to achieve represents the opportunity to pursue his/her objectives.

[52] For educational attainment, a two-thirds weighting is given to adult literacy, and a one-third weighting is given to combined primary, secondary, and tertiary gross enrollment.

inhabitants achieve an average life span of 85 years, and everyone has access to education and a decent level of income.[53]

While the 1995 Human Development Report focuses on describing the HDI, it also provides a critique of the index. Its main comments refer to the lack of any measure of political freedom, cultural values, or environmental sustainability. There are also concerns about the choice of variable used to measure the three indicators, the quality of the data upon which the indicators are based, and the treatment of income, which some argue should be removed since it is a means and not an end. More recently, Morse (2003) presented a convincing argument that frequent changes to the calculation of HDI make it unwise to make year-on-year comparisons. For example, adjustments made to the calculation of life expectancy and GDP can alter a nation's HDI position by ±10 to 15 ranks. Morse calls for the use of meaningful and robust categories for human development, instead of the current ranking system. Notwithstanding the shortfalls of the HDI it is a useful *partial* or *rough* measurement of human progress and should be treated as such.

Today, the UN uses four additional indices to capture gender imbalances and income disparities across nations (UNDP 2003). The five UN human development indices are:

1. **HDI** (Human Development Index);
2. **HPI-1** (Human Poverty Index for developing countries) -- this index measures *deprivations* in the three human development indicators of the HDI;
3. **HPI-2** (Human Poverty Index for selected OECD countries) -- this index measures deprivations in the same manner as HPI-1, but also includes social exclusion through a long-time unemployment rate;
4. **GDI** (Gender-related Development Index) -- this index adjusts the HDI to reflect inequalities between men and women; and
5. **GEM** (Gender Empowerment Measure) -- this is an entirely new index which measures female participation in *political* and *economic* decision-making, and female power over economic resources.

While there are still major areas not covered by these new indices, such as environmental sustainability and culture, they do begin to provide a better picture of the state of worldwide human development.[54] Table 2.4 presents (where applicable) the rankings of the five human development indices for selected countries. Since the four additional indices are not calculated for the full range of countries included in the HDI, cross-indicator comparisons must be made with care.

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[53] The HDI treatment of income is complex. Real income (in purchasing power parity, or PPP, dollars) is adjusted to account for the diminishing utility of higher levels of income for development. The notion is that an individual does not *need* an infinite amount of money for a decent standard of living. Therefore, the HDI defines an income threshold that is believed to permit a reasonable standard of living, after which the value of additional money is sharply discounted. In 1995, the threshold was set at the average global real GDP per capita in PPP dollars in 1992 - which was just over $5,000 (UN 1995). See the later discussion on 'primary goods' raised by John Rawls.

[54] The topic of measuring sustainability is dealt with in Chapter 5.

As might be expected, those nation states that have a good HDI value also have a high level of GDP per capita. Conversely, those nation states with a poor HDI value face severe poverty.

Table 2.4: HDI, HPI-1, HPI-2, GDI, and GEM Ranks of Top and Bottom Countries[55]

HDI rank (out of **175** countries)	**Country**	**HDI value** 2001	**GDP per capita (PPP US$)** 2001	**HPI-1 rank** (out of **94** countries)	**HPI-2 rank** (out of **17** countries)	**GDI rank** (out of **144** countries)	**GEM rank** (out of **70** countries)
1	Norway	0.944	29,620	-	2	1	2
2	Iceland	0.942	29,990	-	-	2	1
4	Australia	0.939	25,370	-	14	4	11
7	United States	0.937	34,320	-	17	5	10
8	Canada	0.937	27,130	-	12	6	9
9	Japan	0.932	25,130	-	10	13	44
10	Switzerland	0.932	28,100	-	-	12	13
104	China	0.721	4,020	26	-	83	-
127	India	0.590	2,840	53	-	103	-
	EU Member States						
3	Sweden	0.941	24,180	-	1	3	3
5	The Netherlands	0.938	27,190	-	4	7	6
6	Belgium	0.937	25,520	-	13	8	15
11	Denmark	0.930	29,000	-	5	9	4
12	Ireland	0.930	32,410	-	16	16	16
13	United Kingdom	0.930	24,160	-	15	11	17
14	Finland	0.930	24,430	-	3	10	5
15	Luxemburg	0.930	53,780	-	7	18	-
16	Austria	0.929	26,730	-	-	14	7
17	France	0.925	23,990	-	8	17	-
18	Germany	0.921	25,350	-	6	15	8
19	Spain	0.918	20,150	-	9	20	14
21	Italy	0.916	24,670	-	11	21	32
23	Portugal	0.896	18,150	-	-	23	21
24	Greece	0.892	17,440	-	-	24	40
	Candidate Countries for EU Enlargement						

[55] Source: *UN Human Development Report 2003*, http://hdr.undp.org/reports/global/2003/ (accessed on 04/08/06).

HDI rank (out of 175 countries)	Country	HDI value 2001	GDP per capita (PPP US$) 2001	HPI-1 rank (out of 94 countries)	HPI-2 rank (out of 17 countries)	GDI rank (out of 144 countries)	GEM rank (out of 70 countries)
25	Cyprus	0.891	21,190	-	-	25	34
29	Slovenia	0.881	17,130	-	-	29	27
32	Czech Republic	0.861	14,720	-	-	32	28
33	Malta	0.856	13,160	-	-	33	-
35	Poland	0.841	9,450	-	-	35	25
38	Hungary	0.837	12,340	-	-	36	41
39	Slovakia	0.836	11,960	-	-	37	24
41	Estonia	0.833	10,170	-	-	38	33
45	Lithuania	0.824	8,470	-	-	42	48
50	Latvia	0.811	7,730	-	-	47	30
57	Bulgaria	0.795	6, 890	-	-	51	-
72	Romania	0.773	5, 830	-	-	57	53
96	Turkey	0.734	5,890	-	-	81	66
	Selected Balkan States						
47	Croatia	0.818	9,170	-	-	44	36
60	Macedonia	0.784	6,110	-	-	-	-
66	Bosnia and Herzegovina	0.777	5,970	-	-	-	-
95	Albania	0.735	3,680	-	-	73	-
	Selected Middle East States						
22	Israel	0.905	19,790	-	-	22	23
46	Kuwait	0.820	18,700	-	-	45	-
48	United Arab Emirates	0.816	20,530	-	-	49	65
73	Saudi Arabia	0.769	13,330	30	-	68	-
79	Oman	0.755	12,040	50	-	71	-
106	Iran	0.719	6,000	31	-	86	-
148	Yemen	0.470	790	67	-	127	70
	Selected African States						
111	South Africa	0.684	11,290	49	-	90	-
120	Egypt	0.648	3,520	47	-	99	68
146	Kenya	0.489	980	63	-	115	-
166	Guinea-Bissau	0.373	970	84	-	137	-
167	Congo, Dem. Rep. of the	0.363	680	74	-	136	-
168	Central African Republic	0.363	1,300	85	-	138	-
169	Ethiopia	0.359	810	92	-	139	-

HDI rank (out of 175 countries)	Country	HDI value 2001	GDP per capita (PPP US$) 2001	HPI-1 rank (out of 94 countries)	HPI-2 rank (out of 17 countries)	GDI rank (out of 144 countries)	GEM rank (out of 70 countries)
170	Mozambique	0.356	1,140	87	-	140	-
171	Burundi	0.337	690	80	-	141	-
172	Mali	0.337	810	91	-	142	-
173	Burkina Faso	0.330	1,120	93	-	143	-
174	Niger	0.292	890	94	-	144	-
175	Sierra Leone	0.275	470	-	-	-	-

All 15 EU member states have a relatively high HDI rank (within the top one fifth of the HDI) and all 13 candidate states for EU enlargement have HDI values lower than those of existing members. Romania and Turkey appear to be two of the less developed nations from Western Europe interested in joining the EU. With regards to the Balkan countries, their levels of human development seem comparable with those of the EU candidate states. A look at countries in the Middle East reveals a wide range in HDI values. Israel, Kuwait, and the UAE have a relatively high level of human development, whereas Yemen, for example, falls within the bottom fifth of the rankings. Finally, African countries represent a significant proportion of the lowest HDI values. At face value, the best place to live from a human development perspective would appear to be Norway and the worst place would be Sierra Leone.

Since the gender-related development index (GDI) and the Gender Empowerment Measure (GEM) are calculated for almost all of the top 50 nations included in the HDI (with the exception of 2 nations in the GDI and 10 in the GEM), it is possible to compare the indicators, but the omissions must be taken into account.

If we consider the GDI - which adjusts the HDI to reflect inequalities between men and women - the movements in rankings are not significant enough to draw any tangible conclusions. However, if we take a look at the GEM, the positions of Japan, Italy, and Greece relative to the HDI all fall significantly. In Japan's case, its ranking fell from 9th to 44th, which is likely to worsen as the 10 nations not included in the GEM rankings are added over time. What these results indicate is that women in these countries face inequality in opportunities with regards to economic and political participation and decision-making. Therefore, whereas the HDI highlights the inequalities between nation states, the new indices such as the GEM highlight, to varying degrees, the inequalities that exist *within* nations.

If we accept the three core opportunities presented by the 1995 Human Development Report as a proxy for human development, and we compare these opportunities to the motivations behind human behavior,[56] some interesting conclusions can be drawn. Foremost, we see that the first two opportunities for human development - i.e., for people

[56] It is important to remember that our needs motivate our behavior.

to live a *long and healthy life* and *acquire knowledge* - correlate with the two main forces which influence our physiological and psychological well-being (refer to the bottom and top arrows of Figure 2.2, respectively). Taking physiological well-being first, our health is a measure of whether our physical and biological needs are being satisfied. We recall that basic human needs for *safety*, *security*, and *sustenance* - arguably the core determinants of a (physically) healthy life - are a fundamental motivator of human behavior (Kasser 2002). Consequently, the *opportunity* to have a healthy life is essential, since without such a choice our basic physiological needs will remain unsatisfied, reducing our overall well-being.

A similar, although slightly more complex analogy can be made for our psychological well-being. First, the process of learning can be seen as being part of our *intrinsic motivation* - i.e., the natural human inclination to explore, to *learn*, to seek out novelty and challenges, and to realize one's potentialities (Ryan and Deci 2000a).[57] Second, the *social environment* (e.g., our family, network of friends, or relationships with teachers) has the ability to inhibit or support one's intrinsic motivation. Ryan and Deci (2000b) argue that there are three essential aspects of intrinsic motivation: our needs for competence, autonomy, and relatedness (or connectedness). Finally, Boree[58] explains how our learning is *influenced* by our history, society, and culture and is *mediated* by our social environment - as indicated by Figure 2.2.[59] To conclude the analogy, learning is considered by psychologists to be an innate human function which, when accompanied by a nurturing social environment, ultimately leads to the satisfaction of our needs for competence, autonomy, and connectedness. While schooling is only a proxy measurement of learning, it is likely to indicate whether or not a social environment is supportive of its community members' basic psychological needs. Thus, bearing in mind that the availability and quality of education within a population is likely to vary, it could be argued that a more learned society is likely to have a better psychological well-being than one which lacks even the basics of education.[60]

The reason for highlighting the above analogies is to show the clear connection between the first two opportunities for human development and the ultimate well-being of humans. In fact, *physical health* and *learning* could be described as essential attributes to a high level of well-being and for putting one on a path towards the good life.

The third core opportunity for human development - i.e., to be able to achieve a *decent standard of living* - is where it becomes difficult to connect the indictor (in this case,

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[57] Ryan and Deci (2000b) argue that intrinsic motivation is essential to cognitive and social development and that it is *the* source of an individual's enjoyment and vitality throughout life.

[58] Source: George Boeree, *The Ultimate Theory of Personality*, http://www.ship.edu/%7Ecgboeree/conclusions.html (accessed on 04/08/06).

[59] It is important to recognize that learning, in the psychological sense, is much broader than learning in the UN HDI sense. The former considers all life experiences as some form of learning, whereas the HDI considers learning only in relation to schooling.

[60] A word of caution is offered, however, since the manner and quality of teaching varies dramatically across the world, and simply attending school does not automatically mean that one is learning. It does mean, however, that one potentially has the *opportunity* to learn and this is the rationale for its use in the HDI.

income) to basic human needs. A major problem is that using the average global real GDP per capita (in purchasing power parity dollars in 1992 - which is just over $5,000)[61] to measure whether one can achieve a decent standard of living does not take into account the *social environment* which defines what a *decent standard* actually is. The achievement of a decent standard of living, as defined by American culture, is likely to require substantially more money than the average global real GDP per capita. Remember that the HDI indicator of income devalues all income over its threshold since "*people do not need an infinite income for a decent standard of living*" (UN 1995, p. 18). Such an evaluative statement, while perhaps correct if we are considering the basic provisions for life (such as food and shelter), is not likely to resonate with societies in which a decent quality of life is associated with a higher (relative) level of income. These societies, of course, are the consumer societies.

2.1.4 Income and Well-being

> "*We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness*" (U.S. Declaration of Independence, July 4th, 1776).[62]

The relationship between income and well-being (or happiness) across cultures has been studied in detail by psychologists and economists (Argyle 1987; Diener and Suh 2000; Kasser 2002; Layard 2005). The overwhelming result from this body of work is that "*people who strongly value the pursuit of wealth and possessions report lower psychological well-being than those who are less concerned with such aims*" (Kasser 2002, p. 5). If we return to Max-Neef's (1989) theory that the satisfiers to human needs are culturally defined, this brings to the surface an interesting question about *who* defines the level of income needed for a decent standard of living. In line with Max-Neef, it is suggested in Section 2.1.2 that the level of income needed for a decent standard of living is defined culturally through the influence of history and the values instilled in a nation's economic, social, and political systems. If true, this means that part of our desire for a certain level of income is based upon an *extrinsic motivation*. This is somewhat problematic since an extrinsic motivation means that our behavior is aimed at obtaining the approval of others (Kasser 2002) - i.e., we buy a certain type of product or strive for a high income to ensure that we gain the approval of our friends or maintain our perceived status in society. Such behavior is not likely to result in our ability to satisfy our intrinsic needs for competence, autonomy, and connectedness.

A more worrying issue relates to whether feelings of deprivation are creating a motivation for a better material standard of living. It could be argued that until we reached the era of global media, people did not feel deprived in relation to other nations. Now that the differences in consumption are so visible, poverty, and its affect on culture,

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[61] Supra note 53.

[62] Source: The Independence Hall Association (IHA), *The Declaration of Independence*, http://www.ushistory.org/declaration/document/index.htm (accessed on 04/08/06).

becomes an important issue - i.e., people 'feel' economically and materially poor. If we return to the original assumption that the satisfaction of needs drives economic and political systems (see Section 2.1), one quickly realizes that if basic human needs become confused with materialistic wants on a global scale, the problem of a throughput society explodes.

A throughput (or high-waste) society,[63] by definition, depends on increasing rates of consumption (or throughput) (Princen et al. 2002). If we are losing jobs as a result of production efficiencies, the only way to create more jobs is to expand the economy and increase throughput. A critical question, therefore, is whether basic human needs drive our throughput society, or does this drive stem from a *conditioned* response?

In neo-classical economics, human needs/wants drive systems of exchange and markets. The concern is that the world of industrialization and commerce has made the distinction between basic human needs and wants unclear (Michaelis 2000). Indeed, one could argue as Galbraith (1958) did that if a want is to be urgent, it should be the result of a need that originates *within* the individual. This position was later supported by economist Nicholas Georgescu-Roegen (1971, p. 324), who argued that "*only those goods and services an individual can enjoy personally influence his satisfaction.*" If a want is *externally* contrived, it cannot be an urgent (or basic) need. Hence, satisfying that want will only occur through behavior which is led by extrinsic motivation. And as discussed above, this is not likely to result in the enhancement of an individual's well-being.[64]

The subtext of the above discussion is that in promoting economic growth, companies entice people to buy their services or products. The primary way for the value or benefit

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[63] Clapp (2002) provides a useful discussion of *preconsumer* and *postconsumer* waste. Preconsumer waste is generated in the production of consumer items and postconsumer waste (or garbage) is what is thrown away once the usefulness (or utility) of a product has ended. Clapp argues that the drive towards economic liberalization since the 1980s - in both the North and South - has created a global organization of production, trade, and consumption. This economic liberalization has been supported by Western-style legal and institutional mechanisms that favor commoditization and expansion (Manno 2002). Hence, high levels of consumption fuel the throughput society, without which national and global industries would struggle to survive in their present form. To counter the forces pushing for the globalization of markets and the removal of trade barriers, Manno (2002) argues that non-consumption solutions to human needs are inherently local. "*New legal and political capacity to stimulate investment in community-based, less commoditized satisfaction for human needs and wants must devolve to the level nearest to the people with those needs and wants*" (Manno 2002, p. 97). He also argues that "*new legal frameworks ... allow localities to innovate economically and ... protect them from the colonizing impulses of global forces and actors*" (Manno 2002, p. 98). In today's market economy, an individual's ability to sell (and make a profit) is closely connected to his/her wealth and power. However, it is clear that the *good life* cannot be achieved through the sale and purchase of products alone. Hence, government needs to create innovative public policies to ensure that noncommercial - i.e., non-consumptive - values are an integral part of modern society.

[64] The idea that capitalist economies have been successful in achieving intermediate goals of increasing material wealth - but that this has been accomplished at the expense of underlying human values [and the environment] - is becoming more widely accepted by economists (Ackerman et al. 1997). Indeed, the emerging field of ecological economics is a good example of a branch of economics that is attempting to integrate human values into economic analysis (Krishnan et al. 1995). See the later discussion in Section 4.2.2.

of a product/service to be conveyed to the consumer is through advertising.[65] Hence, it can be argued that advertising leads to *producer-created demand* - i.e., what we need/want is conditioned by advertising. Galbraith (1967) provides a succinct example of this idea. "*Were there but one manufacturer of automobiles in the United States, it would still be essential that it enter extensively on the management of its demand. Otherwise consumers, exercising the sovereignty that would be inconsistent with the company's planning, might resort to other forms of transportation and other ways of spending their income*" (ibid, p. 207). Further, Soros (1997) argues that the notion of producer-created demand has established 'money' as *the* measure that identifies a product or an individual's value.

> "*Advertising, marketing, even packaging aim at shaping people's preferences rather than, as laissez-faire theory holds, merely responding to them. Unsure of what they stand for, people increasingly rely on money as the criterion of value. What is more expensive is considered better. The value of a work of art can be judged by the price it fetches. People deserve respect and admiration because they are rich. What used to be a medium of exchange has usurped the place of the fundamental values, revising the relationship postulated by economic theory*" (Soros 1997, p. 52).

Michaelis (2000) takes the concept of producer-created demand one step further by extrapolating it to other areas. In particular, she asks the question of whether a government's failure to regulate advertising may inhibit our ability to satisfy our intrinsic need for autonomy. "*The market economy contains structural incentives for businesses to market conceptions of the good life that support sales of their own products. Many other circumstances, including social norms, work culture, and infrastructure constraints, provide strong pressures for individuals to adopt particular conceptions of the good life. Hence, by adopting a hands-off approach, governments may actually be failing to protect an important freedom*" (Michaelis 2000, p. 26). A major problem with the current form of advertising is that people start to live their lives believing that a high level of income and material wealth are essential to their happiness (Jacobson and Mazur 1995).

Similarly, Sanne (2002) argues that a focus on the social and psychological factors of consumer behavior[66] neglects to consider how producers and businesses *create*

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[65] In an insightful look at technological determinism in American culture, Smith (1994, p. 13) describes how "*advertising became the instrument by which big business, in need of ever-expanding markets for its mass-produced products, imprinted instrumental values - and with them, the ethos of mass consumption - on the populace. Advertising agencies, in short, not only sold the products of industrial capitalism but also prompted a way of thinking about industrial technology. Using the psychological concepts of association and suggestion, neatly packaged in colorful and briefly worded appeals that excited mental images, advertisers encouraged people to believe that technology, broadly construed, shaped society rather than the other way around. As more and more psychology-based advertisements reached the public through print, radio, and eventually television, technology became idolized as the force that could fix the economy and deliver on the legendary promise of American life. Such technocratic pitches constituted a form of technological determinism that embedded itself deeply in popular culture.*"

[66] For an insightful discussion on the historical and theoretical foundations of the consumer society and consumerism, see Miles et al. (2002); Stearns (2001); Miles (1998); Firat and Dholakia (1998); and Krishnan et al. (1995).

consumption to satisfy their own interests. It also neglects the role of the state and how business has a tendency to co-opt or lobby government for market conditions that favor consumption. This latter issue creates what Sanne (2002, p. 282) calls "*structural lock-in effects.*" Such effects are (in order of impact):

1. "*the pattern of work-and-spend promoted by naturalising paid work as 'full time' with continuous, life-long occupation supported by a legal structure of social insurance, eligibility to social benefits, etc.*
2. *the making of a consumer culture where marketable goods are forwarded as the means to satisfy not only material needs but also needs of social stratification*[67] *and cultural identification*[68]
3. *the promotion of individual means of transport, in particular cars, which presuppose heavy investments in road infrastructure, a classical aim of much business lobbying*
4. *new communication infrastructures which force a technology shift on consumers*" (Sanne 2002, p. 282).

Sanne (2002) argues that governments, and businesses, tend to counter incentives to curb consumption with reference to consumer sovereignty. Such a position passes the responsibility to the consumer, whose purchasing behavior then becomes subject to moral inquiry. The basic argument is that firms would provide environmentally-friendly products if consumers demanded them. Hence, we must first address the values supporting present lifestyles by educating consumers about the effects of their behavior. The problem is that there is a fine line between education and persuasion/coercion; the latter being an infringement on an individual's freedom to choose. But one could argue that an individual's freedom to choose is affected by advertising targeted directly at our insecurities. A reliance on consumer sovereignty is further complicated by the fact that a growing number of consumers in America seem paralyzed by an inability to speak out against materialistic tendencies since this would go against our core belief that people should have the freedom to make their own decisions (The Harwood Group 1995). Hence, people turn away from questioning their behavior and that of others, undermining any argument that society will act responsibly if provided with sufficient information on the problems associated with their consumption. Sanne (2002) argues that the key to a sustainable future may be to counter the pattern of work-and-spend by establishing shorter working hours. The notion being here that with less income and working hours we will consume less and be able to enjoy more leisure time. However, there are those who question whether more leisure time would lead to a better quality of life.

> "*The psychological underpinnings of capitalism have enabled the leisure time which technology affords us to be converted into yet another opportunity for the*

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[67] The differentialist view of consumption is that of social stratification, i.e., the use of wealth to *conspicuously consume*, to display artifacts of taste or expense commensurate with your position in society (Sanne 2002). Also see Thorstein Veblen's (1994 [1902]) classic work, *The Theory of the Leisure Class*, which introduced the phrase *conspicuous consumption.*

[68] The culturalist view of consumption connects the individual to her own self-understanding (Sanne 2002). Consumption is seen as a reflection of the self; what you buy supports your understanding of who you are. Both differentialist and culturalist views are part of utilitarianism, since in both cases the objective is to increase overall well-being.

consumption of unnecessary goods. Inasmuch as capitalism has 'freed' the worker from the worst excesses of the labour process, it has sought to occupy his free time with 'compensatory needs' that bring neither happiness nor personal fulfillment" (Redclift 1984, p.53).

The psychological *and* environmental problems associated with advertising and the throughput (or consumer) society have been well documented (Brown 1981; de Graaf et al. 2002; Diener and Suh 2000; Durning 1992; 1994; Goodwin et al. 1997; Kasser 2002; Layard 2005; Princen et al. 2002; Ryan and Durning 1997; Schlosser 2002; Stern et al. 1997). However, calls for public recognition of the potential problems with a market economy have failed to materialize. One possible reason for this is that we are so entrenched in the current economic paradigm that we are unable to recognize that we are in some way addicted to consuming (Ehrenfeld 2004). While the consumption of products and services clearly improves our quality of life, we should be aware that our perception of the good life has been/is being manipulated by market actors whose primary incentive is profit. Hence, the line between consumption that satisfies *intrinsic* and *extrinsic* needs is becoming blurred.

If we are interested in measuring human development, life expectancy at birth and educational attainment are a useful starting point. However, using income as a measure for a decent standard of living presents some difficult problems. First, across and within societies, people are likely to have very different views of what a decent standard of living actually is.[69] Second, there is a concern with regards to the influence that the market economy has on the *definition* of a decent standard of living and the good life. This concern is further complicated by the fact that the market economy is currently the predominant mechanism by which people in developed countries are able to meet their basic needs for safety, security, and sustenance.

While there are clearly problems with using income as a measure of human development, measuring happiness, or well-being, using income has led to mixed results (Diener and Oishi 2000; Kenny 1999).

"*For liberals, there is the finding that poor people are less happy on average. For conservatives, there is the finding that wealthy nations are happier, and that the*

[69] An individual's opinion of a decent standard of living depends upon her own level of income and upon where she sees herself in the societal structure (Kasser 2002). Thus, using income to measure standard of living is likely to be inadequate at representing the views of individuals in nations with a high GDP per capita. At the other end of the spectrum, there is strong evidence to suggest that as GDP per capita increases from virtually zero to around $5,000 per year (in PPP dollars), life expectancy at birth increases from about 40 years to just over 70 years (World Bank 1993). The same set of data also shows that as income increases beyond $10,000 per year, life expectancy remains relatively constant at just under 80 years. Interestingly, it has been shown that the same trend occurs with income and well-being (Inglehart 2002; Inglehart and Klingemann 2000). There is a dramatic increase in well-being up until an income of $10,000 per year, after which increases in income only have a limited effect on improving a person's well-being - although, there is an increase. A note of caution is added here: this outcome does not mean that unlimited wealth will *not* affect an individual's well-being. As discussed throughout this section, there is a substantial amount of research that shows that if an individual focuses on materialistic pursuits, his/her well-being is likely to decrease.

degree of inequality in nations does not seem to adversely affect SWB [subjective well-being]. *For those who believe that materialism is not the road to happiness, there is the finding that wealthy societies have not grown in SWB as they achieved even higher levels of wealth, and also the finding that believing money is very important is related to less life satisfaction. For the psychologist there is the finding that global feelings of well-being influence financial satisfaction in a top-down fashion beyond the bottom-up influence of objective income. And for the cross-cultural scientist there is the finding that culture and expectations seem to play a role in people's SWB*" (Diener and Oishi 2000, pp. 214-215).

2.1.5 Conclusion

There is convincing evidence to suggest that understanding the fundamental needs of humans is essential if we are to develop strategies to transition society towards more sustainable forms of development. Put simply, human needs motivate behavior and developing a better understanding of this relationship can only enhance economic, social, and political decision-making.

The notion of living a good or virtuous life has long captured the minds of many great philosophers. While there are several systems of philosophy that can be used to describe what constitutes the good life, it is clear that an individual's view of the good life will have a strong influence on his/her behavior within society, including his/her actions within economic and political systems. Furthermore, no matter what construct is used to describe the good life - Aristotelian virtues, Capra's self-assertive and integrative human tendencies, or the Communitarian perspective on the individual and community - the notion of *living a well-balanced life* is omnipresent.

In Western cultures, the commonly held belief is that everyone has (or should have) access to the good life and that there is no one view that defines what this should be. The idea is that each individual has the right to create and pursue his/her own vision of happiness. Further, it is hard to imagine that there will ever be universal agreement on what constitutes a good life since this will ultimately be influenced by individual personalities and beliefs and by societal and cultural values.

Over the past century, psychologists (and even some economists) have shown how human needs and desires motivate our behavior. For example, Kasser's (2002) essential human needs of *sustenance*, *competence*, *autonomy*, and *connectedness* and Max-Neef's (1989) notion that the satisfiers of needs are defined by economic, social, and political systems provide a useful framework from which discussions about human needs can progress. A basic premise of these theories is that our well-being and quality of life increase when our needs are satisfied and decrease when they are not. Interestingly, human motivation appears to result as much from our *own* knowledge of the good life (and the needs this life engenders) as it does from belonging to a community of people that share a common conception of the good life. Hence, *social* ethics - a moral code of conduct - are likely to play an important role in motivating human behavior.

It is well documented that individuals, groups, and cultures develop the *actions* and *value systems* that are used to realize their needs. This is especially important when considering differences in the needs of people in developed versus developing nations, where livelihoods vary significantly. It also means that the satisfiers to needs will change over time and across cultures with socio-economic change. Further, if societal and cultural values nurture basic psychological needs, it is likely that the social fabric of a community will strengthen, which in turn will facilitate the well-being and integrity of individuals within that community (Ryan 1995). If not, then the reverse is likely to occur.

The most prominent attempt at measuring whether human needs are being met is the UN Human Development Index (HDI). The HDI's three main indicators - life expectancy at birth, educational attainment, and real GDP - provide a useful *partial* measurement of human progress within a nation and should be treated as such. However, if each indicator is compared to the motivations behind human behavior, some interesting conclusions can be drawn. Foremost, we see that the first two opportunities for human development - i.e., for people to live a *long and healthy life* and *acquire knowledge* - correlate with two major forces that influence our physiological and psychological well-being. First, we recall that basic human needs for *safety*, *security*, and *sustenance* - arguably the core determinants of a (physically) healthy life - are a fundamental motivator of human behavior. Consequently, the *opportunity* to have a healthy life is essential, since without such a choice our basic physiological needs will remain unsatisfied, reducing our overall well-being. Second, learning is considered by psychologists to be an innate human function which, when accompanied by a nurturing social environment, ultimately leads to the satisfaction of our needs for *competence*, *autonomy*, and *connectedness*. While schooling is only a proxy measurement of learning, it is likely to indicate whether or not a social environment is supportive of its community members' basic psychological needs. Thus, it could be argued that a more learned society is likely to have a better psychological well-being than one which lacks even the basics of education.

However, the HDI's use of income as a measure of well-being presents some difficult problems. First, people from different societies and cultures are likely to hold a wide range of views about what a decent standard of living actually is. Second, there is a concern that *producer-created demand* is having a negative influence on the *definition* of a decent standard of living and the good life. In a similar context, many have argued that a reliance on the market is likely to result in over-consumption and environmental harm due to inadequate consumer information. These two latter points rest upon the argument that the market economy contains structural incentives that encourage firms to market conceptions of the good life that reinforce the sales of their products and services.

A growing concern in Western culture is that our view of the good life has been affected (or put out of balance) by the forces of the market economy (i.e., advertising, as well as social competition for conspicuous consumption). The result of this imbalance is that an individual's behavior is being *externally regulated* - i.e., it is aimed at obtaining the approval of others. For example, we buy a certain type of product or strive for a high income to ensure that we gain the approval of our friends or maintain our perceived status

in society. Such behavior is not likely to result in our ability to satisfy our intrinsic needs for competence, autonomy, and connectedness.

A neoclassical economics solution to the above concern might be that each person should act in his/her own interests and let the market allocate resources accordingly. This solution assumes that each person is receiving good information and is able to make informed, rational decisions. However, this does not appear to be the case for consumers aged 45 and over in the U.S., who are finding it increasingly difficult to use their spending power effectively (AARP 2004). It also assumes that even if a person had perfect information he/she would act in a socially responsible (and rational) manner - an assumption that is likely to be challenged by the Communitarian movement.[70]

Relying solely on the market to ensure that basic human needs are met is clearly not a viable option - who would provide education and primary health care for the poor? Hence, government has an important role to play in ensuring that markets function for the benefit of society and to intervene where they fall short. To enable an acceptable balance of responsibility to be achieved, there needs to be a willingness on the part of governments, society, and industry to engage in discussion and the analysis of the connection between freedom, regulation, and control - and its relationship to overall societal good - if and when radical changes to our social and physical systems become necessary (Haland 1999). Further, a reliance on social influence (or good will) to initiate change ignores evidence that unless the right environment and resources are made available, society will be asked to act beyond its capacity (Schmuck and Schultz 2002). In many ways, what is needed is a co-evolutionary approach to change, in which the values held by government, society, and industry evolve to support human needs and the objectives of sustainable development.

To put the problem of sustainable development in simple terms, if a society is unable to fulfill its basic human needs, and as a consequence continues to divest in human development and degrade the environment, it is difficult to envision a future in which its development will be sustainable. "*The sustainability problem is a result of individual and collective human behaviour. It cannot be treated as an economic or technical problem, without considering the mechanics that intervene on the behavioral side of it*" (Pol 2002, p. x). Hence, government, society (i.e., communities and individuals), and industry have a responsibility to promote values that center on innate human needs, the satisfaction of which should lead to good physiological and psychological health. Further, each stakeholder also needs to promote levels of consumption that do not exceed ecological limits and set a standard of living to which all can aspire. Ultimately, turning our focus to

[70] The objective of communitarianism is to identify ways to restore social and moral consensus to communities without imposing a set of behaviors and values upon them. The movement is based upon the concern that in the U.S. the relationships between individuals and groups, rights and responsibilities, and among the institutions of state, market, and civil society are out of balance. This imbalance means that personal and social ethics are also out of balance, resulting in a preoccupation with individualism. Thus, if a large segment of society exhibits individualistic tendencies, it is questionable whether they would act in a more socially responsible manner if provided with perfect information about the impacts of their (economic and social) behaviour.

meeting human needs[71] is likely to *"make fewer demands on our environmental resources, but much greater demands on our moral resources"* (Brown 1981, p. 359). In the end, the challenge facing society is how to reconcile the void between individual human needs on the one hand and the sustainable development of social and physical systems at the local, national, and global level on the other.

2.2 Social Justice, Inequality, and the Social Contract between the Governed and the Government

> *"The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little"* (Franklin Delano Roosevelt, Second Inaugural Address, January 20, 1937).

An important conclusion drawn above is that government should act as a trustee to ensure that basic human needs are met in an equitable and just manner. However, governments cannot provide the whole answer; competitive markets will also continue to play a vital role in meeting human needs. The challenge is to find a tolerable balance between government regulation and economic (and other forms of) freedom.[72]

In general, economists tend to reject the notion that the government should interfere with the market and argue that we should let people express their utility in the market place. However, as discussed in the previous section, consumers are finding it increasingly difficult to use their spending power effectively. Hence, it appears that there are two predominant views: [1] there are basic needs and that is why we need *markets*; and [2] there are basic needs and that is why we need *government.*

The focus of this section will be on the problems of equity within a country or region, equity between developed and developing nations, and intergenerational equity (note: the latter two forms of equity were predominantly the focus of the Brundtland Commission). The critical question addressed here is what is fair *within* society and what role should government play? If the state is to play a role in needs satisfaction, we should have some understanding of the relative roles of the governed and the government. In this regard, we begin this section with a look at the *social contract.*

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[71] Ironically, a focus on the human need for increased purchasing power may come at the expense of the environment through increasing commercial activity. Clearly, a physical standard of living needs to be 'co-optimized' with environmental quality and employment.

[72] A reliance on markets is not likely to be sufficient, since if there is *producer-created demand*, then businesses influence both the supply and the demand side of the economy. While such influence may not result in monopoly prices, it has the potential to reduce our ability to fulfill our basic needs of *sustenance, competence, autonomy*, and *connectedness* (Kasser 2002). Hence, government has a role to play in ensuring that a full range of products/services are provided for society.

2.2.1 The Social Contract and the Theory of Justice

> "*Man is born free; and everywhere he is in chains. One thinks himself the master of others, and still remains a greater slave than they*" (Rousseau, 1762).

The modern notion of the social contract can be traced back to the political and moral theories of Thomas Hobbes (1985 [1651]), John Locke (1988 [1690]), Jean-Jacques Rousseau (1968 [1762]), and Immanuel Kant (1989 [1785]), but the present day interpretation rests most heavily on the work of John Rawls (1971).

The basic premise of the social contract is that an individual - in accepting that the pursuit of self-interest is ultimately self-defeating - relinquishes certain freedoms/rights to a system of collectively-enforced social arrangements in exchange for peace and security.[73] Hence, he/she agrees to follow the 'general will' of society and be held accountable if his/her 'individual will' motivates behavior that breaks the social contract - i.e., the law of the land (Rousseau 1968). Whatever freedoms an individual loses in the transition from the State of Nature[74] to the Civil State are more than compensated for by belonging to a civil society that ensures liberties and property rights. Hence, the social contract tries to balance individual freedom with being a member of a civil society that limits freedoms for the greater good.

During the 19th century, interest in the social contract declined as the utilitarian movement took hold (Rawls 1971). As mentioned in Section 2.1.1, utilitarianism argues that all moral judgments should aim to achieve the greatest good for the greatest number (Bentham 1970 [1781]); and (Mill 2002 [1863]). Hence, the objective of social institutions and human actions under a utilitarian framework is to develop and enforce laws that maximize the well-being and happiness of society. Yet, utilitarianism suffers from two major problems (Brock 1971). First, the theory raises moral conflicts, particularly in regards to justice. For example, while reducing taxes might maximize the happiness (or material well-being) of society, it might also have the effect of reducing the availability of basic health or educational services for the disadvantaged. The aggregative

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[73] Source: Friend, C. (2004) The Internet Encyclopedia of Philosophy, *The Social Contract*, http://www.iep.utm.edu/s/soc-cont.htm (accessed on 04/08/06).

[74] The 'State of Nature' refers to a hypothetical state of living that occurred prior to the establishment of society and the introduction of any form of government or social arrangements. Hence, in the State of Nature there are no restraints on how one can behave. The manner in which one defines the State of Nature has implications on how the social contract is subsequently envisioned. For example, Hobbes's (1985) political philosophy was based upon the idea that men in a State of Nature (i.e., in a state without civil government) are in a state of constant war, which any rational and self-motivated individual would want to end. Hence, the solution is to establish a social contract to ensure peace and order and to enable individuals to live in a civil society, which suits their own interest. Hobbes's hypothetical view of the State of Nature was extreme in that he envisioned a world in which man would constantly fear for his life. Locke (1988) built upon Hobbes's notion of the social contract, but constructed his theories upon a different view of the State of Nature. Locke (1998) argued that without government to enforce social arrangements and laws, man is not free to do anything he pleases since he is constrained by a sense of morality. In this regard, the "*State of Nature is pre-political, but it is not pre-moral. ... It is therefore both the view of human nature, and the nature of morality itself, which account for the differences between Hobbes' and Locke's views of the social contract*" (Source: Friend, C. (2004) The Internet Encyclopedia of Philosophy, *The Social Contract*, http://www.iep.utm.edu/s/soc-cont.htm (accessed on 04/08/06)).

character of utilitarianism means that it is not concerned about the pattern of distribution of welfare,[75] and therefore provides no justification for inequality in its distribution (Cohen 1993). Further, "*it would not only be morally right to sacrifice the interests of individuals or minority groups if this would serve to maximize common utility, but those who are sacrificed would even have a moral duty of benevolence to let this happen*" (Wetlesen 1999, p. 42). Second, utilitarianism fails to support the more liberal nature of Western societies that emphasize liberty and individual rights. For example, slavery was a useful institution in the U.S. for promoting the success of agricultural advance, but it was ultimately rejected on moral and socio-political grounds. Similar arguments apply in the elimination of child labor in industrialization.

In an effort to address the shortfalls of utilitarianism as well as those of intuitionism (i.e., the systems of philosophy that consider intuition as the fundamental process of our knowledge), John Rawls published his seminal work in 1971, *A Theory of Justice*, which renewed the notion of the social contract by arguing that political and moral positions can be determined using impartiality.

The traditional social contract (envisioned in its various forms by Hobbes, Locke, Rousseau, and Kant) revolved around the agreement of people in a State of Nature to form a society and government that they will be obligated to obey (Brock 1971). In this regard, the social contract is "*primarily a theory of political obligation*" (ibid, p. 488). In contrast, Rawls developed a version of the contract in which the relevant agreement revolves around moral principles, the principles of justice (ibid, p. 488). Central to Rawls's theory is the hypothetical situation, the 'Original Position,' in which an individual's knowledge is constrained by a *Veil of Ignorance*. Behind the *Veil of Ignorance*, "*no one knows his place in society, his class position or social status; nor does he know his fortune in the distribution of natural assets and abilities, his intelligence and strength, and the like. Nor, again, does anyone know his conception of the good, the particulars of his rational plan of life, or even the special features of his psychology such as his aversion to risk or liability to optimism or pessimism. ...* [T]*he parties do not know the particular circumstances of their own society, ... its economic or political situation, or the level of civilization and culture it has been able to achieve*" (Rawls 1971, p. 137). Rawls argues that decisions made for society should be made as if the participants do not know in advance what their lot in life will be.

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[75] The Brundtland report, *Our Common Future*, interprets 'welfare' as the "*satisfaction of human needs and aspirations*" (WCED 1987, p. 43). This interpretation rests upon fundamental human needs for 'primary goods' such as food, shelter, clothing, employment, etc. and the legitimate expectations for a better life. Wetlesen (1999) argues that we can reasonably interpret the Brundtland commission's view of welfare in an *objective* and *subjective* sense. The former is concerned with conditions and standards of living, and the latter with the perceived quality of life that an individual is able to achieve. The Brundtland report is also concerned about the equitable distribution of welfare. "*The essential needs of vast numbers of people in developing countries - for food, clothing, shelter, jobs - are not being met, and beyond their basic needs these people have legitimate aspirations for an improved quality of life. A world in which poverty and inequality are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life*" (WCED 1987, pp. 43-44).

In essence, Rawls's Original Position is an abstract version of the State of Nature. It follows that from the Original Position, people are able to identify what they must do individually and collectively (through social institutions) to realize the nature of justice. The simplicity of the *Veil of Ignorance* is its strength. By denying contracting parties the knowledge of their own characteristics or circumstances, they are forced to adopt the moral point of view and are unable to develop principles or policies that favor themselves. Rawls also states that contracting parties are assumed to be "*rational and mutually disinterested*" (Rawls 1971, p 13): 'rational' in the sense that the contracting party makes the most effective decision to reach a given ends, and 'mutually disinterested' in the sense that each person does not take "*an interest in one another's interests*" (ibid, p. 13). Thus, the 'rational' choice is to develop principles and strategies for a just society that are developed from initial conditions that are inherently fair. Justice, therefore, proceeds out of fairness, giving rise to Rawls's formulation of "*justice as fairness*" (ibid, p. 17). Further, as Brock (1971, p. 489) notes, in Rawls's theory there is no historical agreement, which means that contracting parties are able to adopt "*the standpoint of someone in the original position, and so the moral point of view, at any time.*" In theory, an individual in the Original Position will adopt the same principles for justice as any other person, thereby establishing a robust set of principles and arrangements to regulate a just society.

A problem identified by Rawls when considering the design of the social institutions that form the basic structure of society is that individuals are born into the world with a wide range of circumstances and characteristics. While it is not possible to alter many of the human characteristics that form our personalities and physical ability, Rawls argues that it is possible to adjust the social institutions to favor those who are disadvantaged. Hence, Rawls developed two principles of justice that he argues contracting parties would select in the Original Position - behind the *Veil of Ignorance* - to establish a just society.

> **First Principle**: "*each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all.*"
>
> **Second Principle**: "*social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged, consistent with the just savings principle, and (b) attached to offices and positions open to all under conditions of fair equality of opportunities*" (Rawls 1971, p. 302).

The first principle determines the distribution of civil liberties. It states that each member of a society is to receive as much liberty (or personal freedom) as possible, as long as every other member of society receives the same. The second principle states that social and economic inequalities are only justified if the most disadvantaged members of society are made relatively better off under new arrangements. As Friend notes, "*only if a rising tide truly does carry all boats upward, can economic inequalities be allowed for in a just society.*"[76]

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[76] Supra note 73.

Rawls (1971) developed the second principle (known as the *difference principle*) using the *maximin rule* - i.e., the best outcome is one that minimizes the maximum loss. He argued that since people do not know their position in society when behind the *Veil of Ignorance*, they will select the *difference principle* since it will be to their benefit if they end up in the most disadvantaged section of society.

In the latter part of principle 2(a), Rawls introduces the notion of 'just savings,' which is the first comprehensive treatment of intergenerational equity (or justice). The basic idea is that when in the Original Position, behind the *Veil of Ignorance*, individuals do not know which generation or in what stage of socio-economic development they might live, and must, therefore, select 'savings' principles that do not favor earlier generations over later ones.[77] In *A Theory of Justice*, Rawls's formulation of the just savings principle was based upon a 'motivational assumption' that contracting parties would want to save for their successors - regardless of whether their ancestors saved for them.[78] This formulation runs counter to the notion of 'mutually disinterested' contracting parties and has been criticized as being sexist and arbitrary (Barry 1978; Okin 1989).

In *Political Liberalism*, Rawls (1993) revised his notion of the just savings principle to address these inconsistencies. His revised assumption is that *generations* are mutually disinterested. Therefore, contracting parties in the Original Position, behind the *Veil of Ignorance*, should "*agree to a savings principle subject to the further condition that they must want all previous generations to have followed it. Thus the correct principle is that which the members of any generation (and so all generations) would adopt as the one their generation is to follow and as the principle they would want preceding generations to have followed (and later generations to follow), no matter how far back (or forward) in time*" (Rawls 1993, p. 274). In this formulation, the principle of just savings is considered as binding for all previous and future generations.[79] A problem, however, with Rawls's restatement is that he does not consider the implications of an increasing number of people in the future,[80] or that the current generation has a larger population than the pervious generation - a fact that will clearly change how much society should save (Barry

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[77] In the words of Rawls (1971, p. 287): "*The parties do not know to which generation they belong or, what comes to the same thing, the stage of civilization of their society. They have no way of telling whether it is poor or relatively wealthy, largely agricultural or already industrialized, and so on. The veil of ignorance is complete in these respects. Thus the persons in the original position are to ask themselves how much they would be willing to save at each stage on the assumption that all other generations are to save at the same rates. That is, they are to consider their willingness to save at any given phase of civilization with the understanding that the rates they propose are to regulate the whole span of accumulation. In effect, then, they must choose a just savings principle that assigns an appropriate rate of accumulation to each level of advance.*"

[78] Sources: Stanford Encyclopedia of Philosophy, Intergenerational Justice, *Rawls's Just Savings Principle*, http://plato.stanford.edu/entries/justice-intergenerational/#3.3 (accessed on 04/08/06); Wolf, C. (2004) *Saving, Sustainability, and Intergenerational Justice*, http://www.public.iastate.edu/~jwcwolf/Papers/WELLMAN.HTM (accessed on 04/08/06); and Wissenburg, M. L. J. (1997) *The distribution of rights*, Proceedings of the 1997 Environmental Justice Conference, University of Melbourne.

[79] Supra note 78.

[80] In contrast, in Northern industrialized societies, there are implications of decreasing populations which can not provide sufficient amenities for those retiring (The International Economy, 2004).

1999; Casal and Williams 1995; Dasgupta 1994; Heyd 1992). Nevertheless, Rawls's ideas provide a useful starting point for discussions about intergenerational equity.

The two principles of justice have a specific order in which they are to be considered. The first principle must be considered prior to the second principle, since "*liberty can only be restricted for the sake of liberty, not for other social and economic advantages*" (Brock 1971, p. 490).[81] This ranking implies that society would rank the determination of civil liberties above that of economic advantage. Also, within the second principle, equality of opportunity (2b) is to be considered prior to the *difference principle* (2a) using the same rationale.

Before progressing further, it is worth mentioning that there are those who question these basic principles of justice. For example, Brock (1971) argues that people in the Original Position are likely to tolerate minor sacrifices in liberty for substantial economic gain; especially in situations of severe economic underdevelopment. Further, the *difference principle* assumes that all risk taking in the Original Position is irrational: "*it allows no possible gain in one's life prospects, should one turn out to be among the better off members of society*" (Brock 1971, p. 491). This latter point reflects a common criticism of Rawls's decision to use a maximin rule (Harsanyi 1975). Rawls (1974) counters such arguments by stating that the original position masks the probabilities of outcomes, making alternative decision rules too risky. In addition, the *difference principle* acknowledges the fact that any good circumstances into which a person is born are "*unearned and undeserved*" (Brock 1973, p. 491). The benefits that are derived from these circumstances should therefore benefit all of society. Thus, whether a person is for or against Rawls's theory of justice will depend, to a certain extent, upon that person's perceived position in society.

Rawls argues his notion of justice as fairness begins with the adoption of the principles of a just society, which will guide all subsequent actions, including the reform of institutions.

> "[H]*aving chosen a conception of justice, we can suppose that* ... [the contracting parties] *are to choose a constitution and a legislature to enact laws, and so on, all in accordance with the principles of justice initially agreed upon. ... Moreover, assuming that the original position does determine a set of principles (that is, that a particular conception of justice would be chosen), it will then be true that whenever social institutions satisfy these principles those engaged in them can say to one another that they are cooperating on terms to which they would agree if they were free and equal persons whose relations with respect to one another were fair*" (Rawls 1971, p. 13).

[81] It is possible to envisage a situation where liberty is constrained to protect liberty - i.e., "*restrictions to individual freedoms are justified when the unfettered exercise of these freedoms conflicts with other freedoms*" (Beatley 1994, p. 156). For example, the speed at which vehicles are allowed to drive is constrained to protect broader public freedoms such as individual safety.

Rawls argues that the challenge raised by the *difference principle* is how to choose a social system (i.e., a basic structure of government) that will ensure *distributive justice* in a capitalist market economy. From the premise that the basic structure of government and its actions are regulated by a constitution protecting the liberties of equal citizenship, Rawls outlines four branches of government (Rawls 1971, pp. 274-284). First, is the *allocation branch*, required to keep markets competitive, prevent the formation of unreasonable market power, and correct for externalities. Second, is the *stabilization branch*, needed to bring about strong effective demand (through the deployment of finance) and to maintain full employment and choice of occupation (i.e., those who desire work can find it). Third, is the *transfer branch*, essential to the formation and maintenance of a social minimum. By considering basic human needs, this branch determines the level of guaranteed minimum income that maximizes the long-term expectations of the least advantaged. Finally, there is the *distribution branch*, needed to enforce inheritance and gift taxes, in addition to general income or expenditure taxes.

It follows that the allocation and stabilization branches are required to maintain an efficient economy; the transfer branch is designed to ensure that basic human needs are identified and met; and the distribution branch is needed to prevent the concentration of economic power.

As stated in the introduction to Section 2.2, government has an important role as a trustee to ensure basic human needs are met in an equitable and just manner. The above discussion on the social contract and Rawls's theory of justice indicates how government can be structured to enable it to achieve this goal. Yet, establishing a philosophy of government which ensures that basic human needs are met is a complex task.

The knowledge that basic human needs can be categorized under the headings of *sustenance*, *competence*, *autonomy*, and *connectedness* (Kasser 2002) does not provide government with a clear directive on what actions are required to satisfy our basic needs. In this regard, Max-Neef's (1989) formulation of needs and satisfiers is of value in that it identifies the *qualities*, *things*, *actions*, and *settings* that are associated with fundamental needs such as protection, participation, and freedom. Further, since such a matrix is ultimately defined by society - an essential characteristic of the social contract - an interesting experiment would be for a representative group of contracting parties to complete the matrix while behind the *Veil of Ignorance*. In theory, such action would develop the satisfiers to human needs that are culturally defined and impartial.

Once the basic human needs of a society are agreed upon, the role of government (in a Rawlsian sense) is to develop laws, polices, and programs to assist those members of society that are unable to satisfy their basic needs. Opponents to the formation of such a welfare state argue that the only way to meet the needs of the disadvantaged is through economic regulation and taxation, which results in a loss of civil liberties (Nozick 1974).[82] Hence, civil liberty and social welfare stand in constant tension with each other.

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[82] In 1974, the late Robert Nozick - a professor of philosophy at Harvard and colleague of John Rawls - published *Anarchy, State and Utopia* in opposition to the *non-minimal welfare state* proposed by *A Theory of Justice*. Nozick (1974, p. ix) defined the minimum state as follows: "*Our main conclusions about the*

> *"The extent to which the needs theory dominates the philosophy of government ... can be measured by the levels of taxation and regulation of economic activity. Government takes money out of the hands of individuals and spends it on what it considers are the needs priorities of the people. The more an individual is taxed, the greater the loss of his freedom to determine his own priorities and to satisfy his individual needs. In short, through taxation and regulation, government decides how a person should spend his money. Rather than leave a person's resources to himself and permit him to make his own arrangements for the satisfaction of his needs, the government expropriates his wealth and in return seeks to provide him the necessities of life as determined by government. ...* [I]*t is clear that a needs based theory of human rights can be pursued only at the expense of the gradual loss of freedom and a gradual movement towards totalitarianism*" (Cooray 1985).[83]

One might question, however, whether a laissez-faire market (envisioned by Cooray) is able to operate free from government intervention and supply the products/services that society needs. In particular, Brulle (2000, p. 37) expresses concern that government is not able to operationalize the social contract, arguing that "*there is little public policy about policy.*"

Brulle (2000) describes how since the Great Depression, the U.S. government has become an active participant in economic activity, primarily to stabilize the economic system and to compensate for the adverse effects of capital accumulation. This involvement in the economy means that the government assumes a level of responsibility to ensure the legitimacy of the market. Since economic growth is based upon investment and consumption, the government plays an important role in furthering these two drivers of economic development. Brulle (2000, pp. 34-35) argues that the "*inability of the market to maintain itself creates a politically maintained private market in which socialized production and private appropriation of production exist in a system legitimized by formal democratic rules. This creates a conflict between the normative justifications for collective decisions. Market outcomes are legitimized as the outcomes of democratic will formation. This leads to a series of contradictions and crises in Western society.*"

Brulle's (2000) major concern is that the public sphere - "*an arena in which the common good was debated and a democratic consensus was reached*" (ibid, p. 37) - has been

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state are that a minimal state, limited to the narrow functions of protection against force, theft, fraud, enforcement of contracts, and so on, is justified; that any more extensive state will violate persons' rights not to be forced to do certain things, and is unjustified; and that the minimal state is inspiring as well as right. Two noteworthy implications are that the state may not use its coercive apparatus for the purpose of getting some citizens to aid others, or in order to prohibit activities to people for their own good or protection." Interestingly, while Nozick and Rawls's philosophy of government were opposed, they both agreed that individual rights are more important than utilitarian considerations and that government should be neutral in respect to people's right to choose and pursue their own vision of a good life (Sandel 1996).

[83] Source: Cooray, M. (1985) Human Rights in Australia, *The Basic Human Rights and the Needs Based Human Rights*, http://www.ourcivilisation.com/cooray/rights/chap5.htm (accessed on 04/08/06).

undermined by the insulation of government action from public input.[84] This situation has had the effect of exposing the public sphere to "*the manipulative deployment of media power to procure mass loyalty, consumer demand, and compliance with systemic imperatives*" (Habermas 1992, p. 452 from Brulle 2000, p. 37). In such an environment, it is difficult to envision how society can be an effective part of the decision-making process. Thus, the social contract between the governed and the government is undermined, thwarting efforts to establish a social order that enables "*the communicative generation of legitimate power*" (Habermas 1992, p. 452 from Brulle 2000, p. 37).

2.2.2 Operationalizing the Social Contract

Given the above discussion, a critical question remains: *how should we operationalize the social contract?* Further, if government is to act as a trustee, how should it interact with the public?

Ashford and Rest (2001) provide some useful answers to these questions. In particular, they argue that the perceived and actual role of government in public participation is crucial, as is the role adopted by the stakeholders.

> "*Specifically, what is important is whether the government sees itself and is seen as (1) a trustee of community/stakeholder interests, or alternatively (2) as a mediator or arbitrator of conflicting interests in the community or stakeholder group. The roles adopted by the participants of community and stakeholder involvement processes are likewise important, specifically the participant dynamics that foster majoritarian or utilitarian outcomes, versus communitarian outcomes.*[85] *Both sets of roles can affect the process and outcomes of public participation efforts. In other words, the role of government and the tenor of community or stakeholder participation are codeterminative of success -- which we define, in large measure, as enhancing fairness, justice, and empowerment for the most* [adversely] *affected.*

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[84] Brulle (2000, pp. 36-37) puts forward a number of ways in which government policy is insulated from the public. For example, the use of scientific discourse in the development and analysis of state policy has the effect of limiting the public's access to institutional policies. The management of political demand through the selective involvement of certain groups in negotiations presents clear barriers to public participation. Also, public demands are insulated by increasing the decision-making authority of the executive agencies of the state. Nader (2004) and Korten (2001) also argue that the power of commercial enterprises has grown to such an extent that they are able to exert a strong influence over government, thereby undermining the ability of society to express its views through the democratic process.

[85] "*The ... communitarian approach to conflict resolution is a process wherein the various community members or stakeholders strive to achieve the greater social good rather than maximize their own benefit, thereby transcending individual interests. We emphasized the distinction between a consensus reached by majoritarian processes (where the political majority gets what it wants, thereby approximating maximum collective utility), and a communitarian approach using normative processes, in which citizens and other stakeholders are willing to sacrifice self-interest on behalf of longer-term and more far-reaching societal goals*" (Ashford and Rest 2001, p. VII-9).

In order for the government to act in a trusteeship capacity, it must be committed to justice and fairness in the Rawlsian sense - i.e., it must first and foremost encourage or allow those activities that provide relatively greater advantage to those individual members or groups who are relatively worse off to begin with ... . In a political climate where stakeholder involvement is encouraged to legitimize conflict resolution or the parceling out of scarce agency resources, government can easily abdicate its trusteeship role in favor of a more utilitarian approach to problem solving. The result is often a continued polarization of various community groups and members.

...

To the extent that government sees and presents itself as a convener or mediator of opposing interests, government itself may foster utilitarian, rather than communitarian values and outcomes. Conversely, where government presents itself as a guardian of the disadvantaged, community participation mechanisms that protect minority views and interests by addressing imbalances of power are encouraged. The community members themselves may step out of their roles as representatives of narrow community interests, and address issues of fairness on a broader scale. Thus, vehicles for public participation and stakeholder involvement must be seen within this broader perspective in order to gauge their accomplishments" (Ashford and Rest 2001, p. VII-9).

The research undertaken by Ashford and Rest (2001) indicates that the outcome of discourse between government agencies and the public depends on the roles adopted by each. To help visualize the interactions between government and society, they developed a matrix that presents the likely outcomes under the different government/stakeholder positions (Table 2.5).[86]

In the left column of Table 2.5, the two roles of government are indicated: [1] the government acts as a *trustee* of stakeholder interests; and [2] the government acts as a *mediator* of conflicting interests between/among stakeholders. For the stakeholders, two (somewhat idealized) positions are presented: [1] *utilitarianism* - in which stakeholders seek to maximize their own utility; and [2] *communitarianism* - in which stakeholders act for what *they* perceive as the greater social good. Further, a distinction is made between the *participating* stakeholders, i.e., those actively involved in public participation efforts, and the non-participating public who are also stakeholders.

[86] While Ashford and Rest (2001) use two matrices to distinguish the *community* from the wider group of *stakeholders*, only the latter is discussed here. Those interested in the difference between community involvement mechanisms and stakeholder involvement mechanisms are directed to Ashford and Rest (2001).

Table 2.5: Types and Outcomes of Interactions between the Government and Stakeholders

	STAKEHOLDER POSTURE	
GOVERNMENT'S ROLE	**UTILITARIAN** (Maximizing individual/social benefit)	**COMMUNITARIAN** (Promoting the 'greater social good')
As a trustee for the affected stakeholders	1. Decision made by government in a trusteeship role on behalf of all the *participating stakeholders*	2. Decision made by government in a trusteeship role on behalf of the stakeholders (mirroring a *normative* consensus, possibly expanding to benefit the larger non-participating public as well)
As a facilitator of utilitarian or majoritarian consensus, or alternative dispute resolution among the stakeholders	3. Stakeholder involvement processes reach a *consensus* or *compromise* among the *participating* stakeholders	4. Idealized stakeholder involvement processes reach *normative* consensus, possibly expanding to benefit the larger non-participating public as well

Source: Adapted from Ashford and Rest (2001, p. VII-14).

If we consider the first row in Table 2.5 - i.e., the government adopts the role of *trustee* - two situations can arise (Ashford and Rest 2001, p. VII-13). First, government acts on behalf of the *participating* stakeholders to promote utilitarian solutions (cell 1). Second, government acts on behalf of *all stakeholders*, including those who are not present, to promote communitarian solutions (cell 2). Likewise, if we consider the second row in Table 2.5 - i.e., the government adopts the role as *facilitator* of compromise or consensus - we see two different situations (ibid, p. VII-13). First, government acts to implement the compromise/consensus reached by the participating stakeholders (cell 3). Second, government acts to implement the normative consensus achieved by stakeholders on behalf of the larger non-participating public (cell 4). As before, the former promotes utilitarian solutions and the latter communitarian ones.

Ashford and Rest (2001, p. VII-15) draw the following conclusions from the matrix:

> "*If what is desired is reaching decisions that benefit the larger group of stakeholders (both participating and non-participating), this can be achieved either by government adopting a role as a trustee/decision-maker for the larger group of stakeholders ...* [cell 2] *or through an idealized stakeholder involvement process facilitated by government ...* [cell 4]. *This is especially appropriate in environmental justice communities.*
>
> *On the other hand, if the participating stakeholders are able or not* [able] *... to think beyond their narrow self-interests, stakeholder involvement processes will leave them most satisfied if either the government facilitates giving them what they want through meaningful participation in reaching compromises or resolving*

disputes ... [cell 3] *or if the government serves as a trustee for their interests* ... [cell 1]"

Hence, the choice of public participation mechanism should be chosen with care, "*paying special attention to the best way to achieve procedural fairness, procedural competence, and optimal outcome. ... This will necessarily involve a variety of complementary mechanisms, utilizing both community and stakeholder involvement processes*" (ibid, p. VII-14).

To help visualize the implications of Ashford and Rest's (2001) framework, Table 2.6 has been created to show whether the (idealized) roles of government and stakeholder postures are likely to result in a Rawlsian outcome. The table uses the terms 'Rawlsian outcome,' 'Rawlsian/Non-Rawlsian government,' and 'strong/weak stakeholder postures,' which require some clarification.

A *Rawlsian outcome* is where new legislation, policies, or programs support initiatives that offer greater advantage to individuals or groups who are relatively worse off to begin with.

Table 2.6: Likelihood of Achieving a Rawlsian Outcome with a Rawlsian/Non-Rawlsian Government *and* Strong/Weak Stakeholder Postures

	STAKEHOLDER POSTURE			
GOVERNMENT	**UTILITARIAN** (Maximizing individual/social benefit)		**COMMUNITARIAN** (Promoting the 'greater social good')	
	Stakeholder Influence	**Rawlsian Outcome**	**Stakeholder Influence**	**Rawlsian Outcome**
Rawlsian Government (Government acts as trustee for stakeholders)	*Strong*	Outcome uncertain	***Strong***	Extremely likely
	Weak	Possible	***Weak***	Highly likely
Non-Rawlsian Government (Government acts as facilitator for utilitarian/ majoritarian consensus)	*Strong*	Extremely unlikely	***Strong***	Likely
	Weak	Unlikely	*Weak*	Possible

A *Rawlsian government* refers to a government that is willing and has the capacity to either impose or endorse Rawlsian outcomes. If the stakeholders hold a predominantly utilitarian posture, it is likely that the Rawlsian outcomes will need to be *imposed* upon the stakeholders, which a Rawlsian government may be willing to do. While such a situation appears autocratic, one needs to recognize that utilitarian solutions can result in unjust outcomes that can infringe upon an individual's liberty and rights. Here, the *fundamental assumption* is that Rawlsian outcomes are more likely to be just and fair for all members of society. Hence, if the stakeholders hold a predominantly communitarian posture - which promotes the (perceived) greater societal good - the government is likely to simply *endorse* the solutions agreed upon by stakeholders.

It follows that a *non-Rawlsian government* is either unwilling, or does not have the capacity, to impose Rawlsian outcomes on the stakeholders. Instead, it adopts the position as mediator of stakeholder interests. Under this arrangement, the responsibility for achieving a just and fair society is left to the stakeholders. A *non-Rawlsian government* does not mean that a Rawlsian outcome cannot be achieved; it simply means that government does not act as a trustee for stakeholder interests, and it would take a strong communitarian group of stakeholders to press for a Rawlsian outcome.

Under both the utilitarian and communitarian postures, *stakeholder influence* is idealized as either being *strong* or *weak*. While the influence and ability of stakeholder groups depend upon their size and composition (Olson 1971), we are not concerned with such detail in this hypothetical exploration. For simplicity, we can assume *strong stakeholder influence* means that the stakeholders have the ability to influence government action, and *weak stakeholder influence* means that this is less likely.

When considering Table 2.6, it is helpful to think about specific issues/problems that government and stakeholders might address, such as air pollution.

While the ideas presented in Table 2.6 are hypothetical, they present some valuable insights that can help guide decision-making towards a just and fair society. In effect, the table shows two important outcomes: [1] *a Rawlsian-sympathetic government may not be sufficient to achieve a Rawlsian outcome if the stakeholders adopt a utilitarian posture and the government accedes to their wishes*; and [2] *a non-Rawlsian government can arrive at a Rawlsian outcome, but only if stakeholders adopt a communitarian posture*[87] *and the government accedes to their wishes.*

If stakeholders adopt a strong or weak communitarian posture, the likelihood of a Rawlsian outcome being reached is good, but of varying likelihood, regardless of whether a government is a trustee or mediator of stakeholder interests. However, if there is a Rawlsian government, a Rawlsian outcome will be more likely (see the upper right cells in bold). In contrast, if stakeholders adopt a strong or weak utilitarian posture the likelihood of a Rawlsian outcome being reached is extremely unlikely or uncertain (see the shaded cells), although not impossible. If the Rawlsian government and utilitarian stakeholders are either both strong or weak, it is difficult to predict the outcome. In all likelihood, the stronger entity will prevail, although the final solution may not satisfy the winning party as a result of hard-won compromises. However, if there is a non-Rawlsian government and strong utilitarian stakeholders, it is very likely that the outcome would be

[87] It should be understood that communitarian stakeholders will not develop a Rawlsian outcome based upon Rawls's (1971) *Theory of Justice*; rather, they are likely to approximate a Rawlsian outcome by pursuing the greater social good (or common purpose or goal). Thus, communitarians are 'likely' to arrive at a Rawlsian outcome from the perspective of shared moral values that stem from the traditions of a community. While it is not possible to know whether, and to what extent, communitarian stakeholders will develop Rawlsian outcomes - since the perception of a 'fair outcome' is likely to differ between communities - one would imagine that their strong emphasis on the 'community' is likely to prevent or minimize the marginalization of disadvantaged groups. For an insightful discussion of the differences between views of liberals (i.e., Rawlsians) and communitarians, see Etzioni (1990).

utilitarian in nature.[88] In many respects, the U.S. is a good example of this situation, where government tends to facilitate utilitarian consensus (Ashford and Rest 2001).

The strength of the decision-making philosophy described above can be illustrated by a simple example. In a typical policy setting, if one was to adopt a Rawlsian approach to decision making - i.e., any new social arrangement should *preferentially advantage the least advantaged* - analysts would likely ask by how much should the least advantaged be made better off? Since the Rawlsian approach only talks about *movement in the right direction*, there is no unique answer to how much to preferentially advantage the least advantaged as long as significant maldistributions remain. In contrast, if we were to adopt a utilitarian approach it would be possible to identify the optimum level of safety or income transfer, for example. Therefore, the Rawlsian approach should be seen as a movement (a process) and not a final state, but it is nonetheless possible to operationalize Rawls's theory of justice by 'bounding' the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian.

If we consider the risks that workers are willing to accept to take a dangerous job, it is possible to illustrate the concept of *bounding acceptable moves*. It has been observed that workers coming from a poor socio-economic class are willing to accept a dangerous job at a lower level of pay than workers who come from a more affluent socio-economic class - e.g., the sons or daughters of the executives of the firm that is offering employment (Ackerman and Heinzerling 2004; Ashford 1981; Ashford and Caldart 1996). In this case, the sons/daughters of the executives are likely to demand higher pay to accept the risks associated with the work. Therefore, *consciously* setting the pay at a level that only the workers from a poor socio-economic class would accept is wrong from a moral standpoint. This outcome is what economic efficiency and utilitarianism dictates. Clearly, a Rawlsian solution is not to provide a level of pay that *only* workers from a poor socio-economic class would accept, but something much more towards what the most advantaged would be willing to accept given the associated level of risk. The Rawlsian outcome, while not calculable in the absolute sense, can certainly be bounded. At the upper bound, if the executives paid their workers as much as the richest portions of society would require to assume the job, it would not be anti-Rawlsian. Thus, the final solution will lie between the upper and lower bounds at a point that the stakeholders believe is fair, economically feasible, and in line with the interests of society as a whole.[89]

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[88] The difference between '*Extremely unlikely*,' '*Unlikely*,' '*Possible*,' '*Likely*,' '*Highly likely*,' and '*Extremely likely*' is the extent to which it is believed that it will be possible to *increasingly advantage the least advantaged*. It is important to realize that this framework does not attempt to achieve a single state of utopia; Rawls does not define such a state. This fact highlights an important difference between Rawlsian thinking and utilitarianism - utilitarian outcomes *can* be defined by an end state (i.e., efficiency). In contrast, Rawlsian outcomes should be seen as a *movement* towards equality, not equality per se. If a society were to continually advantage the least advantaged, it is conceivable that it would eventually achieve equality. But this is not necessarily the case. If a society continually allowed concentrations of wealth in an effort to make the economic pie bigger, it might never reach total egalitarianism (i.e., social equity).

[89] The idea of bounding the 'bounding' the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian is explored further in Section 4.1.4.

The above illustration shows that Rawls's Original Position is essentially a voting tool. It is a way of getting society to agree upon what is fair for the society. In this sense, it has a communitarian weighting - it helps individuals to instill in social arrangements what they perceive as the greater social good. Thus, asking society to 'vote' about what is fair from the Original Position can be seen as a way of operationalizing the communitarian choice process.

If we consider the concept of sustainable development,[90] an interesting question is whether Rawls's theory of justice can ensure that human activity does not degrade the environment to a state where it is unable to recover. The reason for asking this question is simple. It stems from the belief that the ultimate rationale of governance is to support and encourage a way of life that recognizes and values human (economic and social) needs and the natural environment, is just and fair, and continually strives to achieve an acceptable balance between civil liberty and regulation. Hence, the philosophy of government and stakeholder posture adopted by society will have a significant influence on whether it is able to move towards sustainability.

The four major environmental drivers of the concern for sustainable development (to be further discussed in Chapter 3) are:

1. the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being;
2. the rapid use of finite resources and energy supplies;
3. the direct impacts of toxic pollution on human health and the health of other species; and
4. the disruption of the global climate.

All four of these drivers occur as a result of *human action* and the *technology* we have at our disposal. Therefore, it will only be possible to address these problems if there are social arrangements that enable us to do so in an effective manner. The growing interest in *environmental justice*[91] provides some evidence that society is willing to ensure development does not adversely affect the disadvantaged by protecting the environment in which they live. However, as a practical matter, environmental justice is primarily concerned with the protection of people. Hence, in addition to searching for Rawlsian solutions to social problems (which include economic and indirect environmental considerations), government and stakeholders also need to search for solutions that take environmental protection into consideration.

In *A Theory of Justice*, Rawls provides little discussion on the environment. His rationale for this omission is given in one lengthy paragraph in which he raises the notion of justice

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[90] For a discussion of sustainable development see Section 4.1. For a detailed history of the emergence of the concept of sustainable development, see Chapter 3.

[91] See the 1994 U.S. Presidential Executive Order (12898), *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, February 11, 1994, http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf (accessed on 04/09/06).

to nature (in contrast to justice to humans). Rawls begins the paragraph by recalling the limits to his *Theory of Justice.*

> "*Not only are many aspects of morality left aside, but* ***no account is given of right conduct in regard to animals and the rest of nature****. A conception of justice is but one part of a moral view.* ***While I have not maintained that the capacity for a sense of justice is necessary in order to be owed the duties of justice, it does seem that we are not required to give strict justice anyway to creatures lacking this capacity****. But it does not follow that there are no requirements at all in regard to them, nor in our relations with the natural order. Certainly it is wrong to be cruel to animals and the destruction of a whole species can be a great evil.* ***The capacity for feelings of pleasure and pain and for the forms of life of which animals are capable clearly imposes duties of compassion and humanity in their case.*** *I shall not attempt to explain these considered beliefs.* ***They are outside the scope of the theory of justice, and it does not seem possible to extend the contract doctrine so as to include them in a natural way. A correct conception of our relations to animals and to nature would seem to depend upon a theory of the natural order and our place in it.*** *One of the tasks of metaphysics is to work out a view of the world which is suited for this purpose; it should identify and systematize the truths decisive for these questions.* ***How far justice as fairness will have to be revised to fit into this larger theory it is impossible to say****. But it seems reasonable to hope that if it is sound as an account of justice among persons, it cannot be too far wrong when these broader relationships are taken into consideration*" (Rawls 1971, p. 512, emphasis added).

Several interesting points can be gleaned from Rawls's comments (Bell 2003; Partridge 1976). First, Rawls adopts the position that since creatures 'lack the capacity for a sense of justice,' they should not be considered as moral agents within the community afford justice. Thus, rather than extending 'duties of justice' to individual animals or entire species, Rawls states that society has an obligation to impose 'duties of compassion and humanity in their case.' Rawls does not extend his thoughts on what these 'duties compassion and humanity' might be since he believes they are not commensurate with the 'contract doctrine' upon which the *Theory of Justice* is based. Bell (2003, p. 5) makes an interesting argument that while Rawls excludes sentient animals from the community afforded 'justice,' this does not mean that he intended to exclude them "*from the community of moral subjects.*" As Rawls comments, 'a conception of justice is but one part of a moral view.'

Second, Rawls appears to view humans (or social systems) as separate from nature. The impression he gives is that a *Theory of Justice* is separate to 'a theory of the natural order.' Adopting such a position leads Rawls to several conclusions that seem "*to be at considerable variance with key components of the ecological point of view*" (Partridge 1976, p. 209). For example, Rawls (1971, p. 287) states that "*a society meets its duty of justice by maintaining just institutions and preserving their material base,*" with no recognition that such a position might be constrained by the availability of natural resources and/or ecological limits. In addition, Rawls tends to adopt a reductionist view

of systems[92] and does not include environmental goods in his list of 'just savings' (Partridge 1976).[93]

Finally, Rawls ends his paragraph by recognizing that his *Theory of Justice* 'will have to be revised' to adequately account for 'animals and the rest of nature.' In many ways, his decision not to extend his theory represents a missed opportunity. The recognition that the *Theory of Justice* needs to be amended or incorporated into a 'larger theory,' has encouraged many to take up this challenge (Dobson 1998; Lehman 1995; Miller 1999; Partridge 1976). The most common recommendations for changing Rawls's theory are to make the 'environment' or 'ecosystems' into 'primary goods,' and to consider these forms of natural capital under the 'just savings' principle. Environmental justice advocates have also argued that "*the ability to live in a safe environment is a primary good*" (Chapman 2001, p. 16).

Rawls (1971, p. 62) defines 'social' primary goods as "*things that every rational man is presumed to want*" such as rights and liberties, powers and opportunities, income and wealth, and self respect.[94] These goods are seen to be essential to human development and to the realization of one's life plan. Since the "*basic structure of society*" (ibid, p. 62) is the main conduit through which these primary goods are distributed, creating a structure that fosters justice and fairness is of paramount importance. This objective forms the bases for Rawls's *Theory of Justice.*

While making the environment into a 'primary good' is an elegant solution, it does not make explicit the relative importance of the environment when compared to the 'social' primary goods. If we are concerned about sustainable development then social systems need to be considered within the boarder context of the natural environment within which they exist. When viewed in this manner the environment becomes a 'meta-primary good' - i.e., without it none of the 'social' primary goods could exist. One interesting way to give the environment a much more prominent role in Rawls's theory of justice is to include it in a *third* principle of justice. Since protecting and preserving the environment is essential for the longevity of the human race, one can envisage the following principle of justice that could be considered in the Original Position.

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[92] Such a view stands in contrast to an 'ecological ethic' that values each part of a system in the context of the whole (Partridge 1976).

[93] Rawls (1971) argues that each generation has a responsibility to pass onto the next a certain amount of 'capital' that is to be agreed upon using his 'just savings' principle. The purpose of the 'just savings' principle is to achieve a fair distribution of capital between the most disadvantaged members of the current and future generations. Rawls (1971, p. 288) defines 'capital' as "*not only factories and machines, and so on* [i.e., human-made capital and possibly financial capital], *but also the knowledge and culture* [i.e., social capital], *as well as the techniques and skills* [i.e., human capital], *that make possible just institutions and the fair value of liberty.*" What is most apparent from this statement is that 'natural capital' is clearly not part of Rawls's notion of capital.

[94] Interestingly, Rawls (1971) does refer to 'natural' primary goods, but these are described as health and vigor, and intelligence and imagination - i.e., they are not concerned with the 'natural environment.' Since these natural primary goods are not *directly* affected by the 'basic structure of society,' Rawls considered them to fall outside of his *Theory of Justice.*

> **Third Principle**: social arrangements are to be organized so that they (a) protect and continually improve the environment, especially for those individuals and species most heavily affected by environmental degradation/pollution, and (b) do not result in activities that exceed the ecological carrying capacity of the environment.

The intent of the Third Principle - the *environmental principle* - is [1] to ensure that society continually strives to protect and improve the environment and the lives of people negatively affected by pollution (broadly defined), and [2] to keep human activity within ecological limits.[95] The basic premise of the principle is twofold. First, protecting human health is believed to be of paramount importance. Second, the natural environment is believed to be good in and of itself and should be protected and regenerated if it is being degraded by human activity. In reality, the first part of the principle 3(a) is likely to be the most useful, since defining *and* agreeing upon the ecological carrying capacity of the environment 3(b) is still a major work in progress. In addition, the first part of the principle 3(a) aligns well with the idea of *movement in the right direction* and does not attempt to define an end state or goal.

It is believed that the *environmental principle* is consistent with the 'just savings' principle since it can be argued that past, current, and future generations would select it. First, let us consider the present generation. When in the Original Position, behind the *Veil of Ignorance*, contracting parties do not know whether they live in an area of high pollution and low environmental quality. Therefore, it can be argued that a rational and mutually disinterested individual would select the *environmental principle* on the grounds that it would improve his/her quality of life - especially if he/she ended up living in an area bearing a disproportionate amount of pollution. The same argument also applies across generations. Since contracting parties do not know whether they live in a generation that is negatively affected by poor environmental quality, it is in their own interests to adopt a principle "*that they must want all previous generations to have followed*" (Rawls 1993, p. 274). Thus, the third principle of justice should be selected since any rational individual would have wanted the previous generation to have applied it.

If we consider future generations a potential problem does arise. If each generation continually improves the environment, then subsequent generations are likely to be better off from an environmental quality and health standpoint. However, if each subsequent generation happens to gain from an improved environment, surely this outcome is desirable from a human perspective. Indeed, one might argue that society has a duty to preserve and improve the environment for the well-being of future generations - a

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[95] A significant work that focuses on the links between environmental *quality* and human *equality* and those between sustainability and environmental justice more generally is Agyeman et al.'s (2003) *Just Sustainabilities: Development in an Unequal World.* The publication, which consists of a selection of papers, focuses specifically on the linkages between the political and policy processes surrounding environmental justice and sustainability. *Just Sustainabilities* highlights "*an important and emerging realization that a sustainable society must also be a just society, locally, nationally and internationally, both within and between generations and species*" (ibid, p. 3).

fundamental principle of sustainable development.[96] Another argument one could make that deviates from the 'just saving' principle, is that since each generation is mutually disinterested in one another, the critical point is that the *environmental principle* improves the quality of the environment *within* each generation. Thus, it seems plausible that past and future generations would choose the *environmental principle* since it would be in their own rational interests to protect and improve their environment.

The third principle follows the lexicographic structure of Rawls's two principles of justice (i.e., it is to be considered third). This ordering means that human considerations are put before the natural environment, which means the framework could be labeled as one of 'liberal ecologism' (Bell 2003). While some might argue that the environmental principle is of paramount importance and should be put first, if Rawls's *Theory of Justice* is used as a basis then the environmental principle should build upon his theory. In addition, placing the environmental principle first would undermine the stability of Rawls's *Theory of Justice.* As it is, only the first principle of justice achieves relative stability (or 'overlapping consensus') when compared to other comprehensive theories on the political conception of justice (Barry 1995). Thus, placing the environment first would undermine the stability and elegance of Rawls's theory.

A final point worth mentioning is that the environmental principle does not make species into 'formal' stakeholders that are part of the community afforded justice. This outcome is in keeping with Rawls's (1971) argument that we have 'duties of compassion and humanity' to animals [and the natural world]. One can argue that society's 'duty' toward the natural environment is to act as trustee on its behalf. Therefore, since species (other than humans) are not represented in the Original Position, individuals or groups must act on their behalf. Perhaps ecologists are the only group that has the capacity to adopt such a role. However, it is possible that other groups might want to act as trustee for species and the environment based upon different belief systems.

An important objective of the third principle of justice is to focus attention on *movement in the right direction.* Given the inherent complexity of intergenerational issues, and the fact that we are unable to allocate resources fairly within current generations, it is believed that the *environmental principle* will be a useful guide for decision-making and policy formulation. Wells (1996, p. 195) argues that Rawls's "*two principles of justice are extremely important for an ethic suitable to a global ecology. Their implications for environmental policy are pervasive and so important that they should be the objective of much careful thought.*" It is hoped that adding the *environmental principle* to Rawls's Theory of Justice will show how his ideas can form a central pillar to our thinking about sustainable development. While Rawls's two principles of justice focus on the social

[96] The third principle of justice is designed to 'protect and continually improve the environment, especially for those individuals and species most heavily affected by environmental degradation/pollution.' The principle is in keeping with Rawls's general formulation that any new social arrangement should advance (i.e., 'improve') the well-being of the least advantaged. Thus, the third principle of justice should be considered as more than a conservation principle. In addition to conservation, it aims to replenish/restore environmental capacity that has been lost to industrialization.

world, the third principle is designed to force decision-makers and stakeholders to consider how their decisions might affect the natural world.

By *bounding* decisions using the Rawlsian/utilitarian decision-making philosophy,[97] we have developed what Beatley (1994) and Petrinovich (1999, p. 5) refer to as a 'pluralistic moral philosophy' that considers "*both utilitarian concerns and basic rights and freedoms of individuals*," rather than relying on a single philosophical view for decision-making. The argument put forward in this section is that outcomes which lean towards Rawlsian solutions are more likely to move a society towards sustainable development than purely utilitarian ones through the reduction of inequality.

The value of the bounded Rawlsian/utilitarian decision-making philosophy is that it is not only applicable for social outcomes. It can also be used to consider decisions that affect *trade* and *technological development* - two factors that have a significant influence on whether society moves towards or away from sustainable development.

One can argue that government is, in fact, the trustee of trade, since trade *is* currently the province of government - i.e., they negotiate trade agreements and engage in designing the rules of international commerce. It can also be argued that an equal province of a Rawlsian government is the trusteeship of technology.

The importance of technological development becomes apparent when considering a shift from an outcome focus (identified using the Rawlsian framework) to the mechanistic, pragmatic question of *who* guides the pathway to realizing that outcome. For example, *if* technology is central to achieving a larger economy that can be divided in a more equitable way, then someone needs to be a trustee for the birth of that technology. If a government acts as a trustee for society, it should by default assume this role. If not, then it is left to either industry or to society to adopt this role. However, from a Schumpeterian perspective,[98] it is unlikely that industry will displace itself by encouraging the

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[97] When deciding upon a new social arrangement, the range of potential outcomes (the decision space) can be 'bounded' by identifying those outcomes that are purely Rawlsian and those that are purely utilitarian. These two sets of outcomes mark opposite ends of a continuum. As one moves from the utilitarian to the Rawlsian end of the continuum, the potential outcomes will transition from focusing on maximizing societal welfare (without concern for the distributional impacts of a new social arrangement) to identifying the best (or fair) outcome for 'all individuals' in a society. In the latter case, the distributional impacts if a new social arrangement is of paramount importance.

[98] Joseph Schumpeter was an influential, Austrian-born, Harvard economist from the mid-20th century who is most well known for describing the process of competition and monopoly in a capitalist market as "*the process of Creative Destruction*" (Schumpeter 1962, pp. 82-86). Schumpeter (1962 [1942]) believed that the main principle of capitalism was *innovation* and the development of new technologies rather than the "*entirely imaginary*" notion of perfect competition (ibid, p. 82). He saw the process of *innovation* as being distinct from an *invention*. An invention is conceived as an idea, a sketch, or model for a new or improved device. An innovation occurs when the invention is put into use/practice. Schumpeter argued that innovations either passed or failed the 'market test.' Schumpeter's central idea was that innovation leads to economic growth and is, therefore, the engine of capitalism. However, the success of one firm's innovations would ultimately lead to the destruction of another firm's market share. Schumpeter's idea of *Creative Destruction* can also work in the opposite direction towards monopolies. The Schumpeterian perspective is then the process of *Creative Destruction* where "*innovators out-compete non-innovators*" (Kleinknecht 1998, p. 392). In the words of Schumpeter, "*The essential point to grasp is that in dealing*

development of technologies which undermine its existing products/services. Also, it is unlikely that the 'diffuse society' will have the institutional capacity to assume this role. Thus, government - whether acting as a trustee for society or not - has an important role to play in guiding the development of new technology.

By focusing on the social outcomes of justice and fairness (and environmental protection) it is possible to identify the various pathways that must be taken to achieve these outcomes. Since Rawlsian outcomes and sustainable development are really processes, we should feel comfortable using trade and technological development as instruments through which social (and environmental) objectives can be achieved.

Hence, the pathway to achieving sustainable development is not just a case of developing the right social arrangements. It is also a question of trade (which affects distribution) and technological development. With regards to technological development, what is needed is a combination of a Schumpeterian and Rawlsian vision if technology is to advance at a rate necessary to realize the objectives of sustainable development. Implicit in this statement is the notion that current rates of technological progress, if left to the market, are unlikely to adequately address social and environmental problems in a fair and just manner. To achieve the desired rate of change will require 'waves of creative destruction' in order to obtain the best technology and this may require disruptive forms of technological change (see Section 2.3.1).

The value of the framework proposed in this section is that it can be applied to *any* situation in which government is needed to change or implement new social arrangements (i.e., rules, regulations, laws, or policies) to improve the well-being of society. By introducing the idea of *bounding the acceptable moves* when behind the *Veil of Ignorance*, it has been possible to discuss how Rawls's theory of 'justice as fairness' can be operationalized by explicitly relating it to utilitarianism. Bounding the acceptable moves enables stakeholders to move away from a purely utilitarian approach to problem solving which can be unfair to disadvantaged members of society. Justice does not stem from unfair practices.

The third principle of justice - the environmental principle - has been added to Rawls's framework in an effort to link the social and natural worlds in decision-making. The significance of the revised Rawlsian/utilitarian decision-making philosophy is that it supports decision-making that can move society towards sustainable development. First and foremost, it places *social equity* at the center of decision-making. Second, it supports

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with capitalism we are dealing with an evolutionary process. ... Capitalism ... is by nature a form or method of economic change and not only never is but never can be stationary. ... The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers, goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates. ... The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation ... that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in" (Schumpeter 1962, pp. 82-83).

the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society.[99] Finally, it makes 'movement' towards a better *environment* a critical component of any new social arrangements. Hence, the framework provides a valuable tool through which 'movement' towards sustainable development becomes a real possibility.

2.2.3 Equality of What?

The manner in which equality is defined and evaluated is directly linked to the types of inequalities one is trying to right. This section takes a brief look at the various ways in which equality is considered and how this relates to the broader picture of sustainable development.

The major philosophies of government (or social arrangements), some of which are discussed in the previous section, all support the notion of *equality* in terms of a "*focal variable*" - such as income, wealth, happiness, opportunities, rights, or needs-fulfillment (Sen 1992, p. 2). The basic premise of these theories is that each individual should have *equality of opportunities* in regards to the variable(s) selected (see Rawls's second principle of justice). For example, everyone should have an equal opportunity to gain employment or to have an education. In a world in which everyone's circumstances and abilities are the same, focusing on *equality of opportunity* would suffice. Yet this is not the world in which we live and relying on equal considerations often results in the unequal treatment of the disadvantaged.

In the monograph *Inequality Reexamined*, Nobel Prize winning economist Amartya Sen (1992) raises the question of '*equality of what?*' and links it directly to the consideration of human diversity. In particular he argues that social arrangements (e.g., government policies, laws, etc.) should be assessed in relation to a person's capability to achieve functionings.

Sen's (1992) idea of *functionings* is Aristotelian in origin.[100] He defines *functionings* as the various things that a person has "*reason to value*," such as being well-nourished, avoiding escapable morbidity, etc., to more complex realizations such as having self-respect or being a valued member of a community (ibid., p. 5). Alkire (2003, p. 5) describes Sen's idea of *functionings* as being "*an umbrella term for the resources and activities and attitudes people spontaneously recognize to be important – such as poise, knowledge, a warm friendship, an educated mind, a good job. What is centrally important varies in different places, which is why there is no rigid and inflexible set of*

[99] Social and economic inequalities are tolerated only if the most disadvantaged members of society are made better off under new arrangements.

[100] We recall from Section 2.1.1 that Aristotle believed that the attainment of the good life or happiness was the result of *Self-Realizationism*, the ability to realize one's potentialities, character, or personality. To Aristotle, the person who has the greatest potentialities and is able to actualize this potential has the brightest prospect of happiness. Conversely, the person whose potential remains unfulfilled will ultimately be frustrated and unhappy.

specific capabilities – the priorities will have to be set and re-set again and again in different ways."

It follows that an individual's *achieved functionings* are those that the individual has successfully pursued and realized. However, Sen (1992) argues that focusing on achieved functionings (or focal variables) alone is not sufficient. The inherent diversity among individuals - in relation to their external circumstances and psychological and physiological make up - means that the characteristics of inequality tend to *diverge* within the variable under analysis. In other words, differences in the circumstances and abilities of people mean that *equality of opportunity* will not lead to *equal* wealth or happiness, for example. In addition, equality *between* different focal variables may not coincide. "[E]*qual opportunities can lead to very unequal incomes. Equal incomes can go with significant differences in wealth. Equal wealth can coexist with very unequal happiness. Equal happiness can go with widely divergent fulfilment of needs. Equal fulfilment of needs can be associated with very different freedoms of choice. And so on*" (ibid, p. 2). Hence, Sen's core argument is that the "*the basic heterogeneity of human beings*" and "*the multiplicity of variables in terms of which equality can be judged*" are two factors that complicate the idea of equity (ibid, p. 1). This means that a focus on individual functionings (or focal variables) does not necessarily incorporate an individual's *freedom*[101] to achieve. Hence, Sen introduces the concept of *capability* to describe an individual's freedom to achieve 'valuable' functionings. "*It represents the various combinations of functionings (beings and doings) that the person can achieve. Capability is, thus, a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another ... to choose from possible livings*" (ibid, p. 40).[102]

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[101] The freedom Sen refers to is "*the **real opportunity** that we have to accomplish what we value*" (1992, p. 31). More recently, Sen (1999, p. 36) described development as the "*process of expanding real freedoms.*" Sen views the expansion of freedom as both "*(1) the **primary end** and (2) the **principle means** of development*" (ibid, p. 36). The former is referred to as the 'constitutive role' and the latter as the 'instrumental role.' The *constitutive role* refers to the basic premise that freedom must be regarded as a primary objective of the development process. The *instrumental role* refers to the various ways that freedom can act as an 'instrument' of development. Sen identifies five types of instrumental freedoms that tend to enhance the capability of an individual to live more freely (ibid, pp. 38-40): [1] **Political freedoms** (i.e., the opportunities that individuals have to be a part of democratic processes); [2] **Economic facilities** (i.e., the opportunities that individuals have to "*utilize economic resources for the purposes of consumption, or production, or exchange*"); [3] **Social opportunities** (i.e., the access that individuals have to facilities such as basic education and health care, which are essential if a person is to have an effective role in economic and political activities); [4] **Transparency guarantees** (i.e., "*the freedom to deal with one another under guarantees of disclosure and lucidity*"); and [5] **Protective security** (i.e., the need to provide a social safety net to assist those individuals who face abject misery, and possibly even starvation and death).

[102] While Sen does not formally list *capabilities*, this has not prevented others from doing so. The most comprehensive attempt is presented by Nassbaum (2000), who developed a set of 'central human functional capabilities.' The major headings of Nassbaum's list of capabilities include the following: life; bodily health; bodily integrity; senses, imagination, thought; emotions; practical reason; affiliation; other species; and control over one's environment (ibid, pp. 78-80). Under each heading, Nassbaum defines the 'combined' capabilities that a person should be able to achieve. For example, the capabilities for *bodily health* are defined as "[b]*eing able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter*" (ibid, p. 78).

Sen's focus on functionings and on the *capability* to achieve functionings differs from the traditional views of equality that tend to focus on variables such as income, wealth, or happiness (ibid, p. 7). Instead of measuring equality using such focal variables, Sen argues that a "*more adequate way of considering 'real' equality of opportunities must be through equality of capabilities (or through the elimination of unambiguous inequalities in capabilities, since capability comparisons are typically incomplete)*" (ibid, p. 7).

A major difference between Sen's capabilities-based assessment of equality and Rawls's theory of 'justice as fairness' lies in their assessment of the holdings of 'primary goods' - i.e., goods which are considered essential for the survival and self-respect of individuals (Rawls 1971).

Rawls's theory is that when in the Original Position - behind the *Veil of Ignorance* - most people will be able to agree on a set of primary goods that are considered important regardless of an individual's circumstances. Rawls argues that social primary goods are "*things that every rational man is presumed to want*" such as "*rights and liberties, powers and opportunities, income and wealth*[, and] ... *self-respect*" (Rawls 1971, p. 62).[103] Hence, Rawls's general conception is that "[a]*ll social primary goods ... are to be distributed equally unless an unequal distribution of any or all of these goods is to the advantage of the least favoured*" (ibid, p. 303). The focus of Rawls's formulation is 'equality of opportunity,' which is captured within the *difference principle* (see Section 2.2.1).

Sen identified a fundamental problem with Rawls's formulation of the difference principle. "*Two persons holding the same bundle of primary goods can have very different freedoms to pursue their respective conceptions of the* [greater] *good (whether or not these conceptions coincide). To judge equality - or for that matter efficiency - in the space of primary goods amounts to giving priority to the means of freedom over any assessment of the extents of freedom, and this can be a drawback in many contexts*" (Sen 1992, pp. 8-9). Thus, Sen argues that equality in the holdings of primary goods or resources ignores the fact that disadvantaged members of society may not have the capability or freedom to convert these goods/resources into the things that he/she values. Therefore, if a government were to use primary goods as a measure of well-being for purposes of justice, there is a concern that disadvantaged members of society might suffer from unjust (or unequal) treatment. To put it another way, these people are likely to have an unfair share of opportunity. Thus, Sen's capability-based assessment of equality forms the foundation for affirmative action, for empowering the powerless, and for positive discrimination (Bidwai 1998).

Sen's theories on capabilities and functionings and Rawls's theory of 'justice as fairness' have had a significant impact on how governments have shaped social arrangements to establish equitable and just societies.[104] Sen's theories have also provided a strong

[103] Rawls (1971) states that other primary goods such as health and vigor, or intelligence and imagination are 'natural' primary goods. While natural primary goods can be influenced by social arrangements, they are not directly under their control.

[104] Incidentally, it was Sen (1993) who once famously said that there are "*no famines in democracies.*"

conceptual foundation for the UN's work on human development (Fukuda-Parr 2002).[105] In particular, his ideas have shaped the UN Human Development Reports (HDRs) and the Human Development Index (HDI), including its extensions.

The essence of Sen's conception of equality is that "*a person's capability to achieve does indeed stand for the opportunity to pursue his or her objectives*" (Sen 1992, p. 7). From this premise, the UN defined human development as the "*process of enlarging people's choices*" (UN 1995, p. 11) and sought the removal of obstacles - "*such as illiteracy, ill health, lack of access to resources, or lack of civil and political freedoms*" (Fukuda-Parr 2002, p. 3) - that prevent an individual from achieving his/her valued objectives in life.[106] Thus, the intention of the UN HDI was to shift international attention to the expansion of basic human capabilities, especially the capability to [1] have a healthy life, [2] acquire knowledge, and [3] reach a decent standard of living.[107] As the purpose of the HDR is the "*global evaluation of development*," these three indices were selected for their universal value since they form the basis from which many choices in life depend (Fukuda-Parr 2002, p. 6). As discussed in Section 2.1.3, the notion of investing in health and education in particular map closely with *physical health* and *learning*, two essential attributes an individual requires to attain a high level of well-being.

Since the early 1990s, the HDRs and the HDI have highlighted the disparities between the developed and developing regions of the world. As the reports and indices make clear, the record is mixed: spectacular development successes in the years since World War II coexist with persistent human suffering and wasted potential.

In a related idea, Fukuda-Parr (2002) developed a useful table (Table 2.7) to compare and contrast the human development approach with the neo-liberal (utilitarian) alternative and its precursor, the Basic Needs approach (first espoused by Paul Streeten (1982) and Frances Stewart (1985)).[108] Table 2.7 provides an idealized framework from which public policy formulation can be considered. For example, by looking at the 'evaluative' and 'agency' aspects of a set of policies, it should be possible to determine whether the government supports a *human development* approach (i.e., its policies are just and fair and consider human capabilities) or a *neo-liberal* approach (i.e., its policies are utilitarian in nature) to the process of development. It is interesting to note that none of the approaches contain an explicit concern for the environment, upon which human activity

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[105] Source: Fukuda-Parr, S. (2002) *Operationalising Amartya Sen's ideas on capabilities, development, freedom and human rights - the shifting policy focus of the human development approach*, http://hdr.undp.org/docs/training/oxford/readings/fukuda-parr_HDA.pdf (accessed on 04/08/06). Note: Sakiko Fukuda-Parr has been the Director of the Human Development Report since 1995 to present (2004).

[106] See Section 2.1.3 for a discussion of the UN's conceptualization of human development that focuses on the Human Development Index (HDI) and its extensions.

[107] While the HDI focus is on 'evaluating' human development, Sen (2003) argues that the human development perspective also contains an 'agency perspective' that is often overlooked. Having identified where improvement to human lives can be made though the HDI, it is necessary to turn to the agency perspective to develop policy and political strategies to realize the necessary changes.

[108] It is worth noting that Sen's theories on capabilities and functionings grew from the Basic Needs approach to international development (Alkire 2004). Sen's main reason to rethink the Basic Needs approach was to introduce a greater role for individual freedom. His concern was that the Basic Needs approach tended to focus on commodities, as opposed to human beings and their functionings.

and development depends.[109] It is clear that if we are to transition towards sustainable development, the need to protect the environment must be added to the need to ensure we live in an equitable and just society that recognizes human capabilities.

Table 2.7: Comparing key features of HD approach with the Neo-liberal alternative and the Basic Needs antecedent

	Human Development[110]	Neo-liberalism	Basic Needs
Well being concept	Functionings and capabilities	Utility	Meeting basic needs
Evaluative aspect			
Leading criterion for evaluating development progress	Human capabilities; equality of outcomes, fairness and justice in institutional arrangements	Economic well being, economic growth, efficiency	Poverty reduction in terms of income, and access to basic social services
Measurement tools favored	Human outcomes, deprivational and distributional measures	Economic activity and condition, averages and aggregate measures	Access to material means; deprivational measures
Agency aspect			
People in development as ends and/or means	Ends and means: beneficiaries and agents	Means: human resources for economic activity	Ends: beneficiaries
Mobilizing agency	Individual action and collective action	Individual action	Not specified
Development strategy			
Key operational goals	Expanding people's choices (social, economic, and political)	Economic growth	Expanding basic social services
Policy concerns			
Policy concern with distribution of benefits and costs	Emphasis on equality and human rights of all individuals	Concern with poverty	Concern with poverty
Policy concern with human rights and freedoms	Ultimate end with intrinsic value. Priority policy concern.	No explicit connection. Current search for link between political and civil freedoms and economic growth.	No explicit connection

Source: Adapted from Fukuda-Parr (2002, p. 17).

[109] However, they do implicitly incorporate employment and purchasing power. This highlights the two different strands of sustainability scholarship, one focusing on environment and the other on economic empowerment.

[110] This perspective is specifically and especially concerned with distributional equity. Neo-liberalism and Basic Needs are not. For example, a neo-liberal approach might focus on raising people above a poverty level, but it will still tolerate enormous levels of disparity.

The disparity between nations identified by the HDRs and the HDI has its counterpart in the gaps between the rich and poor *within* nations. Evidence indicates that there is a growing divide between the income of high-paid and low-paid workers in the U.S. that is creating an 'apartheid economy' of haves and have nots (Barnet 1993; Freeman 1996a; Head 1996; Madrick 1999; Morris and Western 1999).[111, 112, 113] An important work - *The New Geography of Global Income Inequality* (Firebaugh 2003) - which takes a holistic look at global income inequality, provides supporting evidence that since the last third of the twentieth century, income inequality within nations (including the U.S., China, India, and the former USSR) has been increasing. Interestingly, Firebaugh (2003) reaches the conclusion that with the spread of industrialization to developing nations there has been a corresponding decrease in inequality between nations during this period. This conclusion stands in stark contrast to the World Bank's *World Development Report 2000/2001* (p. 51), which claims that "*income inequality between nations has increased sharply over the past 40 years.*"

To a large extent, the manner in which income inequality is addressed in the U.S. will depend upon the degree to which the nation leans towards a 'human development' - and away from a 'neo-liberal' - view of development. The former view is more likely to distribute economic gains through taxes or a higher minimum wage, for example. The latter view is more likely to adopt the view that economic growth will eventually improve everyone's well-being and is less concerned with economic inequalities in the near term.

Sen (1999, p. 14) recognizes the importance of economic growth, but argues that an "*adequate conception of development must go much beyond the accumulation of wealth and the growth of gross national product and other income-related variables.*" Thus, development needs to be concerned with "*enhancing the lives we lead and the freedoms we enjoy*" (ibid, p. 14).[114]

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[111] Head (1996) argues that the average weekly earnings of production and non-supervisory workers (when adjusted for inflation) fell by 18 percent between 1973 and 1995 - from $314 to $258 per week. In contrast, the average weekly earnings of chief executives increased by 19 percent (and by 66 percent after taxes) between 1979 and 1989 (ibid, p. 47).

[112] Freeman (1996a, p. 121) argues that while some 25 million jobs were created during the Regan, George Bush, and Clinton administrations, the nation needs to recognize that it "*has an inequality problem based on falling real earnings for low-paid workers that is unparalleled at least since the Great Depression.*" In making his case, Freeman states that the problem with the economy is not the nation's strong track record of productivity, technological leadership, or rate of economic growth; instead it is the manner in which the economy distributes the economic benefits from this progress.

[113] Freeman (1996a) and Barnet (1993) suggest a number of reasons why there has been a growing inequality in wages. Some of the more significant causes include trade liberalization and the loss of national jobs to the international economy; immigration; the decline of trade unions and with them the ability for employees to address low pay; technological change that displaces jobs; and the influx of women into the workforce, increasing the supply of labor and reducing wages. The challenge facing the U.S. is that many of these forces also have positive outcomes for society. Therefore, countering the trends towards inequality is a highly complex problem for which no one can accurately predict what strategies will work best. Freeman (1996a) argues that the problem with many policies aimed at addressing low wages is that they do so in an indirect way rather than tackling income distribution head-on.

[114] Supra note 101.

Sen's contribution to our understanding of equality and his more recent notion of development as "*a momentous engagement with freedom's possibilities*" (Sen 1999, p. 298), provides one of the only credible challenges to the neo-liberal (or utilitarian) orthodoxy that has guided development efforts since the 1980s (Saha 2002).

Sen's work has also had an important influence on the formulation of sustainable development, which he defines as "*development that promotes the capabilities of present people without compromising capabilities of future generations*" (Sen 2000, p. 5). Sen believes that the Brundtland (need-centered) view of development is "*illuminating*," but "*incomplete*" (ibid, p. 2). He argues that individuals must be seen as "*agents who can think and act, not just as patients who have needs that require catering*" (ibid, p. 2). His basic premise is that by treating people as agents they will - given the opportunity - be able to "*think, assess, evaluate, resolve, inspire, agitate, and through these means, reshape the world*" (ibid, p. 1). Hence, Sen advocates a *capability-centered* approach to sustainable development. The objective of Sen's ideas is to "*integrate the idea of sustainability with the perspective of freedom, so that we see human beings not merely as creatures who have needs but primarily as people whose freedoms really matter*" (ibid, p. 6).[115]

As mentioned earlier, one of Sen's major contributions to sustainable development is his influence on the UN's conceptualization of human development that formed the basis for the HDRs and HDI. Fukuda-Parr (2002), the Director of the HDRs since 1995, argues that it is possible to describe the UN's general human development agenda using five core elements (listed below). Fukuda-Parr calls these five elements the 'New York Consensus'[116] since they are reflected in many of the UN agreements. It is interesting to note the similarities between Sen's ideas on human development and those ideas presented in the New York Consensus.

The five elements of the UN's general human development agenda (or the New York Consensus) are as follows:

- "*Priority to 'social development' with the goals of expansion of education and health opportunities;*
- *Economic growth that generates resources for human development in its many dimensions;*
- *Political and social reforms for democratic governance that secure human rights so that people can live in freedom and dignity, expanding* ... [collective] *agency, participation and autonomy;*
- *Equity in above three elements with a concern with all individuals. Special attention to the downtrodden and the poor whose interests are often neglected in public policy;* [and]

[115] See Section 2.2.1 for a discussion of how Rawls's theory of justice combines individual freedom with sustainable development.

[116] The 'New York Consensus' stands in stark contrast to the 'Washington Consensus,' which promotes market liberalizing policies and a reduction in big government (ul Hague 2004). "*Washington Consensus policies are sometimes referred to as "neo-liberal," based on "market fundamentalism," a resuscitation of the laissez-faire policies that were popular in some circles in the nineteenth century*" (Stiglitz 2002, p. 74).

- *Policy and institutional reforms at the global level that create a more conducive economic environment for poor countries to have access to global markets, technology, information*" (Fukuda-Parr 2002, p. 10).

The above list presents a robust agenda (or paradigm) for *human* development, but human development is only a part - although an extremely vital part - of the broader notion of sustainable development. If we take a holistic look at all of the UN agreements, it is possible to identify several additional elements which, if added to the New York Consensus, would transform it to a consensus of sustainable development. As will be discussed in Section 3.1.1, it is possible to describe the notion of sustainable development - as viewed by the international community - using five critical components: [1] peace and security; [2] economic development; [3] social development; [4] national governance that ensures peace and development; and [5] environmental protection (Dernbach 1998; 2004). A comparison of these five components with the five elements listed above reveals that national governance that ensures peace and security, environmental protection, and employment (an important objective of economic and social development) are not explicitly mentioned in Fukuda-Parr's New York Consensus. Hence, if we are to integrate human development with the broader notion of sustainable development, the following elements need to be added:

- Environmental protection at the local, regional, national, and global level constitutes an integral part of the social and economic development process and is not to be considered in isolation from it.
- Equity considerations extend to future generations.
- National governance that ensures peace and security.
- The creation of secure, satisfying, and safe employment with adequate purchasing power.

The first three additional elements might be called the 'Rio elements' as they stem from the 1992 Rio Declaration on Environment and Development. A significant challenge posed by these new elements lies not so much with the need to protect the environment or with peace and security (although achieving these objectives has proved far from easy), but with the idea of intergenerational equity. Put simply, it is apparent that we are unable to allocate resources equitably in the present, let alone across generations. Hence, we do not have a *near future* that is properly allocated. Further, the ability of governments to develop equitable social arrangements that *also* transition societies towards more sustainable forms of development will depend upon how they, and society, view the purpose of development - i.e., either to establish a fair and just society (Rawlsianism) or alternatively to maximize the well-being of society in the neoclassical sense (utilitarianism).

2.3 Rapid Technological Change

> "*Technology and society are forces that together shape the world in which we live, shifting its contours and rearranging its parts, just as oceans move sand dunes. ... To thrive amidst these waves of change requires both a sense of direction and an ability to understand how change works*" (Westrum 1991, p. 4).

For almost three centuries societies have experienced the transformative power of technology. This section looks at why technology has been and is such an important driver, especially within the last 100 years when there has been an unprecedented rate of technological change. Technology - the application of science for the achievement of practical purposes (Dorf 2001) - is considered in the context of society, the economy, employment, the environment, and national governance.

Today, the power and capabilities of modern technology far exceed any forms of technology that supported earlier societies. One major difference between the technologies of the industrial revolution and those used by hunter-and-gatherer and agricultural societies is the energy sources upon which technologies depend. Modern technology is predominantly powered by nonrenewable energy (oil, coal, and gas), whereas the more primitive technology used by hunter-and-gatherer and agricultural societies as powered by the *three Ws* - wind, water, and wood (Wetlesen 1999).[117] In this regard, the industrial revolution was primarily an *energy* revolution.

The first person to identify the occurrence of major technological transitions during the ninetieth and twentieth centuries was the Russian economist Nickolai Kondratieff (Kondratieff 1935 [1925]). Kondratieff's notion of a long wave cycle (known as a Kondratieff-wave, or K-wave) was originally used to describe long wave economic cycles, or structural changes in the world economy.[118] By observing the behavior of prices and interest rates in the UK and U.S. between 1789 to 1926, Kondratieff identified long wave cycles of S-shaped growth (i.e., initial slow growth that is followed by a period of rapid growth towards saturation) that occurred over a period of 50-60 years. His ideas were later adopted by the Austrian economist Schumpeter (1939) who argued that K-waves were caused by the clustering of innovations that led to rapid technology-based economic growth, which either opened up new markets or disrupted existing ones.[119, 120]

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[117] However, the muscle power of humans and domestic animals also played an important role in helping these societies achieve their objectives (Wetlesen 1999).

[118] Source: Modelski, G., The Evolutionary World of Politics, *Kondratieff Waves*, http://faculty.washington.edu/modelski/IPEKWAVE.html (accessed on 04/08/06).

[119] Supra note 98.

[120] Schumpeter (1934) was the first person to distinguish diffusion from invention and innovation by describing technological innovation as the linear process of *invention-innovation-diffusion*. His theory was that entrepreneurs not only innovate by taking an invention to market, but by creating new manufacturing processes (e.g., Eli Whitney's 'American System' of manufacture of interchangeable parts), identifying products for new consumer markets, and developing new forms of industrial organization. However, a problem with Schumpeter's theories is that he was preoccupied "*with the individual entrepreneur and the individual innovation*" and was reluctant to "*conceptualize invention, innovation, and technology accumulation as a social process*" (Freeman 1990, p. 24). Schumpeter (1934, p. 228) explained clustering by stating that "*the appearance of one or a few entrepreneurs facilitates the appearance of others*," and provided no real explanation for what caused clustering or why Kondratieff's long wave cycles occurred in non-uniform but necessarily periodic intervals (Ruttan 1959). Today, it is widely recognized that the institutional or legislative framework within which businesses operate play an influential role in the formation of innovation clusters (Kingston 2004; Freeman 1990).

Within the modern era of technological development, there have been four distinct 60 to 70-year K-waves (or periods) of technological-driven economic development (Grubler and Nowotny 1990). Each of these waves can be characterized by growth sectors, emerging technologies, and by new concepts of management and industrial organization (Table 2.8). In each case, the emergence of new technologies resulted in a technological transition that tended to follow a sigmoid curve (S-curve) (Figure 2.3). While the fifth technological cycle of development (1985 - 2050) is in the process of being defined, the items/characteristics identified are those emerging in many industrial societies today, with the possible exception of the nuclear sector being a growth sector.[121] A potential growth sector that has been added to Table 2.8 is the *NBIC convergence* (i.e., the convergence of nanotechnology, biotechnology, information and communication technology, and cognitive sciences into major new areas of research and development). Important emerging technologies that have been added to the list in Table 2.8 are nanotechnology and ubiquitous computing (i.e., computers/technologies that are embedded and networked into all aspects of our lives to such an extent that we are not fully aware of their existence or simply take them for granted).

Perhaps what is most striking about the waves of economic development (represented by the pace of innovation) is how the scientific and technological breakthroughs that fueled them have also shaped the modern era by improving public health and changing the fabric of modern society (Langford 2004). From the steam engine to the combustion engine and from the telegraph to satellite and laser communications, each transition has provided new opportunities to improve our quality of life. These transitions in technology have been paralleled by major scientific advances in areas such as medicine and genetic engineering, which have improved the health of those societies with access to the new medicines or knowledge.

With each transition, the complexity of new technological systems is increasing, placing greater demands on our ability to understand how these new systems interact and behave. The task of defining and understanding the dynamic and evolving nature of technological systems will be a major undertaking of the 21st century. One might argue that our inability to understand or predict, and then counteract or respond to, the behavior of these systems is the main reason why there is so much concern about the future prospects for developed societies. We need not look far to see the numerous events that have devastated communities and the natural world as a result of technological and scientific advances.[122]

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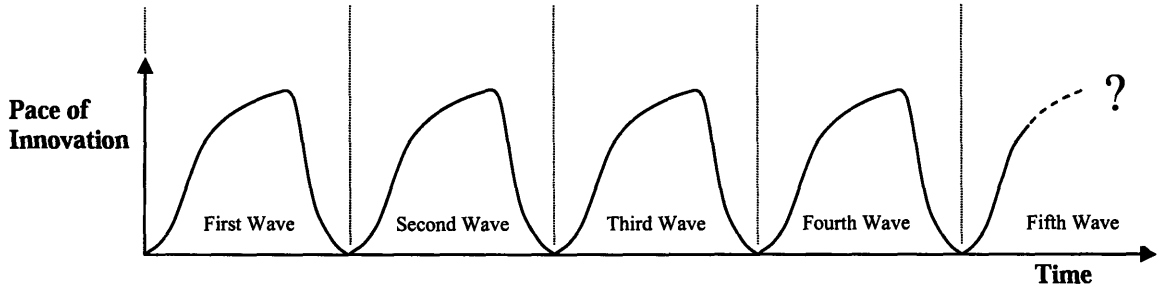
[121] Public unease with the safety of nuclear technology, nuclear proliferation, long-term waste management requirements, and life cycle costs are four important factors limiting the growth of the nuclear sector. However, if a greater emphasis is placed on electricity production that does not produce CO_2 and the four factors above are adequately addressed, the nuclear sector might experience a resurgence (Deutch et al. 2003). However, nuclear power is likely to remain a highly controversial energy option.

[122] A few salient examples include the 1969 oil spills on the Cuyahoga River in Ohio and off the coast of Santa Barbara, U.S.; the 1979 Three Mile Island nuclear accident in Pennsylvania, U.S.; the 1984 Bhopal incident where a leak of deadly methyl isocyanate at a Union Carbide pesticide plant in Bhopal, India killed some 3,800 people; the 1986 nuclear reactor meltdown at Chernobyl power station which released radioactive material throughout the Northern Hemisphere; and the 1989 Exxon Valdez oil spill which released 11 million gallons of oil into Alaska's Prince William sound. While preventing such disasters is a

Table 2.8: Characteristics of Major Technological Complexes

	1770-1830	1820-1890	1880-1945	1935-1995	1985-2050
Growth sectors	Water power Ships Canals	Coal Railroads Steam power Mechanical equipment	Cars Trucks Trolleys Chemical industry Metallurgical processes	Electric power Oil Airplanes Radio and TV Instruments and controls	Gas Nuclear Information Telecommunications Satellite and laser communications [NBIC]
Emerging technologies	Mechanical equipment Coal Stationary steam power	Electricity Internal combustion Telegraph Steam shipping	Electronics Jet engines Air transport	Nuclear Computers Gas Telecommunications	Biotechnology Artificial intelligence Space communication and transport [Nanotechnology Ubiquitous computing]
Management		Economy of scale Interchangeable parts	Administrative management	Professional management	Participatory and interconnected systems management
Industrial organization	Concept of the industrial firm Division of labor	Concept of mass production Interchangeable parts	Concept of management structure and delegation	Concept of decentralization	Concept of systems structure

Source: Grubler and Nowotny (1990), from NRC (2002, p. 73).



Source: Adapted from Jowitt (2004, p. 81).

Figure 2.3: Stylized Graph of Schumpeter's Waves of Technology-based Economic Development [123]

primary objective of systems engineering, some argue that no matter how many warnings and safeguards are designed into our modern large scale technological systems (such as a nuclear power or petrochemical plant), growing systems complexity means that failures are inevitable (Perrow 1999). Of course, what is missing from the above list are incidents that occurred through the intentional use of nuclear, chemical, biological, and conventional weapons.

[123] This figure was based on a similar diagram presented in Jowitt (2004, p. 81). However, an important difference is that Jowitt's graph depicts a reduction in the duration of each subsequent wave of innovation (i.e., the first wave is 60 years in length, the second wave is 55 years in length, and so on, until the fifth wave which is predicted to be 30 years in length). It is most likely that the discrepancy lies in the technologies that have been grouped into each technology-based wave of economic development. If we look at specific technologies there is evidence to suggest that the rate at which society adopts new technology is increasing (see Tables 2.9 and 2.10). See, for example, Christensen's *The Innovator's Dilemma*, in which he charts the rapid advance of disk drive technology that occurred over a contracted time period.

At the turn of the millennium, the National Academy of Engineering (NAE) undertook a study to identify the twenty greatest engineering achievements of the twentieth century.[124] A look at how these achievements (shown below) relate to Table 2.8 is instructive. For example, several of the achievements identified by the Academy have been *emerging technologies* during one wave of economic development that later became one of several technologies supporting *growth sectors*. The internal combustion engine (ICE) and electronics were emerging technologies during the second (1820-1890) and third (1880-1945) waves of economic development, respectively. Both technologies then support growth sectors in the following waves of economic development. The ICE played a critical role in the car and truck growth sectors (1880-1945) and electronics (transistors in particular) were crucial in the development of radio and TV (1935-1995). These trends provide an indication of how individual technologies can follow an S-shaped curve of growth. Their rate of growth is slow during the emergent state, but rapid when part of a growth sector. Once market saturation occurs the pace of innovation (and economic growth) falls as new growth sectors begin to emerge.

The NAE's twenty greatest engineering achievements of the 20th century:

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials

It is hard to imagine what the modern world would be like without the above technologies. For example, in industrialized nations the computer has infiltrated almost all aspects of contemporary life. Even those members of society who do not directly use computers are required to interact with them indirectly (Marx and Smith 1994). For example, supermarkets, banks, libraries, schools, hospitals, trains, buses, automobiles, and airlines all rely on or use computers. Hence, individuals are required to interact with computers on a daily basis whether they are aware of it or not. Peter Drucker (1999), however, makes a convincing case that the computer has simply transformed processes that 'already' existed during the industrial revolution. He argues that it is the Internet and, more specifically, *e-commerce* (both of which rely on computers) that will transform our lives.

> *"The truly revolutionary impact of the Information Revolution is just beginning to be felt. But it is not "information" that fuels this impact. ... It is not the effect of computers and data processing on decision-making, policymaking, or strategy. It*

[124] Source: National Academy of Engineering, *The Greatest Engineering Achievements of the 20th Century*, http://www.greatachievements.org/greatachievements/index.html (accessed on 04/08/06).

> *is something that practically no one foresaw or, indeed, even talked about ten or fifteen years ago:* ***e-commerce*** *- that is, the explosive emergence of the Internet as a major, perhaps eventually* ***the*** *major, worldwide distribution channel for goods, for services, and, surprisingly, for managerial and professional jobs. This is profoundly changing economies, markets, and industry structures; products and services and their flow; consumer segmentation, consumer values, and consumer behaviour; jobs and labor markets*" (Drucker 1999, p. 47). ... "*E-commence is to the Information Revolution what the railroads were to the Industrial Revolution - a totally new, totally unprecedented, totally unexpected development. And like the railroad ..., e-commerce is creating a new and distinct boom, rapidly changing the economy, society, and politics*" (ibid, p. 50).

Implicit in the above discussion is the idea that technology has played, and will continue to play, an influential role in shaping modern industrial societies. This idea of *technological determinism* - a *technology-led* theory of social change - can be traced back to the early stages of the industrial revolution.[125]

Largely due to the early technocratic views of America's forefathers, who believed that economic and political independence could be achieved by developing machine-based manufacturing, and big business advertising,[126] the American technological culture was firmly established by the mid twentieth century (Pursell 1996; Smith 1994). Tables 2.9 and 2.10 provide some evidence of the emergence of this culture by highlighting the rates of adoption and ownership levels of several major technologies in the U.S.

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[125] Smith (1994) provides an insightful discussion of how technological determinism, initially conceived in Europe, found a fertile ground in the newly independent United States as a result of its desire for progress. He argues that Benjamin Franklin and Thomas Jefferson were the "*nation's prophets of progress*" who sought new mechanical technologies as a means to realize the vision of a "*virtuous and prosperous republican society*" (ibid, p. 3). Smith suggests that to Franklin and Jefferson, "*progress meant the pursuit of technology and science in the interest of human betterment (intellectual, moral, spiritual) and material prosperity*" (ibid, p. 3). However, at the turn of the 19th century, Smith (1994) describes how Franklin and Jefferson's views failed to prevail due to the emergence of a more technocratic vision of progress espoused by Alexander Hamilton and Tench Coxe. This technocratic view grew from the belief that America's political independence rested upon economic independence. The early success of machine-based manufacturing convinced Hamilton and Coxe that technology would be the means by which economic independence could be achieved. In addition, with the nation's abundant resources and a limited populace to exploit them, if America was to surpass Britain and Europe in technological prowess then new technology and machines would be required (Pursell 1996). During the following century and a half, America's decision to focus on technological advance laid the groundwork for major advances in manufacturing that had a significant influence on American culture (Pursell 1996; Smith and Marx, 1994). An example of two influential innovations produced during this period were Eli Whitney's 'American System' of manufacture of interchangeable parts (Smith 1994) and Henry Ford's triumph of the automobile (Flink 2001). See Pursell (1996) for an insightful discussion of influential technologies from America.

[126] Supra note 65.

Table 2.9: Speed of Adoption of Technology in the U.S.

Technology	Year Invented	Years until 25% of the U.S. population adopted it
Electricity	1873	46
Telephone	1875	35
Auto	1885	55
Television	1925	26
Microwave oven	1953	30
Personal computer	1975	15
Cellular phone	1983	13

Source: Dorf (2001, p. 72).

Table 2.10: Percent of U.S. Households with the Technology in 1999

Television	98%
Cordless phone	72%
Personal computer	46%

Source: Dorf (2001, p. 72).

It is now apparent, at the turn of the 21st Century, that Western economies are transitioning towards a post-industrial, or information-based, society (Castells 1999). Bell (1999) describes a post-industrial society as one which relies on the economics of information (or intellectual capital) as opposed to the economics of goods (from manufacturing). Where the steam engine was the catalyst for the industrial revolution, global information technology is the catalyst for the information revolution. Therefore, the signs of an emerging post-industrial society are a growing service sector in relation to manufacturing and an increasing reliance on information technology. The post-industrial society will not displace the older one; instead it will overlay some of the previous layers in a similar way that the industrial society did not eliminate the agricultural sectors of society (Bell 1999). People will still rely on produce and products to survive. The development of new technological forms for the post-industrial society will need to respond to this new era of human development, where information and products and services become intertwined.

In the insightful article *The Age of Social Transformations*, Drucker (1994) charts the major changes that have occurred in the structure of society from the early agricultural to the new knowledge-based societies. In particular, he describes how two technology-based shifts in the nature of employment have occurred.

It is evident that before War World I, the single largest group in every country was comprised of traditional farmers, followed in developed nations by live-in domestic servants (Drucker 1994, p. 54). By the 1950s, the industrial revolution - triggered by emerging technologies such as the steam engine - had gathered full momentum and industrial workers now formed the single largest group in developed nations (ibid, p. 56). The core tasks of these workers were manufacturing and serving the products of manufacturing (such as car and appliance repair). However, around the turn of the millennium, the traditional industrial worker was being replaced by the technologist -

"*someone who works both with hands and with theoretical knowledge*" (ibid, p. 56). Good examples of technologists are dentists and computer and x-ray technicians. More generally, Drucker (ibid, p. 62) refers to the newly emerging dominant group as "*knowledge workers.*" He argues that although the foundation of the knowledge worker is a formal education, this is only the beginning. If the new comparative advantage lies in the application of knowledge, this means that the knowledge worker must be able to learn continuously to bring value to his/her firm or business (ibid, pp. 62-63). Modern day knowledge-based workers form what is now termed the *service industry*, which includes health care services (such as dentistry and medicine), knowledge-based services (such as banking, information management, etc.), and food and retail services. However, it should be recognized that the first two job categories are likely to require higher levels of educational achievement than the latter category.

Drucker (1994) argues that the problem with this latest transition is that displaced industrial workers cannot simply move into knowledge-based or service employment since they lack the education necessary to do such a task. Hence, if industrial workers are to succeed in knowledge-based employment, they must "*change their basic attitudes, values, and beliefs*" (ibid, p. 62). It also means that good education becomes paramount. What Drucker fails to acknowledge, though, is that displaced industrial workers may have no choice but to accept low-wage employment in the service sector. While working in a fast food establishment, for instance, will bring in a minimal income, it is debatable whether such employment is fulfilling to the worker. Hence, the future does not look promising for those industrial workers who are caught in the transition between the industrial and service economy.

2.3.1 Sustaining and Disrupting Innovation

The increasing pace at which new technology is being adopted by societies is having the effect of stimulating still more rapid technological change. Today, technological innovation drives high-technology industries in the U.S. and in other nations around the world. The desire to provide customers with new and better products and services - or to reduce/eliminate negative externalities associated with the use or manufacture of products/services - means that companies are pitched in a constant battle to be the first to bring the latest technologies to market. In such an environment, companies that rely on incremental innovation can see their markets disappear as new radical innovations enter and displace their products from the market place. The purpose of this section is to look at the process of technological change and innovation and ask what types of changes are necessary to transform systems towards sustainable development. Further, this section considers how these changes might be affected by supply- and demand-side policies.

For policy evaluation and design purposes, it is important to classify technological change and innovation in a functionally-useful way. At the outset, four different levels of technological change must be considered:

1. product changes;
2. process changes;
3. shifts from products to product-services; and

4. more far-reaching system changes.

All four types of technological change are necessary to achieve sustainable development. However, the impact of each type of change will depend upon whether it is incremental, moderate, or radical in nature and on the scale at which the change occurs (regional, national, or international). One way to consider these factors is to look at differences in the processes of technology development. An important distinction is the difference between technology development that proceeds in an *evolutionary* manner (or in a *co-evolutionary* manner where technology developers and customers change what is produced and demanded over time) and technology development that is driven by *government intervention* or *societal demand*. In both cases, technological change can occur in each of the four levels presented above.

Using language that is familiar to traditional innovation scholars, an *incremental innovation* involves a step-by-step co-evolutionary process of change, whereas *radical innovations* are discontinuous and possibly involve the *displacement* of dominant firms and institutions (Ashford et al. 2002; Luiten 2001; Moors 2000; Partidario 2003). Christensen (1997) distinguishes the former as *sustaining innovation* and the latter as *disrupting innovation*, and argues that both sustaining and disrupting innovation can be incremental, moderate, or radical. Unfortunately, the term 'radical' is used in the literature in these two different ways and is a source of confusion. The discussion on product innovation (below) should help to clarify its use.

Much of the innovation scholarship relates to evolutionary theory in the context of products, and here the (changing) nature of the customer base is important. In particular, in defining and distinguishing *sustaining* and *disrupting* product innovation, Christensen (1997) relies on the concept of 'value networks' made up of different customers. He notes that incumbent firms tend to develop predominantly sustaining product technologies for existing customers while new entrants pioneer disrupting product technologies for a new customer base. Christensen's (1997) research does not extend beyond the product domain to explore how development might be different under *strong governmental* or *societal interventionist policies* that supersede evolutionary changes.

In the context of *encouraging* sustainable development transformations, *supply-side policies* (e.g., R&D support; tax treatment of investment; environmental, health, and safety regulation; etc.) are interventionist in nature and are focused on encouraging technological changes with certain performance characteristics in mind. In contrast, *demand-side policies* (e.g., purchasing tax incentives, public-service advertising, counter-advertising, education, etc.) are designed to change societal preferences and may be useful in implementing or gaining acceptance of sustainable development policies. While demand-side policies are less interventionist, they can have a significant effect on evolutionary processes of change. The critical question is whether the rate of change towards sustainable development is likely to be sufficient under an evolutionary (laissez-faire) approach to innovation, or whether a more interventionist approach is required. An argument made in this thesis is that evolutionary approaches may proceed too slowly to stem sustainability concerns related to important problems such as global climate change

and toxic pollution.

Already mentioned is the fact that Christensen's (1997) theories focus on the product domain. *Process changes* and *innovation*, though important to workers, are not very important to the customers of a product. Producers of products may develop more sustainable processes to make their products, but these actions are not normally driven by customer demand. Hence, Christensen's (1997) concept of 'value networks' and new customer bases may not be as useful in the process domain as they are in the product domain. Distinguishing sustaining and disrupting *technologies* may be useful, but these 'innovations' are driven by producers and manufacturers who operate within a demanding regulatory environment rather than product consumers.

For shifts from products to *product-services* - e.g., purchasing a Xerox *service* rather than a Xerox machine - customers may be even more important than they are in the product realm. Finally, *system changes* involving a number of producers and actors - and perhaps service providers - involve a more dramatic re-alignment of actors (see Section 4.2.3.5).

In the discussion that follows, a behavioral model is developed that describes for *product changes* the influence of incumbent vs. new entrants, the likelihood of sustaining vs. disrupting technology, and implications for different customer bases.

Figure 2.4 has been created to help explore different types of innovation.[127] It presents a matrix that can be used to locate an innovation in one of twelve categories. The matrix shows where a sustaining or disrupting innovation originated (i.e., from an existing firm or new entrant), its type, and whether the innovation serves existing customers or a new customer base. While it can be difficult to draw clear boundaries between these descriptors, the framework provides a first order approximation of whether an emerging technology is of a sustaining or disrupting nature.

An incremental, moderate, or radical *sustaining innovation* is a technological change along the same lines that technology has been developing historically. The development of the internal combustion engine (ICE) provides a good example of sustaining innovation. Improvements in the performance of an ICE have been incremental, moderate, and radical in nature. Sustaining innovations that originate from an existing firm fall into *Category II* (which covers the vast majority of sustaining innovations) on Figure 2.4 and those that originate from a new entrant fall into *Category VIII*. In both of these cases, the existing customer base that values the traditional attributes (or performance) offered by the technology is served.[128]

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[127] While the matrix is relevant to product, process, product-service, and system innovations, the focus here is only on product innovation.

[128] Category II has been highlighted in Figure 2.4 since the majority of sustaining innovations are likely to come from existing firms. The presence of technological and political lock-in (or entry barriers) makes it difficult for new firms to enter established markets. In addition, while Categories I and VII have been included in the matrix for completeness, it is unlikely that a sustaining innovation will develop a new customer base that previously did not see the value of the existing technology. However, such a situation might occur where a firm missed an opportunity to sell its product to a consumer base, by not perceiving that the consumers had a need for its product.

Sustaining innovations tend to follow the trajectory of 'Product A' in Figure 2.5. This figure indicates that sustaining innovations eventually improve the performance of an established technology beyond the actual market demand for the product. To remain competitive in mainstream markets, firms need to continually improve their product to retain and capture new customers. An improved product can generate higher returns (found in the upper right of Figure 2.5), since firms can charge a premium for their product rather than being forced to compete on price.[129] However, the further an established technology progresses along a sustaining innovation trajectory, the more vulnerable it becomes (over time) to emerging disrupting technologies that can undermine its customer base. In effect, sustaining innovations can 'overshoot' the performance requirements and/or budgets of customers, who will then switch to a cheaper product/service - even one with somewhat reduced performance - as one becomes available. These more suitable products/services are known as disrupting innovations. They are termed disrupting both because the technical development is not within the mainstream development trajectory[130] *and* because they have attributes that appeal to a new or emerging customer base (in Christensen's conceptualization).

[129] Firms that compete on price tend to rely on 'process innovation' to reduce production costs and increase profit margins.

[130] Since the focus is on the technology itself rather than its market appeal, it might be more appropriate to described disrupting innovations as disrupting *technologies.*

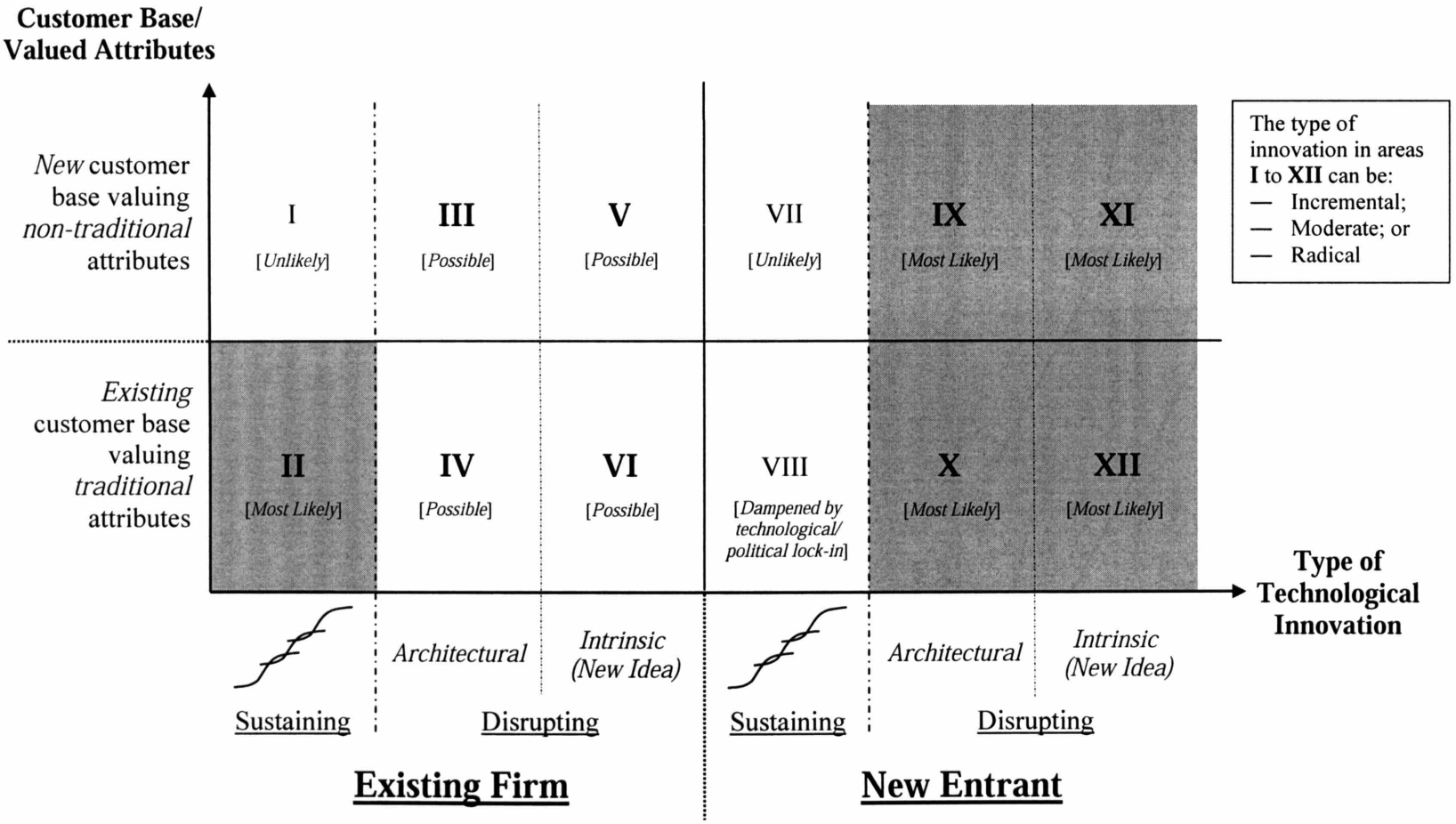
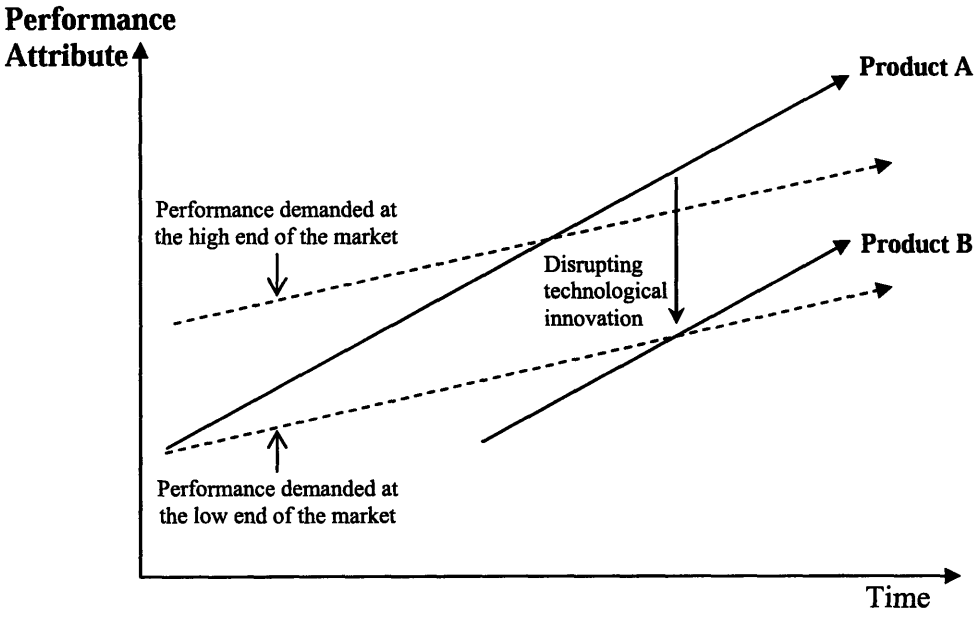


Figure 2.4: Matrix Showing Potential Outcomes from Sustaining and Disrupting Technology



Source: Adapted from Christensen (1997, p. xix).

Figure 2.5: Intersecting Trajectories of Performance Demanded versus Performance Supplied in a Generic Product Market

An incremental or radical *disrupting innovation* can take two forms: one that combines two or more prior developments in a new way, creating an 'architectural' innovation; or one that stems from a new idea and is an 'intrinsic' innovation. The former could, but need not be supported by a significant research and development effort. Disrupting [architectural] innovations tend to be "*cheaper, simpler, smaller, and, frequently, more easy to use*" (Christensen 1997, p. xviii), and offer a lower level of performance, at least in some ways. Christensen (1997) makes a convincing case that since emerging disrupting technologies [both architectural and intrinsic] are not initially performance-competitive (in the context of their traditional attributes) with mainstream technologies, they are initially sold to a niche element of the existing market and/or (more likely) to a new customer base. However, once the performance of a disrupting technology improves (along a sustaining innovation trajectory) to a point at which it becomes competitive with mainstream technologies (since it offers sufficient performance in the traditionally-valued attributes and has other attractive attributes as well - see Product B in Figure 2.5), it can capture the market by displacing the established products/services.

It is important to recognize that the set of attributes valued by the customers of Product B are likely to be different to those valued by the customers of Product A. For example, Product A (e.g., a desktop computer) might be valued for its hard disk capacity, whereas Product B (e.g., a laptop computer) might be valued for its sufficient capacity along with its size or portability. As the size, portability, *and* hard disk capacity in the laptop computer improve along sustaining innovation trajectories, the laptop may eventually

reach a point where its hard disk capacity can compete with the capacity offered by desktop computers and yet offer other attractive features. At this point, the laptop can begin to undermine the market share of desktops. This process of disruption can be explained using Figure 2.6.

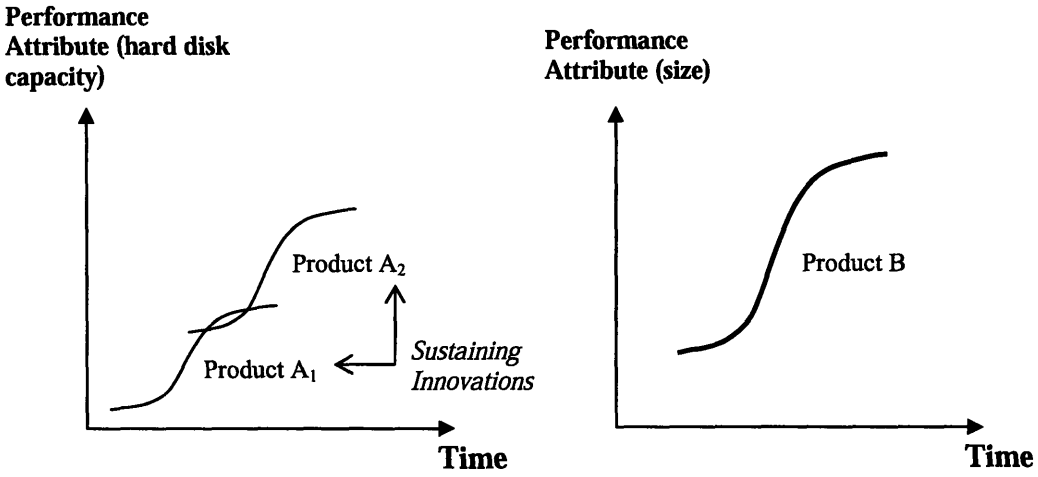


Figure 2.6: Disrupting Technology S-Curve

The graph on the right of Figure 2.6 shows the home value network for the laptop (Product B), where the size/portability of the computer is assumed to be the important attribute. The rate at which the size of the laptop is reduced is represented by the S-curve. The graph on the left of Figure 2.6 shows the home value network for desktop computers (Product A), where hard disk capacity is assumed to be the leading attribute. This graph also shows how one model of hard disk used in desktops (Product A_1) has been replaced by a more advanced model (Product A_2) - which provides an example of a sustaining innovation. When the hard disk capacity of the laptop - a secondary attribute in the home value network for Product B - reaches a level at which it can begin to approach the performance demanded by the desktop consumers, it can invade the market and start to capture market share, ultimately displacing the sustaining innovations on the left side of the figure.

An example of a *disrupting 'architectural' innovation* is the hybrid electric-internal combustion vehicle. This technology combines the ICE with battery technology to develop a new vehicle architecture. While hybrid vehicles are fuel efficient and offer environmental benefits, they currently provide a lower level of performance when compared to the power and acceleration of ICE vehicles.[131] Therefore, the majority of customers of ICE vehicles (Product A in Figure 2.5) who value these specific traditional attributes are not likely to purchase a hybrid vehicle (Product B in Figure 2.5). Thus, hybrids are initially likely to be sold to customers who value the attributes of a more environmentally sound and fuel efficient vehicle. However, once the performance and

[131] This situation is likely to change as hybrid vehicle technology rapidly advances. The new Ford Escape Hybrid is a case in point. Its power and acceleration are comparable to that of ICE powered Ford Escape. See Ford, *Escape Hybrid*, http://www.fordvehicles.com/escapehybrid/home/ (accessed on 04/08/06).

cost of hybrid vehicles approach that of ICE vehicles, they have the potential to disrupt the ICE vehicle technology, assuming that power and acceleration remain valued performance attributes.[132] If the hybrid vehicle technology is developed by a new entrant it falls into *Category X*; if an existing firm develops the technology it falls into *Category IV* (Figure 2.4).

An example of a *disrupting 'intrinsic' innovation* is Alexander Graham Bell's telephone, which gradually undermined, and then supplanted, Western Union and its telegraph operators (Christensen et al. 2001). In this case the disrupting technology came from a new entrant, which means the innovation can be located in *Category XI*. Another example of a *disrupting 'intrinsic' innovation* is the hydrogen fuel cell vehicle, which holds the potential to disrupt ICE and hybrid vehicles from the market. In this case, existing firms are attempting to develop the technology for the U.S. market, placing the hydrogen fuel cell vehicle in *Category VI*.

Christensen (1997) argues that disrupting [product] technologies are almost always developed by firms outside the prior market or business. This is why *Categories IX* to *XII* are highlighted in Figure 2.4. Firms in the existing market that develop disrupting technologies (*Categories III* to *VI*) might be described as highly innovative, with the capacity and willingness to reinvent themselves given the opportunity. However, as Christensen's (1997) research reveals, it is questionable whether a firm is able to disrupt its own product from the market with a new product.

It is important to recognize the evolutionary nature of technological innovation described above. Once an established technology has been displaced by a disrupting innovation, the disrupting innovation then becomes vulnerable to disruption as it develops along a sustaining innovation pathway. Thus, the process of disruption is unrelenting and evolutionary in nature. This phenomenon is what Schumpeter (1962, p. 84) famously referred to as the "*perennial gale of creative destruction.*"

While the above discussion focuses on product innovation, it is believed that Christensen's ideas can be extended to include process, product-service, and system innovations (Ashford et al. 2002). However, Ashford (2000) provides a word of caution that relying on existing industries for sustainable transformations ignores evidence that firms must not only possess the *willingness* and *opportunity* to change, but the *capacity* to change. In particular, he questions whether those industries and firms responsible for environmental problems are able - through the use of continuous institutional learning, the application of life-cycle analysis, dialogue with stakeholders, and implementation of environmental management systems - to transform themselves into sustainable industries and firms. "*It is not marginal or incremental changes that are needed for sustainability*

[132] In this example it is assumed that the hybrid vehicle is competing directly with the ICE vehicle whose customer base values 'traditional' performance attributes. However, one might argue that the hybrid vehicle is creating a new customer base that values 'non-traditional' (i.e., environmental and efficiency) attributes. In this case, the hybrid vehicle could displace the ICE vehicle market altogether due to an evolution in consumer preferences (which could be stimulated by environmental regulation or evolving consumer preferences). Under this new scenario, if the hybrid vehicle technology was developed by a new entrant it would fall into *Category IX*; if an existing firm developed the technology it would fall into *Category III*.

but rather major product, process, and system transformations - often beyond the capacity of the dominant industries and firms" (Ashford 2002, p. 1417). The same problems arise when considering change in government and societal institutions. Therefore, *creative interventionist policies* are seen as essential in encouraging system innovation towards sustainable transformations (see Section 4.2.3). Moving from improving pesticide safety and designing bioengineered crops to a reconceptualization of sustainable, perhaps decentralized, agricultural systems, is one example where creative government policy would be essential.

It is possible to visualize how Christensen's (1997) ideas can be extended to include process, product-service, and system innovation by re-drawing Figure 2.4 to reflect these additional levels of innovation (Figure 2.7). It is important to realize that the dominant mechanisms for change in each level of innovation are likely to vary, meaning that different categories (i.e., I to XII) in the matrix are likely to be shaded. When considering each level, who is - and who is not - likely to develop future technology under strong government directives/societal demand and the implications for *future* organizational changes (especially in the context of systems) are important issues to consider. Further, while product, process, product-service, and system changes are necessary to achieve sustainable development, it is likely that system innovations will be particularly important when focusing on large scale socio-technical systems, such as the transportation system.

In conclusion, as a result of sustaining and disrupting innovations, existing technologies are likely to be improved or supplanted over time provided that new competitors are able to enter existing, or develop new, markets without being held back by entry barriers. If it is possible to influence the dynamics of the evolutionary change process it might be possible to place development onto a sustainable, potentially radically different, trajectory. Thus, as Dorf (2001, p. 70) comments, "[f]*or good or ill the contemporary world is and will continue to be substantially shaped by technology.*"

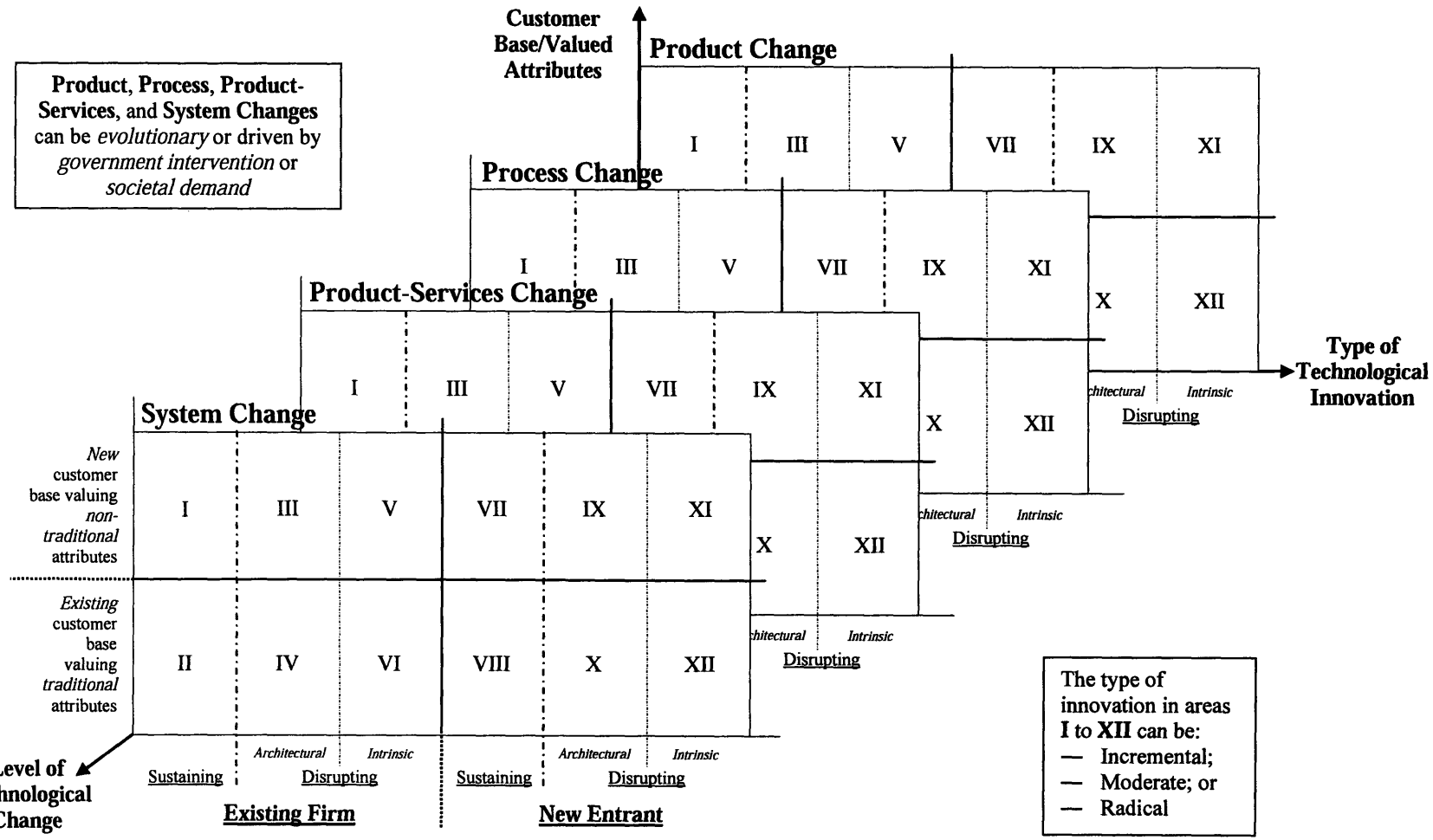


Figure 2.7: Matrix Showing Potential Outcomes from Sustaining and Disrupting Technology for Four Different Levels of Technological Change or Innovation

2.3.2 Technology, Society, and Sustainable Development

The ability of technology to shape the world by influencing international conflicts, national politics, the distribution of wealth and power, equality between genders, and the environment makes it a powerful force for change. With regards to sustainable development, the main concern lies with the negative impacts that technology can have on the environment and society. To use the words of Commoner (1971; 1972), the technology of the twentieth century was 'flawed.'[133] While the *production* and *use* of new technologies have improved living and working environments for many, the reverse is also true. In addition, technology is largely responsible for the degradation of the natural environment to the extent that ecosystems and wildlife have either been destroyed or put under serious stress (Carson 1962). We must also add the more recent concern for the global climate, which is being threatened by the sheer scale of modern industrial processes and the emission of greenhouse gases.

An additional concern raised by Streeten (2001) rests not so much with the environmental impacts of technology, but with the *pace* at which technologies are changing. The critical issue is that rapid technological change means that governments must have a high degree of flexibility and adaptability to counter or control the negative impacts of new technologies. This issue here is especially acute in developing nations where governments are struggling to address some of the most basic human needs such as the provision of food and shelter for its people. Hence, government policies lag behind technology, meaning that technology is evolving without a real plan.

Mumford (1952; 1967; 1971) and Ellul (1964), two prominent twentieth century historians of science and technology, warned of the inherent problems with creating a society based upon technology. In *The Technological Society*, Ellul (1964) was particularly concerned that the integration of machines (or technology) into society was developing a world of order and efficiency to suit the needs of machines rather than one in which the diversity of humans could flourish. While Ellul (1964) makes an eloquent, though very pessimistic critique of technological development, he refrains from providing answers to the problems he raises. To find these we must look to the work of Winner (1977; 1986).[134]

Winner's (1977, p. 323) most influential insight from his book *Autonomous Technology* was that "*technology is itself a political phenomenon.*" What Winner means by this is that "*technology in a true sense is legislation*" in that its forms "*shape the basic pattern and content of human activity*" (ibid, p. 323).[135] Therefore, if human behavior is regulated by

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[133] Commoner's emphasis is on synthetic organic chemicals and the dependence on fossil fuel energy sources.

[134] See Langdon Winner's home page for more information about his work, http://www.rpi.edu/~winner/ (accessed on 04/08/06).

[135] In *Code and Other Laws of Cyberspace*, Lessig (2000) makes a similar argument to Winner in relation to how the technology, architecture, and code of the Internet regulate our behavior. To Lessig, these parameters that govern the Internet are "*a kind of law* ... [that determine] *what people can and cannot do*" (ibid, p. 59). Their form shapes individual freedoms and the 'virtual' spaces in which people interact. Just

technology, a logical question is whether individuals have a voice in guiding the development of technology. As Winner argues, "[n]*ew technologies are institutional structures within an evolving constitution that gives shape to a new polity, the technopolis in which we do increasingly live. For the most part, this constitution still evolves with little public scrutiny or debate. Shielded by the conviction that technology is neutral and tool-like, a whole new order is built-piecemeal, step by step, with the parts and pieces linked together in novel ways without the slightest public awareness or opportunity to dispute the character of the changes underway*" (ibid, p. 324).

To address these problems, Winner (1977, pp. 326-327) proposes that:

1. there is a need to begin searching for new technological forms;
2. the development of new technological forms should occur through stakeholder participation;
3. the scale and structure of the technological forms should be immediately understandable to non-experts, they should be flexible and mutable, and should foster a low level of user dependency; and
4. the technologies developed should be informed by a sense of what is seen as appropriate by society, as opposed to developing ideas found to provide a narrow utility, regardless of their broader implications.

In a more recent book, *The Whale and the Reactor: A Search for Limits in an Age of High Technology*, Winner provides a more detailed articulation of his ideas. The central argument of this book is that technological systems, which are inherently political, are not value neutral in that they favor the interests of certain members of society (Winner 1986). In line with the proposals put forward in his previous work, Winner argues that societies must understand the implications of new technological systems before they are implemented to allow for their modification or rejection. Thus, he concludes:

> "*The important task becomes ... not that of studying the 'effects' and 'impacts' of technical change, but one of evaluating the material and social infrastructure specific technologies create for our life's activities. We should try to imagine and seek to build technical regimes compatible with freedom, social justice, and other key political ends. ... What I am suggesting is a process of technological change disciplined by the political wisdom of democracy. It would require qualities of judiciousness in the populace that have rarely been applied to the judgment of instrumental/functional affairs. ... Faced with any proposal for a new technological system, citizens or their representatives would examine the social contract implied by building the system in a particular way. They would ask, How well do the proposed conditions match our best sense of who we are and what we want this society to be? Who gains and who loses power in the proposed change?*

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as liberty in 'real' space occurs through the presence of government, Lessig argues that liberty in virtual space can only be achieved through the creation of a 'constitution.' This constitution would be a legal architecture (a form of social contract) "*that structures and constrains social and legal power, to the end of protecting fundamental values - principles and ideals that reach beyond the compromises of ordinary politics*" (ibid, p. 5). Thus, the constitution would promote certain desired values (e.g., free speech, privacy, etc.) that can be sustained by courts, governments, and institutions.

Are the conditions produced by the change compatible with equality, social justice, and the common good? To nurture this process would require building institutions in which the claims of technical expertise and those of a democratic citizenry would regularly meet face to face. Here the crucial deliberations would take place, revealing the substance of each person's arguments and interests. The heretofore concealed importance of technological choices would become a matter for explicit study and debate" (Winner 1986, pp. 55-56).[136]

While Winner's ideas have been criticized as being too theoretical, Smith (1994) argues that his emphasis on moral and political principles has been valuable in guiding the formulation of programs for action. A difficult challenge raised by Winner's idea of establishing a democratic political philosophy to guide the development of technological systems is whether it is possible to predict the impacts of new technology forms. Few would have imagined the global impact of the Internet when it was first conceived. However, it is possible to take an educated guess (using tradeoff analysis - see Section 4.2.1.4) as to who might or might not benefit from the proposed technologies and whether they support the values and beliefs of society. In this regard, the value of Winner's ideas is that they encourage governments to ask questions about new technology, as opposed to pushing forward with seemingly good ideas without stakeholder input. Given Winner's argument that technology is legislation, if a new technological form is imposed upon society without any debate on its potential implications, one can argue that this action is undemocratic and is potentially unjust.

Sclove (1995, p. ix) reinforces Winner's arguments by stating that "[i]*nsofar as (1) citizens ought to be empowered to participate in shaping their society's basic circumstances and (2) technologies profoundly affect and partly constitute those circumstances, it follows that (3) technological design and practice should be democratized.*" In his book, *Democracy and Technology*, Sclove (1995) develops a design criteria for democratic technologies (Box 2.1) that he argues can be used to development more sustainable, socially equitable, and humane forms of technology. The themes of designing technologies that improve conditions for disadvantaged members of society, enhance working and social environments, and promote local/regional self-reliance and ecological sustainability are of particular relevance to sustainable development.

Box 2.1: A Provisional System of Design Criteria for Democratic Technologies (Sclove 1995, p. 98)

Toward DEMOCRATIC COMMUNITY:

A. Seek a balance among communitarian/cooperative, individualized, and transcommunity technologies. Avoid technologies that establish authoritarian social relations.

Toward DEMOCRATIC WORK:

B. Seek a diverse array of flexibly schedulable, self-actualizing technological practices. Avoid meaningless, debilitating, or otherwise autonomy-impairing technological practices.

[136] Also see *Democracy in a Technological Society*, edited by Winner, which explores the relationship between democracy and technology (Winner 1992).

Box 2.1: A Provisional System of Design Criteria for Democratic Technologies (Sclove 1995, p. 98)

Toward DEMOCRATIC POLITICS:

C. Avoid technologies that promote ideological distorted or impoverished beliefs.
D. Seek technologies that can enable disadvantaged individuals and groups to participate fully in social, economic, and political life. Avoid technologies that support illegitimately hierarchical power relations between groups, organizations, or polities.

To help secure democratic self-governance:

E. Keep potentially adverse consequences (e.g., environmental or social harms) within the boundaries of local political jurisdictions.
F. Seek relative local economic self-reliance. Avoid technologies that promote dependency and loss of local autonomy.
G. Seek technologies (including an architecture of public space) compatible with globally aware, egalitarian political decentralization and federation.

To help perpetuate democratic social structures:

H. Seek ecological sustainability.
I. Seek "local" technological flexibility and "global" technological pluralism.

In Section 2.2.1, it was argued that if technology is to advance at a rate necessary to move society towards sustainable development, then what is needed is a combination of a Schumpeterian and Rawlsian vision of technological development. The Schumpeterian vision suggests that the *creative use of government intervention* is a more promising strategic approach for achieving sustainable transformations in technological systems than a focus on policies that rely on a *firm's* more short-term economic self-interest.[137] The Rawlsian vision implies that any such intervention ensures that new social arrangements, or investments in new technological systems, make the least advantaged members of society relatively better off. If we add Winner's and Sclove's ideas to this framework, we now have a series of principles that can help guide 'democratic' government intervention in the development of new technological forms.[138]

A second argument made in Section 2.2.1 is that once a desired outcome has been agreed upon by society and government, the government should assume the responsibility for

[137] Streeten (2001) argues that both high-technology firms and governments shy away from basic research since the associated long-term results are not easily appropriated. He supports his claim by stating that the Green Revolution of the 1960s was financed neither by industry nor government, but instead by the Ford and Rockefeller Foundations. A major problem is that these foundations do not have adequate funding to support research that can address the "*modern high-technology problems that will drive globalisation in the next century*" (ibid, p. 69).

[138] See Van de Poel (2000) for an insightful discussion of the role that 'outsiders' - i.e., professional scientists and engineers, outsider firms, and societal pressure groups - can play in technological development. While understanding the demands of stakeholders who are directly affected by a technological regime/system is important, Van de Poel focuses on stakeholders who are 'outside' of the technological regime/system. He argues that outsiders are more likely to initiate radical innovations that depart from the existing regime/system. "*Compared to the traditional remedy of government intervention, enlarging the role of outsiders in technical development may, at least sometimes, be a more practicable way to* ***democratize technical development*** *or to achieve better forms of technical development*" (ibid, p. 394, emphasis added).

managing the 'pathway' towards the desired outcome - if necessary.[139] The modifier, 'if necessary,' is added since industry, for example, might be quite capable of guiding the development of technology as long as the timeframe is tolerable. In cases where the timeframe exceeds what is practical from a commercial perspective, then government should take responsibility for guiding the development of the new technology. A critical point here is that if the desired outcome was agreed upon through a democratic and inclusive process, the question of who guides the development pathway is simply a case of best fit. On the other hand, if it is not possible - as a result of entrenched vested interests - to establish an inclusive and balanced decision-making process, the role of government in guiding the development pathways becomes more critical.

While it has only been possible to provide an overview of how technology can impact society, the discussion has identified a number of important issues. It is apparent that any attempt to address environmental and social (i.e., health and safety) externalities are hampered by technology that is [1] changing at a *rapid pace*; [2] driven by special interests in search of profit, which can lead to *producer-created demand* (see Section 2.1.4); [3] developing without any explicit discussion of how new technological forms might *regulate* individual behavior; and [4] downgrading, as opposed to upgrading, the nature of employment in terms of job satisfaction, wages, job security, and physical skills. In each case, existing governance structures appear inadequate. They are unable to keep pace with technological change, are dominated by powerful economic interests, and are unable to ensure comprehensive stakeholder participation. In this regard, we might locate the current state of governance in the U.S. in the bottom left hand quadrant of the Rawlsian/utilitarian decision-making philosophy (Table 2.6).

2.4 Living Beyond Our Ecological Means: The Technology Debate

A central question in the sustainable development discourse is how inflexible, yet fragile ecological limits are with respect to human activity - especially activity supporting economic growth. With all else remaining constant, the more rigid the limits, the more radical and painful the changes necessary for sustainability become. Therefore, the debate has traditionally centered on the potential and ability of technology to substitute one resource for another, reduce material and energy intensity, or to otherwise render less relevant these limits.

Building upon the growth theories of Adam Smith and David Ricardo, Thomas Malthus provided one of the earliest predictions of how population growth is likely to be constrained to a 'stationary state' by the availability and productivity of agricultural land.[140] More recently, during the emergence of the environmental movement in the

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[139] See Section 4.2.3 for a discussion of evolutionary economics and strategic niche management as alternative strategies for pathway change.

[140] A central theme of Malthus's work was that once all of the available agricultural land was used, a population could no longer continue to grow and would arrive at a 'stationary state.' While Malthus recognized that the stationary state could be postponed by technological progress or a halt in population

1960s and 1970s, the issue of limits to growth arose again. However, this time it was debated through a number of different lenses. The predominant views linked the prevailing and perceived future ecological crisis to the failure to internalize environmental externalities (Pigou 1932); the use of pesticides/chemicals (Carson 1962); population growth (Ehrlich 1968); inadequate property rights (Coase 1960; Hardin 1968); flawed technology (Commoner 1971); the exploitation of non-renewable energy (Georgescu-Roegen 1971); the fixation with economic growth (The Ecologist 1972); and prevailing world trends in population growth, capital investment, resource usage, agricultural productivity, and pollution rates (Meadows et al. 1972).[141] Each of these lenses tries to identify the factors and trends that lead to environmental damage. Perhaps one of the earliest, most intuitive approaches to understanding environmental problems came from the "**I = PAT**" formula (Ehrlich and Holdren 1971).

Impact (environmental) = **Population** x **Affluence** (GDP per capita) x **Technology** (environmental impact per dollar of GDP)

Since its publication a number of revisions have been suggested. For example, Holdren et al. (1995) adjusted the formula to disaggregate affluence from resource use and to separate measures of the 'stress' that technology imposes on the environment from measures of actual damage, which depend upon stress and 'susceptibility.' The measurement of susceptibility is predominantly a function of cumulative damage from previous environmental stress. Thus, the revised formula is:

Damage (environmental) = **Population** x **Economic activity per person** (affluence) x **Resource use per economic activity** (resources) x **Stress on the environment per resource use** (technology) x **Damage per stress** (susceptibility)

It is important to realize that formulae such as these are a simple representation of a highly complex system. They are informative and can help stimulate discussions about the causes of environmental degradation, but to argue whether or not they are 'right' is unwise (Holdren et al. 1995). What they indicate is that we need to consider the magnitudes of all the factors since these are multiplicative in their effects on environmental damage. However, we should also recognize the limitations of these formulae. They do not take into account the interdependencies or non-linearity that might exist between the factors, there is no explicit consideration of societal factors and how

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growth, his model has since been regarded as too pessimistic (Redclift 2000). It underestimated the ability of technology to extend ecological limits and did not account for the fact that rising per capita incomes, education, and urbanization can lead to a reduction in birth rates (OECD 1995). "*What the years since Malthus have shown incontrovertibly is that high living standards do not engender population growth; that population growth can be reduced and halted; and that the productive power of technology is enormous. It is clear today as it was to Malthus, that the stationary state is not an inevitability*" (Redclift 2000, p. 37). See: New School University, *Classical Growth Theory*, http://cepa.newschool.edu/het/essays/growth/classicalgrowth.htm (accessed on 04/08/06).

[141] Refer to Sections 3.2.1 and 3.3.2, for a detailed discussion of these theories.

they can influence each variable, and they do not consider how each of the variables can change over time - which is especially critical for technological change (Holdren et al. 1995).

Given the inherent political difficulty in developing measures to curtail population growth or limit/reduce affluence and the associated levels of consumption, it seems that the easiest way to achieve a less environmentally destructive society is to focus on technological innovation. Indeed, the 'technological fix' has become a major or integral aspect of many theories put forward on how society can live within its ecological means.

Two interesting developments in economics that treat technology differently are the idea of *substitutability* (Solow 1993) and the *steady-state economy* (Daly 1991), which is part of the much broader field of *ecological economics* (Costanza 1991).[142] Solow's (1993) approach to sustainability is rooted in the idea that technology can create high degrees of substitutability between one resource and another and, implicitly, that natural and man-made capital are in some sense 'fungible.' If resources are fungible, it means that society has no obligation to save a resource for future generations as long as an alternative resource is made available. Solow (1993, p. 182) argues that "*what we are obligated to leave behind is a generalized capacity to create well-being, not any particular thing or any particular resource.*" It follows that resources should be assessed as if they were savings and investments (i.e., we have a choice between current consumption and providing for the future through the investment of non-renewable resource rents).[143]

In contrast, Daly (1991) provides what is probably the most well-developed vision of an economy which functions within ecological limits. Arguing from the first principle of thermodynamics, Daly describes a steady-state economy (SSE) as one in which births replace deaths and production replaces depreciation. The objective of the SSE is to keep the throughput of raw materials (low entropy) and waste (high entropy) to levels within the regenerative and assimilative capacity of the ecosystem. Whereas neo-classical economics views the growth economy as a continual expansion of production and

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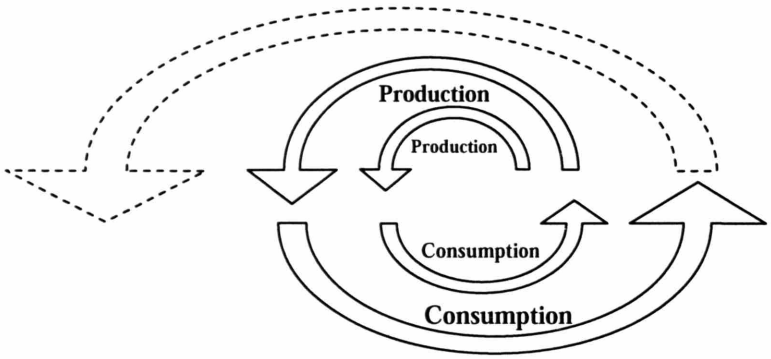
[142] In general, the emerging field of *ecological economics*, which combines both the economy and technology with ecology, provides a holistic perspective of sustainable development (Costanza 1991). It studies the relationships between ecosystems and economic systems, encompassing both biological and cultural change. The human economy is seen as being part of a larger whole. Its domain is the entire web of interactions between economic and ecological sectors. Ecological economics defines sustainability in terms of natural capital - the ability of natural systems to provide goods and services, including clean air and water and climatic stability. Ecological economists propose that the vital role of natural capital (e.g., mineral deposits, aquifers, stratospheric ozone, etc.) should be made explicit in commodity production (Ayres 1996; Daly 1994b). Thus, consumption should not deplete natural capital at a faster rate than it can be replaced by human capital. Daly's notion of the steady-state economy views natural ecosystems as being finite and, therefore, focuses on the scale of human activity (i.e., the economy) that can be supported. Living (and producing) within ecological limits is the major focus of ecological economics.

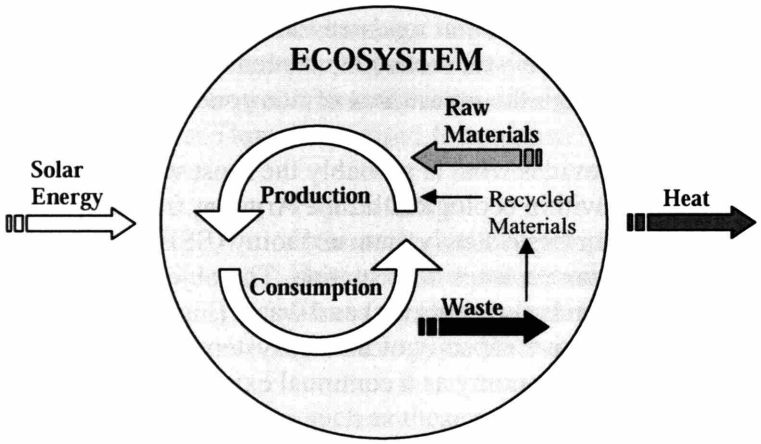
[143] Solow (1993) describes resource rents as the investment of the pure return on a non-renewable resource. For example, in using up a natural resource such as oil in the North Sea oil field, the revenues that are intrinsic to the oil itself should be invested into new technologies that will eventually replace oil. Hence, investing the 'rent' from the non-renewable resource is seen as being an effective way to continue the current levels of consumption while providing for future generations.

consumption (Figure 2.8), the SSE considers these cycles to be in equilibrium with the ecosystem (Figure 2.9).[144]



Source: Adapted from Daly (1991, p. 181).

Figure 2.8: Classical Economics View of Growing Cycles of Production and Consumption



Source: Adapted from Daly (1991, p. 181).

Figure 2.9: Steady-State Economics View of Production and Consumption Cycles in Equilibrium with the Ecosystem

Within the SSE, technology, knowledge, the distribution of income, and the allocation of resources are fluid.[145] Since a fixed amount of resources will yield constant flows of goods and services (all else being equal), technological progress is one way in which more (or more highly valued) goods and services can be produced (Czech 2003; Czech and Daly 2004). However, given the laws of thermodynamics there are limits to what is

[144] See Rees (1995) for an excellent review of the expansionist (neo-classical economic) and steady-state (ecological economic) view of development.

[145] In general, ecological economists, especially those focusing on steady-state economics, are concerned with the size of the economy relative to the ecosystem. The efficient allocation of resources is a concern, but it is not the primary focus as in neoclassical economics.

technological feasible. Thus, there is a theoretical maximum size (an ecological carrying capacity) at which a steady-state economy may exist.

To help describe the SSE, Daly (1991) compares it to a steady-state library, where the addition of a new book would mean the removal of an old book. Thus, while the quantitative physical scale remains constant, the library would continue to improve in a qualitative sense. In this regard, Daly's view of the necessary technological fixes to environmental degradation is more conservative than Solow's. Rather than continuing business as usual and investing in future alternatives, Daly's focus is to develop new science/technology that reduces the environmental burden to rates within ecosystem limits and also extends human lives. Both viewpoints are quite different and represent contrasting views of the role that technology plays in development.

2.4.1 Technological Optimism

During the emergence of sustainable development, the environmental discourse was strongest between the technological optimists[146] on one side, and the self-proclaimed Malthusians on the other who could foresee no technological solution to the pending problems of pollution and scarcity (Krier and Gillette 1985). The technological optimists, while concerned about the environment, believed that human scientific and technological ingenuity would be able to extend any limits faced by society.

As discussed in Section 2.3, the growth of new (and successful) technology tends to follow an S-curve. Therefore, if we consider the entire field of technological advance, it follows that it will be composed of a series of such curves. The question is, however, what shape will this series of S-curves follow? Technological optimists' responded to this question by arguing that technological innovation will 'continue' to advance at an exponential rate, thereby establishing a world of utopia as opposed to disaster (Boyd 1972; Kaysen 1972; Starr and Rudman 1973). Others, however, were not so convinced (Arrow 1969). Indeed, as Krier and Gillette (1985) argue, if the S-curve holds for a single technology, why should it not be true for a set of technologies (Figure 2.10)? And, if it holds for a set, should it not also be true for the entire field of technology? Thus, if we are experiencing rapid growth in technological performance, it might simply be due to the fact that we are in the center of a series of S-curves that together also form an S-curve (Figure 2.10).

[146] Krier and Gillette (1985, p. 406) describe technological optimism as "*a term of art, an article of faith, and a theory of politics.*" They argue that technological optimism obtained its precise meaning as a result of the *Limits to Growth* model, which assumed that factors such as population, industrial production, and pollution would continue to grow exponentially. Thus, it follows that the position of a technological optimist is "*that **exponential technological** growth will allow us to expand resources ahead of exponentially increasing demands. This is the precise meaning of technological optimism as a term of art*" (ibid, p. 408). There is also the implicit assumption that technological innovation will not cause any further pollution or social problems.

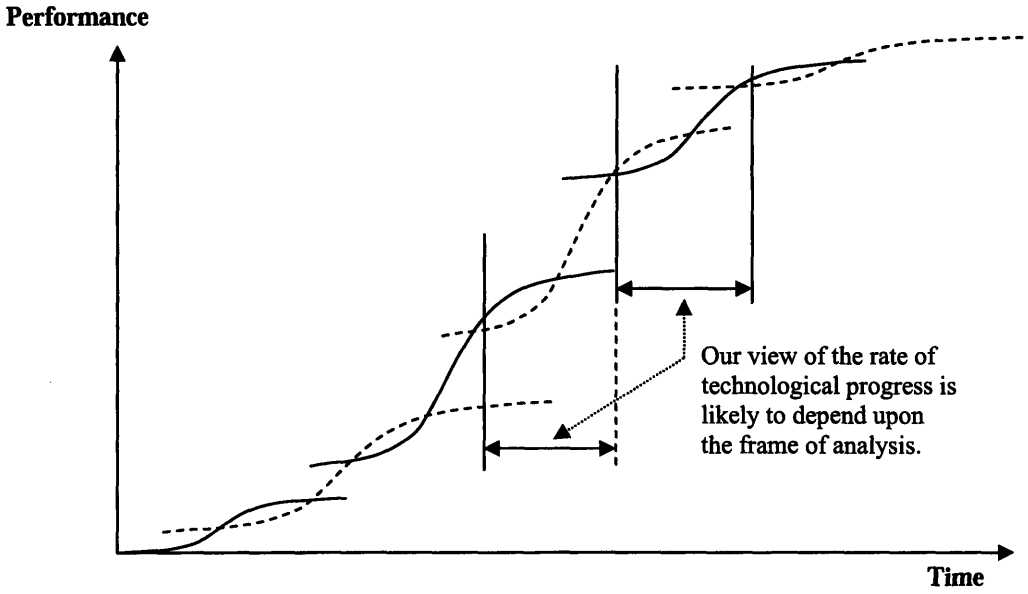


Figure 2.10: The Accumulation of S-curves for a Technology Set

The problem with this type of debate, as recognized by Krier and Gillette (1985), is that the assertions made are most likely to be unprovable. While it is possible to assess individual technologies, it is extremely difficult to assess (in any rigorous manner) whether technology as a whole is progressing at a faster or slower rate than before and whether or not this means we are reaching a plateau in performance (however 'performance' is defined).

With the publication of the World Commission on Environment and Development's (WCED's) report, *Our Common Future* (WCED 1987), it was clear to many that technological optimism had prevailed (Moser 1999). The WCED had chosen science and technological innovation - two mainstays of economic growth in industrial (expansionist) societies - as central pillars to the notion of sustainable development.[147] As Dryzek (1997, p. 136) notes, the concept of sustainable development would surely have been lost "*unless it could be demonstrated that environmental conservation were obviously good for business profitability and economic growth everywhere, not just that these competing values can be reconciled.*"

[147] A retrospective analysis of *Our Common Future* concluded that the economic and environmental objectives put forward by the Brundtland Commission "*cannot be achieved simultaneously*" (Duchin and Lange 1994, p. 8). To address this problem, Duchin and Lange (1994) put forward two paths of action. First, much broader technological and social changes are needed than those espoused in *Our Common Future* if sustainable development is to be brought within reach. Second, 'development economics' (which includes factors such as international lending and advisory practices) need to focus on specific situations and move away from the conviction that there is only one development path - that of liberalized markets which situate all factors of production in the most privately profitable location for their exploitation. Duchin and Lange (1994) argue that a failure to consider national circumstances is likely to affect traditional social relationships in a way that (indirectly) leads to the rise of "*both religious fundamentalism and urban misery in the developing world*" (ibid, p. 9).

As a result of the decision to focus more heavily on science and technology - as opposed to market reforms and/or government policy to guide development - there has been a strong (European and Japanese) research interest in what has been termed 'factor X' (Reijnders 1998). The idea of factor X is similar to that of dematerialization, eco-efficiency, and enhanced natural resource productivity, but whereas these measures of environmental impact tend to be more open ended, the factor X debate attempts to put an exact number on the level of efficiency to be achieved (ibid, p. 14). This willingness to quantify implies that (1) the environmental problem is in fact quantifiable, and (2) that technological improvements are required beyond what current technology is able to achieve.[148] The current set of factor X values range from 4 to 50 (Factor 10 Club 1995; 1997; Jansen and Vergragt 1992; Reijnders 1996; Von Weiszacker et al. 1997); however, there is no overall agreement on the environmental impact to which factor X relates (Reijnders 1998). This fact, combined with differences in the perceived severity of the environmental threat, explains the wide range of factor X values.

It is helpful to connect the factor X debate to the "I=PAT" formula since they are closely interlinked. The factor X approach is clearly a technologically optimistic view of development. But technology is only one factor that affects the environment. It is quite plausible that the environmental benefits achieved by technological innovation will be subsumed by growth in population and/or affluence (Herman et al. 1989; Reijnders 1998; Sachs 1993).[149] In addition, there is also the problem that while technological improvements increase the efficiency with which resources are used, the total consumption of these resources might increase rather than decrease. This phenomenon is known as the *rebound effect* (Berkhout et al. 2000) or the *Jevons Paradox* (Clark and Foster 2001; Jevons 1965 [1865]; 2001). William Stanley Jevons was a 19th century economist who observed that efficiency gains in the use of coal did not necessarily lead to a reduction in its overall use.[150] More recently it has been observed that increases in the fuel efficiency of vehicles have been accompanied by an increase in VMT (vehicle-

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[148] It is important to recognize that while the notion of a 'factor X' economy recognizes the inherent unsustainability of prevailing human activities, its proponents' conceptualization of development remains firmly grounded in the "*growth ethic and technological fix paradigm*" (Rees 1995, p. 355). An alternative view of development is based upon the idea of a steady-state economy (SSE), whereby economic (human) activity remains within fixed ecological limits.

[149] Here we should recognize that whereas the connection between *population* growth and ecological decline is widely understood, the same cannot be said for increasing levels of *affluence* and consumption and their associated impacts on the environment. Indeed, consumption "*is almost universally seen as good, ... increasing it is the primary goal of national economic policy*" (Durning 1994, p. 41). While the environmental and psychological problems associated with consumption are well documented (de Graff et al. 2002; Princen et al. 2002; Schlosser 2002; Kasser 2002; Goodwin et al. 1997; Ryan and Durning 1997; Stern et al. 1997; and Durning 1994; 1992), they have yet to gain traction in mainstream political and economic decision-making. For an insightful debate on the effects of economic growth and consumption on the environment, see Sagoff's (1997) article in *The Atlantic Monthly* and its rebuttal by Ehrlich et al. (1997).

[150] Jevons (2001) observed that the consumption of coal in England increased significantly when the efficiency of the steam engine was improved by James Watt. Watt's innovations, the condenser and the expansive mode of working, reduced the amount of coal needed to fuel the steam engine's furnace, making the engine a cost effective power source that was soon adopted by industry. As the number of industries using steam engines grew, so too did the amount of coal required to fuel these engines, thereby increasing the overall usage of coal.

miles traveled) and by an increase in sales of larger vehicles (Goldberg 1998). Therefore, the implementation of factor X (or highly efficient) technology needs to be a part of a more comprehensive process of environmental improvement or *ecological modernization* (Ashford et al. 1985; Kemp 1995; York et al. 2003).

When considering factor X targets, it is possible to focus on individual products/technologies or the economy as a whole. While factor X advocates support the notion of setting informed and modifiable targets, it is recognized that the pace of rapid technological change [and the presence of the Jevons Paradox] complicate the management of such a schema (Reijnders 1998). In this regard, *movement in the right direction* might provide an alternative. However, the problem here is what instrument will be used to encourage such movement. Examples of types of mechanisms that can be used to encourage the adoption of factor X technology are demonstration projects (for social learning), government-driven technology forcing (using legislation), financial incentives, ecotaxation,[151] and market mechanisms (such as tradable emissions permits) (Reijnders 1998). The role of government in stimulating technological change is discussed in Section 4.2.3.

2.5 Technological Change and Globalization

> "*I have no doubt that it is possible to give a new direction to technological development, a direction that shall lead it back to the real needs of man, and that also means: to the actual size of man. Man is small, and, therefore, small is beautiful*" (Schumacher 1999, p. 131).

The discussion to this point has been concerned with how rapid technological change has altered the equations of balance between humans and nature, and how ecological limits are increasingly being put under pressure. The focus has primarily been on the social and environmental impacts of technology *within nations*.[152] Here, the discussion begins from the premise that globalization (including both international communications and commerce) is an additional underlying force of change. More specifically, it looks at how technological change *and* globalization might affect development in the North and in the South. Technological change and globalization are conceived as drivers of change *within* and *between* three operationally-important dimensions of sustainable development (Figure 2.11).

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[151] See Green Innovations Inc., information on *Ecotaxation*, http://www.green-innovations.asn.au/ecotax.htm (accessed on 04/08/06).

[152] During the 1980s, the most salient example of human society living outside of its ecological means can be found in Sub-Saharan Africa. Long before the problem of global climate change had been recognized, Sub-Saharan Africa experienced periods of rapid growth with no consideration (or banking) for harder conditions in the future, and in future years when a prolonged drought struck, the result was mass starvation. The cause of the crisis was perceived to be 'natural variation' in the weather. Less than a decade later, it was as if global climate change was waiting in the wings to be formulated as an "ecological issue" as opposed to a "natural variation." It now seems that industrialized societies exceeded the limits of natural variations in the climate long before they linked them to ecological damage.

It is possible to consider the impact of rapid technological change and globalization through four broad lenses - [1] industrial globalization, [2] the international division of labor, [3] the creation of purchasing power, and [4] technology-enabled capital mobility. While it is recognized that technological innovations in products, services, and industrial processes can enhance our quality of life, these innovations can also bring with them social and environmental consequences. It is these consequences that are discussed in this section.[153]

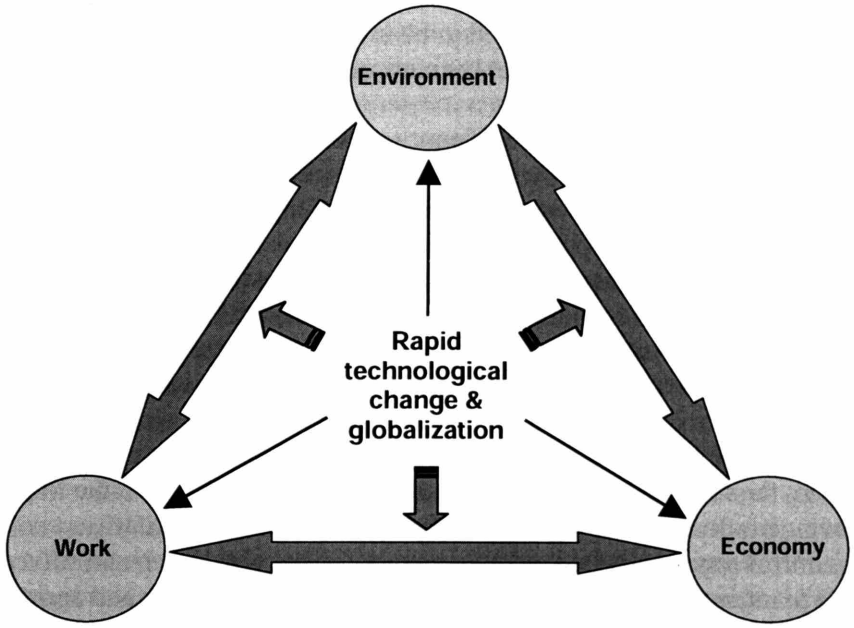

Figure 2.11: Rapid Technological Change and Globalization as Drivers of Change within and between Three Operationally-important Dimensions of Sustainability

When technology is transferred between nations, both the positive and negative aspects of the technology are transferred with the equipment and products. If the receiving nation's ability to control the new technology or industrial processes is limited, then what might well be an environmentally sound technology in an industrialized nation can become environmentally destructive if used in an uncontrolled manner.

Under the first lens listed above, it is possible to identify three main types of industrial globalization - *Internationalization*, *Multi-nationalization*, and *Transnationalization* (Gordon 1995)[154] - the first two of which can lead to the environmental degradation

[153] While the 'sustainability triangle' is often defined as economy, environment, and equity (the Three E's of sustainability), here it is understood that considerations of 'equity' occur in each corner of the triangle. Thus, equity is replaced with employment since technological change and globalization have direct implications on employment in both developed and developing nations. In addition, if we are to meet the basic human needs for food, clothing, shelter, etc., the only practical way to do this is to satisfy the basic need for a livelihood (employment).

[154] For an insightful (early) discussion of how competition in global industries drives the geographic configuration and coordination activities of firms/industries, see Porter (1986).

mentioned above. First, *internationalization* is the expansion of product/service markets abroad, facilitated by information and communication technology (ICT) and e-commerce with the locus of production remaining within the parent country. Technology, or products, that are produced in industrial nations and exported overseas can introduce new problems or worsen existing problems in the importing nation. For example, the sale of pesticides to a nation that previously had never used such chemicals can lead to negative environmental and human health impacts. These problems are exacerbated by improper, or uncontrolled, use that can occur as a result of inadequate training or monitoring. Of course, the impacts of such products need to be considered against the predicted conditions that would exist had they not been introduced.

Second, *multi-nationalization* is where a (multi-national) company establishes production/service facilities abroad to be nearer to foreign markets and/or to take advantage of more industry-friendly labor, environmental, and tax policies while maintaining research-and-development (R&D) and innovation-centered activities in the parent country. In this situation, the parent company is no longer *sending* products overseas, but is *manufacturing* or *assembling* its products overseas. An example of where such an operation had devastating consequences to society in the recipient nation was the Bhopal incident in India. A leak of deadly intermediate methyl isocyanate at a Union Carbide pesticide plant killed some four thousand people and affected the health of thousands more in the city of Bhopal. While Union Carbide batch processing plants in the U.S. are subject to strict health and safety and environmental controls, the Madhya Pradesh province in India did not have the capacity to deploy a similar monitoring/control regime. Indeed, it has been argued that the health and safety violations at the Bhopal plant were overlooked in the name of industrialization and agricultural self-sufficiency.[155] In this case the problem was not due to the sale of products or equipment, but the transfer of manufacturing capacity. The more industrial globalization that occurs in this second category, the more concerned we should become since the impacts on other nations can be extensive.

Benton and Redclift (1994) present another way to consider the second type of industrial globalization by discussing how the spatial relocation of the Japanese car manufacturing industry has led to both positive and negative environmental impacts. On the one hand the relocation of car manufacturing plants in other nations is seen to have reduced the environmental pollution problem in Tokyo. On the other hand, the creation of new consumer markets for Japanese cars is seen to have increased the per capita consumption of energy and material at the global level, with a corresponding increase in the amounts of total pollution and waste. Benton and Redclift (1994) argue that this second type of industrial globalization has the effect of redistributing environmental costs and benefits.

The third type of industrial globalization is the creation of strategic alliances (Gordon 1995; Mowery and Rosenberg 1989), what some call *transnationalization*, in which two different foreign enterprises merge/share their R&D and other capabilities to create a new entity or product line, reduce expenditures, and open up new markets. A good example of

[155] Source: Lopatin, J. (2004) *Environmental Justice Case Study: Union Carbide Gas Release in Bhopal, India*, http://www.umich.edu/%7Esnre492/lopatin.html (accessed on 04/08/06).

a strategic alliance is the Daimler-Chrysler merger, where different technological capacities were combined to create a whole that is seen to be greater and more efficient than the sum of its parts. This form of industrial globalization is not as common as the first two and is most likely to occur between developed nations as opposed to between developed and developing nations.

The second lens of technological change and globalization focuses on how technology can affect the international division of labor.[156] With the advent of the global communication network, it has been possible for companies to outsource jobs, such as those of programmers and telephone operators, to firms in other nations with seemingly little difficulty. These actions are changing the equation for the international division of labor. For example, in 2003, A.T. Kearney predicted that U.S. financial services firms were likely to relocate more than 500,000 jobs (8% of the workforce) in other nations over a five year period (Benjamin and Perry 2003; Lee 2003). Those jobs most likely to be relocated offshore are those that do not require any face-to-face contact. In addition, the global spread of communication technology is mirrored by a reduction in the scale and power of 'traditional' trade unions (Munck 2002). This trend has led trade unions to consider ways of reinventing themselves. It seems their future now lies in finding ways to pull together workers with common interests from a diffuse global labor network that transcends national boundaries (ibid).

Another factor affecting the international division of labor is the second type of industrial globalization (multi-nationalization) in which assembly plants are constructed outside of a company's home nation. In general, the purpose of relocating manufacturing plants from developed to developing nations is to open up new markets and to take advantage of lower production and wage costs and a more relaxed legislative environment. As more production capacity is built in low-wage countries, manufacturing companies in industrialized nations employing unskilled and semi-skilled labor face growing competition. In a global economy where trade barriers are being removed, the displacement of manufacturing jobs in developed nations is a real concern (Bosch 1996).

In addition, the formation of a knowledge-based society and the development of supporting technologies add a new dimension to these problems. A knowledge-based society reduces the need for unskilled or semi-skilled workers in developed nations - who form the largest proportion of the working population - and increase the importance of a well-trained and educated labor force (Drucker 1994; Levy and Murnane 2004; Miller 1995).[157] In effect, a large amount of unskilled labor is being replaced by (computer-

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[156] See Freeman (2003) for an insightful discussion of 'The World of Work in the New Millennium.' In addition to discussing such factors as the feminization of work and the shift in the world labor force to less developed countries, Freeman argues that the rapid growth of computers and information-communication technology are important factors shaping the nature of employment, particularly in developed nations.

[157] In *New Divisions of Labor*, Levy and Murnane (2004, p. 54) argue that the introduction of the computer has raised the demand for people who are able to perform jobs requiring expert thinking and complex communication - i.e., "*tasks that computers cannot do.*" It follows that those jobs which consist of routine cognitive and manual work are susceptible to being displaced by computer programs and advances in computerization only increase the likelihood of such substitution. Levy and Murnane (2004, p. 9) define expert thinking as "*solving new problems for which there are no routine solutions,*" and complex

powered) technology that requires a smaller amount of skilled labor to maintain and operate (Rifkin 1995). These skilled laborers are what Drucker (1994) refers to as the *technologists*. The growing differential in wages between educated/skilled workers and unskilled workers and the higher unemployment rates in the latter group all point to the formation of a knowledge-based society and the reduction of manufacturing (and now servicing-producing) capacity (Firebaugh 2003; Miller 1995).

For developing nations, the emergence of technology-enabled, knowledge-based societies is widening the educational/informational gap, extending the digital divide.[158] In addition, the problem of high unemployment is worsened by the fact that over the next 50 years, the vast majority of population growth is predicted to occur in urban areas in developing nations (UNPD 2003). The constant flow of new entrants into the labor force in these countries is likely to result in 'jobless growth,' meaning that the rise in unemployment is a structural phenomenon (Miller 1995). In this situation it seems the formation of high-tech industries in developing nations will only be sustained if a reliable stream of well-educated workers can be established. Yet, the provision of basic education is a luxury for the vast majority who struggle daily against the poverty trap. In addition, even if an adequate supply of educated workers could be provided, it has been argued that the sheer scale of technology-displaced workers is likely to overshadow any growth in high-tech industries.

> "*In the past, when new technologies have replaced workers in a given sector, new sectors have always emerged to absorb the displaced laborers. Today, all three of the traditional sectors of the economy - agriculture, manufacturing, and service - are experiencing technological displacement, forcing millions onto the unemployment rolls. The only new sector emerging is the knowledge sector, made up of a small elite of entrepreneurs, scientists, technicians, computer programmers, professionals, educators, and consultants. While this sector is growing, it is not expected to absorb more than a fraction of the hundreds of millions who will be eliminated in the next several decades in the wake of*

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communication as "*persuading, explaining, and in other ways conveying a particular interpretation of information.*" In both cases, computers provide an essential support function, but are unable to replace a human's ability to think creatively in difficult and unpredictable circumstances. The "*ability to develop, produce, and market new products relies on the human ability to manage and solve analytical problems and communicate new information, and so it keeps expert thinking and complex communication in strong demand*" (ibid, p. 54). The objective of Levy and Murnane's (2004) work is to outline what constitutes a good, well paid job in a rapidly computerizing economy. See the Economist (2004) for a discussion of how computers have changed the nature of work.

[158] Norris (2001) describes how the Internet is creating a global information divide between industrialized nations and developing societies, a social divide between the information-rich and the information-poor within nations, and a democratic divide between individuals that do and do not have access to the Internet for political purposes. It is estimated that some 429 million people (6% of the world's population) use the Internet - of which 41% live in the U.S.; 27% live in Europe, the Middle East, and Africa; 20% live in the Asia Pacific; and 4% live in South America. Source: Neilsen/Netratings, *First Quarter 2001 Global Internet Trends*, http://www.netratings.com/ (accessed on 04/08/06). Also, see Compaine (2001) for an insightful discussion of the digital divide discourse, from those who believe that societies without access to the Internet are at a social and economic disadvantage, to those who argue it is a non-issue and the digital divide is rapidly closing without government intervention.

revolutionary advances in the information and communication sciences" (Rifkin 1995, pp. xvi-xvii).

However, there are those who question whether the predicted technological changes will result in the formation of a 'jobless economy' due to an increasing demand for highly-skilled and trained workers (Drucker 1954; Levy and Murnane 2004; Simon 1960). Again, the problem with these more optimistic views is the failure to address the fact that the level of education required for high-technology jobs is likely to be unattainable for the vast majority of people in developing nations. Education aside, the impact that rapid technological change in industrialized (or information-based) nations is having on developing nations is put quite succinctly by Miller (1995). "*Rapid changes are stressful enough, but when the spearheading technologies are 'high-tech', labour-saving and involve extremely mobile intangible assets, the social impact is magnified. Unable to keep up with the rapidly and profoundly changing nature of technology, most developing countries are falling further and further behind the industrialized nations in the acquisition and deployment of these technologies that are opening the way to new modes of production, distribution and, in effect, new modes of economic and social life*" (Miller 1995, p. 128).[159]

Given that reducing inequality is central to achieving sustainable development, understanding how rapid technological change and globalization can affect the international division of labor is of critical importance. While it seems that workers with transferable (advanced technology-related) skills and a high level of education are well positioned in the international economy, workers with a less flexible skill-set and a lower level of education - which includes the vast majority of people in the world - appear most at risk to unemployment with every move of the international economy's invisible hand. One potential way to protect labor markets is to "[m]*ove away from the ideology of global economic integration by free trade, free capital mobility, and export-led growth and toward a more nationalist orientation that seeks to develop domestic production for internal markets as the first option, having recourse to international trade only when clearly much more efficient*" (Daly 1994a, p. 187). Such a strategy would put the control of a country's labor markets in the hands of the national government and industry, avoiding pressures to lower standards and wages and externalize environmental and social costs, which are some of the perils of global economic integration (Daly 1993).

[159] In Section 2.3, the major emerging technologies and growth sectors are presented from 1770 to 2050. During these three centuries, the agricultural societies (in the now developed nations) transformed themselves into industrial societies and are currently in the midst of a new transformation into post-industrial, or information-based, societies (Castells 1999; Drucker 1994). The rate of change in these nations is placing significant pressure on developing nations that by and large remain agricultural societies in a state of transformation. While nations such as Malaysia, South Africa, and Brazil are progressing along the industrialization pathway, a significant number of people in developing nations rely either on subsistence farming for their survival or are migrating to cities in search of unskilled or low-skilled (in a technological sense) employment.

The third lens of technological change and globalization focuses on how technology facilitates the creation of purchasing power throughout the world.[160] The transfer and diffusion of technology from industrialized to developing nations is creating a new working and purchasing class, reducing income inequality between these nations (Firebaugh 2003). If purchasing power is created in areas where people previously lived in poverty, the exporting countries' concern for purchasing power is diminished. In effect, the transfer of excess manufacturing capacity from developed to developing nations is creating employment and providing workers with purchasing power. However, a long-term concern with this model is that it is simply turning developing countries into consumers of Westernized products[161] - a concern that (Daly 1996, pp. 31-44) would likely couch in the notion of 'economic growthmania.' Mehmet (1995, p. 7) provides a radical political critique of the mainstream Western (or European-centered) view of

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[160] In Section 2.1.3, we reviewed the Human Development Index (HDI), which measures the level of development achieved by a nation using three indices - health, education, and income. The HDI, and its recent extensions, do not explicitly consider the impact of technology. However, the HDI does provide a clear indication of the extent of the gap between the purchasing power of rich and poor. For example, almost all of the top twenty nations of the HDI have a GDP per capita that falls between $20,000 - $34,000, whereas the twenty lowest ranked nations have a GDP per capita between $500 - $2,000 (PPP, see Table 2.4). Therefore, even if developing nations experience a significant rate of economic growth, their total relative amount of income would remain substantially lower than that of more developed nations. Even following the adjustment of local currencies to consider purchasing power, significant distributional inequalities remain. If we make the additional observation that today around 1.2 billion people out of the developing world's 4.8 billion people are living on less than $1 a day, and around 2.8 billion people are living on less than $2 a day (World Bank 2002), this provides strong support to Durning's (1992; 1994) argument that just over 1 billion people are part of the market economy (who form the consumer society). The remainder either live on its periphery (around 3 billion), or have no role in the economy (1.2 billion). In addition, while income inequality exists between nations, it is also present within nations. In the U.S., the average weekly earnings of production and non-supervisory workers (when adjusted for inflation) fell by 18 percent between 1973 and 1995 (Head 1996). In contrast, the average weekly earnings of chief executives increased by 19 percent (and by 66 percent after taxes) between 1979 and 1989 (ibid). Statistics such as these have broad societal implications, and are linked to growth in property and violent crimes and an increase in prison populations (Dilulio 1996; Freeman 1996b). It is in this context that the implications of rapid technological change and globalization should be considered.

[161] Redclift (1992) argues that the global agenda is dominated by the industrial globalization plans of the North. Using the wisdom of conventional economic development, industrialized nations see developing nations as a growth market for goods and services (Benton and Redclift 1994). By instilling production capacity in developing nations the purchasing power of those employed increases, enabling them to enjoy many of the products and services widely available in the North. However, the problem with this agenda of development is that the world's resources are insufficient to perpetuate the Western lifestyle throughout the world (Wilson 2002). While technological innovation can extend the availability of resources, the new limits to growth appear to be not resource limits, but limits in the ability of sinks to absorb the externalities (i.e., pollution) from economic growth (Meadows et al. 1992; 2004). Therefore, simply relocating manufacturing plants from developed to developing nations without any significant improvements in environmental performance is clearly not sustainable development. While considerations of whole life cycle impacts of products/services and the introduction of factor X technology can lead to more sustainable forms of development, this does not address the question of whether the 'developed nation' model is what developing nations should be following. With such powerful economic and political forces behind industrial globalization, establishing a viable alternative seems extremely difficult. A more fruitful option might be to search for radically different forms of industrial globalization that can operate within ecological limits and better suit the different needs of societies throughout the world. Sadly, the formation of new forms of technology-enabled development is likely to be hampered by the fourth lens of technological change and globalization - technology-enabled financial capital mobility.

development economics (e.g., trickle down theory), which he argues is not "*culture-friendly and has effectively denied the cultural diversity that exists in non-Western branches of humanity, where group and community rights are often held in higher esteem than individualism, and cooperation rather than competition is prized.*" Mehmet (1995) goes on to argue that international security will not be achieved without sound population polices in developing nations *and* the correction of global inequality generated by development economics that continually concentrate capital ownership in the North and support Northern consumerism. While the alleviation of poverty in developing nations is clearly a desirable goal, Mehmet asks the fundamental question of who the transfer of technology and the opening up of new markets is really benefiting.

The fourth lens of technological change and globalization is technology-enabled financial capital mobility. In a report by the National Research Council's (NRC's) Board on Science, Technology, and Economic Policy (STEP), the structure of the U.S. capital markets was described as causing corporate investment to focus on the short-run.

> "*Relative to those of most other countries, U.S. capital markets exhibit many characteristics that are worth preserving: liquidity, openness, and fairness with respect to investors in public companies, among other characteristics. As a consequence of our regulatory system requiring openness and fairness, however, there are limits to the amount of proprietary information made available by issuers to financial investors. Information about competitively sensitive longer-term strategic investments of the corporation is most likely to be withheld from investors. For this reason and because financial investment managers as fiduciaries are usually judged on a short-term basis, U.S. capital markets tend to bias the evaluation of corporate performance toward the short run. Short-run performance is certainly not an irrelevant criterion; it is simply overemphasized to the neglect of long-term growth, especially in publicly held companies*" (STEP 1994, p. 6).

The shortening of U.S. corporate investment time horizons is leading to low-risk and lower-payoff R&D investment that is seen as a considerable source of competitive disadvantage (NAE 1992; Tassey 1999). Firms focusing on short-term investment horizons tend to emphasize incremental innovations and product-line extensions instead of more risky, long-term, and expensive next-generation (radical) innovations that are likely to be more profitable (Tassey 2003). The creation of the international financial markets has made it possible for an individual (with access to a broker or the Internet) to invest in any market. Therefore, the mobility of financial capital is creating a highly competitive capital market that is reducing the timeframes over which return on investment is demanded to the detriment of more long-term, more sustainable industrialization.

A final point worth mentioning is that global competition in technology (including the establishment of product standards and the notion of technological and organizational innovation) is predominantly shaped by competitive actions between the U.S., Japan, and Western Europe (Ernst and O'Connor 1989). Within this highly competitive environment,

technologies are becoming increasingly reliant upon scientific advances supported by techno-nationalism - i.e., the creation of domestic high-tech industries, and/or the attraction of high-tech foreign firms, to supply the domestic consumption of technology (Gibbons 1990; Weiss 1997). Since the vast majority of developing nations do not have their own high-tech industries, their only option (if they wish to be a part of the global economy) is to import technologies designed for industrialized nations which inevitably shape (or regulate) the actions of their societies (Winner 1977; 1986). The various forms of 'techno-globalization' (the globalization of technology) discussed in this section provide an indication of the extent to which Western technology is becoming an integral part of societies throughout the world. As the techno-economic interdependence between nations increases, the issue of technological dominance arises. As discussed above, the blind adoption of technology or products by developing nations can cause significant economic and social follow-on costs. These costs occur as a result of the inability of host nations to manage the adoption (and potential adaptation) and diffusion of advanced technologies in a way that is safe and fits with the culture of its societies. Thus, the worldwide diffusion of Western technology is creating a global society that is reliant upon technology, the majority of which is designed to meet the needs of industrialized nations but possibly not those of the people in developing nations.

While it is daunting to question the seemingly unstoppable force of technological change and globalization, this is exactly what economist E. F. Schumacher (Schumacher 1999 [1973]) and those present at the UNEP- and UNCTAD-organized *Symposium on Patterns of Resource Use, Environment and Development Strategies* did during the mid 1970s (see Section 3.3.4). Schumacher (1999) believed that the technology of mass production was environmentally destructive and self-defeating, and would not employ the mass populace in developing nations. Instead, he argued for *intermediate technology*, technology that can fill the void between the primitive hand tools and the modern combine harvester and is designed to gainfully employ a vast number of the most deprived people in meaningful work. Today, Schumacher's ideas are put into practice by the Intermediate Technology Development Group (ITDG), which he co-founded in 1965.[162] In the same way that Winner (1977; 1986) calls for a democratic political philosophy to guide the development of technology, the ITDG calls for 'democratising technology' - i.e., the inclusion of people in the decision-making processes that drive science and technology.[163]

At the center of the idea of intermediate technology is the notion of self-reliance. As Max-Neef (1991, pp. 57-58) argues, "[i]*t is only by generating self-reliance, where people assume a leading role in different domains* [from the technological to the cultural] *and spaces* [from the international space to the local space], *that it is possible to promote development processes with synergic effects that satisfy fundamental human needs.*"

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[162] See the Intermediate Technology Development Group (ITDG), http://www.itdg.org/ (accessed on 04/08/06).

[163] In a recent ITDG discussion paper on democratising technology, Wakeford (2004, p. 5) argues that "*technologies only work for people if these people are allowed to play an integral part in the development and application of any new or existing technology. To ensure that environmental sustainability and equal rights for every individual are safeguarded it is essential to combine scientific and technological innovation with democratic processes that encourage the active participation of all groups in society, unrestricted by intellectual property systems.*"

However, self-reliance runs counter to the globalization of high-technology, which is guided by the hands of nation states and corporations. Thus, the challenge facing developed and developing nations is how to make the creation of technology more democratically accountable.

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3 The Emergence of Sustainable Development

The concept of sustainable development obtained international recognition at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. However, it is possible to trace the "modern" environmental movement back to the early 1960s, when developed nations - the U.S. in particular - became increasingly aware that the *local* or *regional* environment was being stressed by rapid industrialization.

This chapter traces the rise of the concept of sustainable development during the twentieth century. It begins with a comprehensive look at the level of national activities designed to protect the environment from 1900 until the late twentieth century. The focus then shifts to the 1960s to identify the main factors which established the national environmental agenda in the U.S. This is followed by a review of the major forces which led the international community to begin to address the combined topic of development and the environment during the 1970s, which laid the foundation for the concept of sustainable development.

Over the past forty years, the *drivers* of sustainable development have incorporated - to varying degrees and at different times - what can now be recognized as four environmentally different concerns.[164] First is the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being. This concern was initially raised in the early 1960s when industrial processes and the use of pesticides led to environmental degradation and a loss of wildlife (Carson 1962), and then again more recently in the context of endocrine disruptors that affect reproductive health in all species (Colburn et al. 1996; Solomon and Schettler 1999). Significant progress has been made on improving industrial and agricultural practices; however, the negative impacts of these sectors still present a problem in both developed and developing countries.[165]

The second concern relates to the world's finite resources and energy supplies, and asks the question of whether there are sufficient resources to fuel the economy in its current form (Georgescu-Roegen 1971; Meadows et al. 1972; Schmidt-Bleek 1992). A corollary concern is what will the environmental impact be from using a significant proportion of the existing resources?[166]

The third concern is that toxic pollution directly affects human health and the health of other species (Ashford and Miller 1998; Chivian et al. 1993; Colburn et al. 1996; 1974; 1979; Commoner 2000; Fagin and Lavelle 1996; Geiser 2001; McCally 1999; Schettler et

[164] In this chapter, the term 'driver' is used to describe the 'motivators' of public concern for the human environment. In the following chapter, the term 'driver' is used to describe the actual 'drivers' of change.
[165] Poor environmental standards and under-resourced or non-existent environmental agencies in developing countries mean that environmental problems from industrial processes and the mechanization of agriculture more frequently go unchecked in these regions.
[166] The related topic of environmental economics is reviewed in Section 4.2.1.

al. 1999). As scientists began to understand how ecosystems, humans, and other organisms were affected by industrial and agricultural processes, the issue of how toxic chemicals interact with biological tissue grew in importance.

The final concern is that greenhouse gases from anthropocentric (human-driven) sources are leading to a disruption of the global climate (Schmidheiny 1992). Scientists predict that these gases will cause the globally averaged surface air temperature to increase 1.4 to 5.6°C by 2100, relative to 1990, and the globally averaged sea level to rise 0.09 to 0.88m by 2100 (IPCC, 2001) with consequent dramatic changes in weather, droughts, and floods.

The first, third, and fourth environmental drivers of sustainable development are connected with the unintended effects of human development/growth while the second driver deals with increasing shortages of resources needed to fuel development/growth.

It is noteworthy that the seeds for each of the four environmental drivers seem to have been planted during the 1960s and 1970s. As mentioned above, the 1960s was the era when the destruction of ecosystems was recognized as a significant problem in the U.S. The other three environmental drivers of sustainable development began to emerge - to varying degrees - during the 1970s. The Stockholm Conference on the Human Environment in 1972 brought the topics of ecosystem integrity, biological diversity, and human health and the issue of ecological and resource limits to growth to the attention of the international community. While the conference did raise the potential problem with toxic substances (in its Action Plan), the third environmental driver of sustainable development remained the focus of national legislation during the 1970s. The passage of the 1976 Toxic Substances Control Act in the U.S. is a prime example. Towards the end of the 1970s, the international community began to discuss the related concerns of ozone depletion and greenhouse gas emissions - the fourth environmental driver of sustainable development. However, it was not until the second half of the 1980s and the 1990s that international action was taken to address ozone depletion and global climate change, respectively.

In the 1980s, chemical toxicity began to be downplayed as the chemical industry itself started to point the finger at climate change as the most important environmental problem, almost to the exclusion of toxicity.[167] The 1980s also marks a turning point when nations began to recognize that their environmental problems extended beyond national boundaries and were having impacts on a global scale. This realization spurred the formation of an international environmental agenda, and the actions taken in the following two decades as a result of this agenda can be considered to be the first attempt at global environmental governance (Speth 2003). Towards the end of the 1980s, the World Commission on Environment and Development (WCED) presented what became the first universally accepted definition of sustainable development.

[167] Personal communication with Nicholas A. Ashford, Massachusetts Institute of Technology, 17 May 2004.

> "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*
>
> - *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
> - *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.*
>
> *Thus the goals of economic and social development must be defined in terms of sustainability in all countries - developed or developing, market-orientated or centrally planned. Interpretations will vary, but must share certain general features and must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it*" (WCED 1987, p. 43).

This definition (commonly known as the Brundtland definition, after Gro Harlem Brundtland, the Commission's Chairman) highlights what has since become one of the major issues of contention with sustainable development. The *interpretation* of sustainable development by one nation might be seen as leading to 'unsustainable' development by another. The ongoing debate between (affluent) developed and (poorer) developing nations is testimony to this fact. Having been forced by society to address the problems of industrialization, developed nations argue that their environmental and worker health and safety standards should guide the development process in developing countries. However, developing countries argue that this approach puts them at a disadvantage with regards to development, and it infringes upon their sovereignty. It also bypasses what they see as the bigger problem of over-consumption by the North. Another argument put forward by developed countries is that the creation of a global market will facilitate economic growth, raising the level of wealth within a nation and enabling it to invest (later) in solving the environmental problems associated with development. Developing nations counter this assertion by stating that there has been little evidence that such an approach to development works and that the environmental damage that does occur might well be irreversible. Table 3.1 presents a simplified summary of these types of positions. This chapter explores the above arguments and looks at how the international agenda for the environment and development was established and then transformed into the sustainable development agenda of today.

Table 3.1: Some Contributions and Dangers to Sustainable Development in Developed and Developing Nations

Global position	Contributions to Sustainable Development	Dangers to Sustainable Development
Developed Nations	Technological and managerial capacity; Frameworks for protecting the environment and worker health and safety	Over-consumption; Alienation; Meaninglessness
Developing Nations	Cultural heritage of needs centered living; Community empowerment; Connection to nature	Population growth; Rising expectations

Source: Adapted from Cock (2002, p.186).

As the following sections explore the history of the modern environmental movement, it should become clear that different environmental groups *and* nations have given different priorities to the four major issues discussed above. Hence, political agendas are almost always focused on one or two of the four major environmental concerns to the exclusion of the others. Such a non-integrated planning approach means that nation states and the international community have only been able to create partial solutions to growing environmental problems.[168] This situation is further exacerbated by the fact that each nation is at a different level of development and therefore has different needs, resulting in different political agendas. In addition, even if two nations are alike from a development perspective, their values and beliefs might lead to disagreement over what constitutes an *appropriate* solution.

The following sections attempt to provide an overview of the events that propelled the modern environmental movement into action. While the text presents only a summary of these events, it captures key issues and problems which have shaped our understanding of the concept of sustainable development.

3.1 The Rise of National Activities to Protect the Natural Environment during the Twentieth Century

Before focusing on what is known as the 'modern' environmental movement, it is useful to look at the national environmental initiatives that took place during the twentieth century. This expansive view shows that national and international concern for the environment can be traced back to the early to mid 1900s.

The rationale behind national environmental initiatives has traditionally been connected to the environmental impacts of industrialization and an increase in individual affluence combined with a growing desire for a better quality of life (Speth 2002). This bottom-up

[168] Indeed all 'environmental' problems are related. Large transformations of materials and use of energy create resource shortages and toxic pollution, which leads to climate change and the destruction of ecosystems and biodiversity.

model of environmentalism will be used in Section 3.2.1 to look at the drivers behind the growth of national environmental activities in the U.S. However, using the argument that the 'nation-state' has a basic responsibility for environmental protection, Frank et al. (2000) present a top-down analysis of the growth of environmentalism during the twentieth century. Their model is based upon three main arguments. First, the "*blueprints for the nation-state are drawn in world society*" (ibid, p. 100), meaning that the rules or definitions that determine what a nation can do and how it relates to other entities are defined by the international community. Second, these blueprints have, over time, identified environmental protection as a basic responsibility of the nation-state. Finally, the rate at which these blueprints diffuse throughout the international community is connected to how closely each nation-state is linked to the world society.

Using five indicators,[169] Frank et al. (2000) show that the environmental movement experienced rapid growth between 1900 and 1987 (Figure 3.1). In particular, notable activity occurred after the formation of the United Nations (UN) in 1945 and the creation of the U.S. Environmental Protection Agency (EPA) in 1970 and the UN Environment Programme (UNEP) in 1972. Interestingly, the creation of the EPA and the UNEP marks the point when the focus on national environmental concerns widened to consider an international concern for the global environment. However, during the 1970s and 1980s, nation states continued to focus their attention on creating institutions and laws to administer their own national environmental agendas.[170] In addition, nation states had yet to synthesize and integrate environment and development issues, which occurred in the early 1990s.[171] Figure 3.1 supports the theory that the role of the nation state is influenced by world society since there is a clear increase in national environmental activity before the 'environment' was recognized as needing protection during the 1960s. Frank et al. (2000) state that increasing environmental degradation and affluence (the bottom-up model) does not support the early rise in national environmental activities since these actions occurred in a wide range of countries - not just in developed nations. Hence, "*nation-states are enactors of wider world cultural institutions*" (ibid, p. 99).

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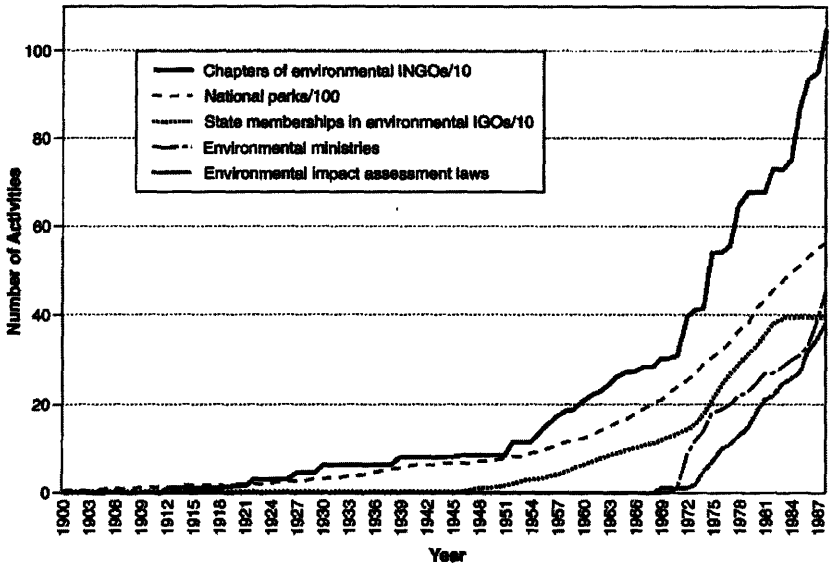
[169] The five environmental indicators are: [1] the number of chapters of environmental international non-governmental organizations (INGOs) - e.g., the World Wildlife Fund - created each year; [2] the *cumulative* number of national parks - e.g., the Grand Canyon and Yosemite in the U.S., the Cape Peninsula in South Africa, etc.; [3] the state membership of environmental intergovernmental organizations (IGOs) - e.g., the International Whaling Commission; [4] the number of national environmental ministries created each year; and [5] the number of environmental impact assessment laws created each year (Frank et al. 2000).

[170] While the formation of these institutions and laws was seen as a positive step by environmentalists, McCormick (1995) cites three main reasons why the environmental initiatives were rarely sufficient to manage the environmental problems occurring. "*First, the environment as a policy issue proved almost impossible to compartmentalise. ... Second, the creation of new departments often caused conflict with existing departments unwilling to give up their powers, resulting all too often in new agencies with mismatched, inadequate, or incomplete duties, or with much responsibility but little power. ... Third, many new agencies lacked adequate human, technical and financial resources; they tended to be junior members of government, their directors often had to operate at middle levels without access to senior policy-makers, and the monitoring and enforcement of legislation varied from close control to none at all*" (McCormick 1995, p. 156).

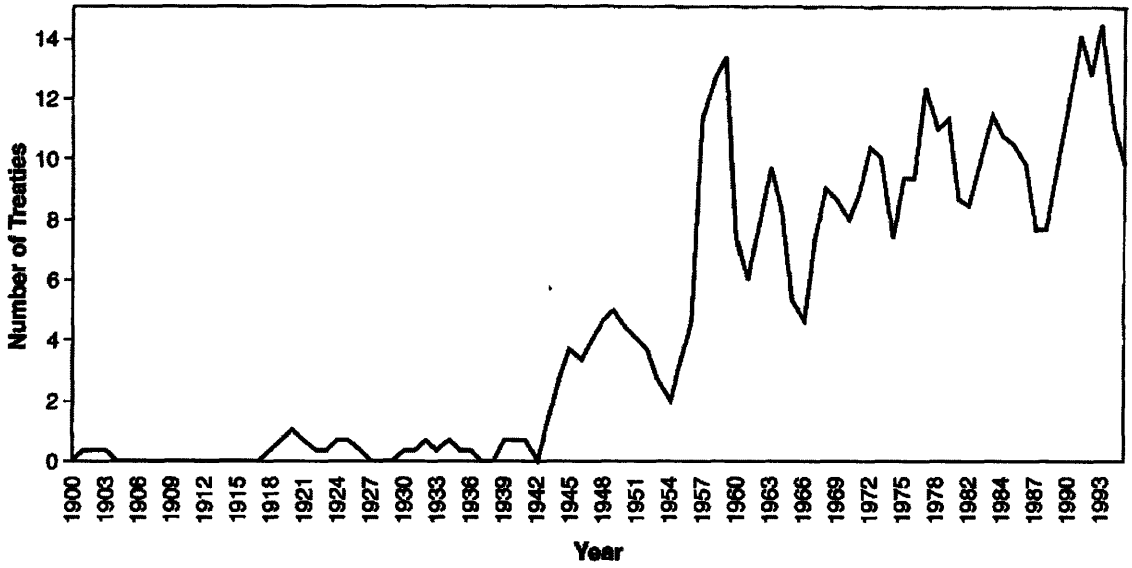
[171] The following section looks at development in an international context. It defines what could be called the "conventional development" model and discusses how this model transitioned to the concept of "sustainable development" in the early 1990s.

Similarly, Frank et al. (2000) present a plot of the number of environmental treaties that were established between 1900 and 1993 (Figure 3.2). This plot indicates that the global environmental regime started to gather momentum in 1945 and has been established since the 1960s. The focus on treaties is due to their "*universalism*," (i.e., they have been created by "*disinterested professionals*" and "*unbiased experts*" and therefore can be applied universally without consideration of domestic circumstances) (ibid, p. 100). Hence, these environmental treaties form an important part of the blueprints for nation-states, supporting the idea of a top-down model of environmentalism.



Legend: INGOs - International Non-Governmental Organizations;
IGOs - Intergovernmental Organizations.
Source: Frank et al. (2000, p. 98).

Figure 3.1: Cumulative Numbers of Five National Environmental Activities - 1900 to 1987



Source: Frank et al. (2000, p. 100), from Burhenne (1997).
The graph presents a three-year moving average.

Figure 3.2: Annual Foundings of International Environmental Treaties - 1900 to 1995

3.1.1 The Transition from Conventional Development to Sustainable Development

While focusing on the larger picture of national environmental initiatives, it is also useful to put these events into the context of national 'development.' The previous section shows how national environmental activities grew exponentially between 1900 and 1987, but it was not until the United Nations Conference on Environment and Development (UNCED) in 1992 that a concerted effort was made by the international community to integrate environment and development issues. Until this point, environmental degradation was acknowledged as an unfortunate side effect of industrial expansion (or economic development/growth) and environmental initiatives focused on mitigating harm as opposed to rethinking the process of development.

Dernbach (1998; 2004) argues that since the concept of sustainable development modifies the international [top-down] approach to development, we need to understand the latter term more broadly if sustainable development is to be used as a framework for national governance. In particular, he suggests that during the past half-century, the international community has viewed the notion of development as incorporating at least four related concepts: [1] peace and security; [2] economic development; [3] social development; and [4] national governance that secures peace and development. These four concepts form what Dernbach calls "*conventional development*" (Dernbach 1998, p. 24). Table 3.2 shows how each concept is reflected by major multilateral treaties and/or through international institutions, which "*provide a common framework for relations among sovereign nations as well as a shared set of national purposes*" (ibid, p. 9).

Table 3.2: The Four Concepts of the Conventional Development Model [172]

Development Concept	Comments
Peace and Security	The international recognition of the need for peace and security began with the formation of the United Nations (UN) following World War II in 1945.[173] In addition, a growing number of multilateral and bilateral agreements have been established to limit the use and spread of certain weapons and weapons systems. Examples of such treaties include the 1997 Treaty Banning the Use, Production, Stockpiling, and Transfer of Antipersonnel Landmines,[174] and the Nuclear Non-proliferation Treaty,[175] first signed in 1968.
Economic Development	Arguably, economic development is seen by nation states and the international community as being the most important component of development. While trade and economic growth have been a driver of development for centuries, the international community's focus on economic development was established with the formation of several important financial institutions following World War II. Some of the most influential institutions include: the International Bank for Reconstruction and Development (known as the World Bank),[176] conceived in 1944 at Bretton Woods, New Hampshire to rebuild the economies of Europe and to encourage development in developing countries; the 1947 General Agreement on Tariffs and Trade (GATT),[177] designed to remove barriers to trade; the UN Development Programme,[178] established in 1965 to promote the economic and social advancement of all peoples; and the International Monetary Fund (IMF),[179] created to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty.

[172] See Dernbach (1998), pp. 9-14.
[173] See the *Charter of the United Nations*, http://www.un.org/aboutun/charter/index.html (accessed on 04/08/06).
[174] See the *Ottawa Convention* banning landmines, http://www.icbl.org/treaty (accessed on 04/08/06).
[175] See the *Treaty on the Non-Proliferation of Nuclear Weapons*, http://www.fas.org/nuke/control/npt/text/npt2.htm (accessed on 04/08/06).
[176] See World Bank Group, http://www.worldbank.org/ (accessed on 04/08/06).
[177] See *General Agreement on Tariffs and Trade (GATT)*, http://www.ciesin.org/TG/PI/TRADE/gatt.html (accessed on 04/08/06).
[178] See the United Nations Development Programme (UNDP), http://www.undp.org/ (accessed on 04/08/06).
[179] See the International Monetary Fund (IMF), http://www.imf.org/ (accessed on 04/08/06).

Development Concept	Comments
Social Development	The concept of social development is most closely linked to 'human rights.' For example, in addition to promoting "*higher standards of living, full employment, and conditions of economic and* ***social progress*** *and development,*" the UN Charter requires the organization to identify and promote solutions to "*international economic, social, health, and related problems*" and to promote "*universal respect for, and observance of,* ***human rights and fundamental freedoms for all***" (emphasis added).[180] In addition, landmark treaties such as the International Covenant on Civil and Political Rights[181] and the International Covenant on Economic, Social, and Cultural Rights,[182] both of which were signed in 1966, have established an international regime which nurtures social development and condemns acts which intrude upon an individual's rights and freedoms. [Note: The international formulation of 'human rights' builds upon the much earlier and broader conception of 'social justice' used by the International Labour Organization in the 1944 Declaration of Philadelphia (Bartolomei de la Cruz et al. 1996).][183]
National Governance that Secures Peace and Development	On December 4, 1986, the UN General Assembly highlighted the important role of national governance in development by adopting the Declaration on the Right to Development.[184] The Declaration clearly reaffirms the importance of international peace and security, economic development, and social development, and promulgates that "*States have the primary responsibility for the creation of national and international conditions favourable to the realization of the right to development.*"[185] The Declaration states that the "*right to development is an inalienable human right,*" and that "*every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized.*"[186]

The first three concepts - peace and security, economic development, and social development - are closely interrelated. For example, without peace and security, economic and social development cannot be achieved. Similarly, without robust and accountable legal and financial structures for investment and commerce, economic development is limited (Dernbach 1998, p. 12). Both examples highlight the need for "s*upportive national governance*" - the fourth concept - to ensure that the development process proceeds in a manner that improves the well-being of a nation's population (ibid, p. 13).

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[180] Source: the Charter of the United Nations, Chapter XI, *International Economic and Social Cooperation, Article 55*, http://www.un.org/aboutun/charter/index.html (accessed on 04/08/06).
[181] See the *International Covenant on Civil and Political Rights*, http://www.unhchr.ch/html/menu3/b/a_ccpr.htm (accessed on 04/08/06).
[182] See the *International Covenant on Economic, Social, and Cultural Rights*, http://www.unhchr.ch/html/menu3/b/a_cescr.htm (accessed on 04/08/06).
[183] See the International Labour Organization, *Declaration Concerning the Aims and Purposes of the International Labour Organization* (Declaration of Philadelphia), Section II, http://www.ilo.org/public/english/about/iloconst.htm#annex (accessed on 04/08/06).
[184] Source: the *Declaration on the Right to Development*, http://www.unhchr.ch/html/menu3/b/74.htm (accessed on 04/08/06).
[185] Source: ibid, article 3, paragraph 1.
[186] Source: ibid, article 1, paragraph 1.

However, as Dernbach (1998) points out, the four concepts of development are silent on the topic of environmental protection. As the scientific understanding of the relationship between the development process (specifically industrialization and the mechanization of agriculture) and the human environment grew during the 1960s and 1970s, governments began to realize that a failure to protect the natural environment was likely to adversely affect their future development prospects. Concerns such as these were addressed in 1992, when the delegates of the UNCED approved the Rio Declaration on Environment and Development. Principles 3 and 4 of the Declaration speak directly to the notion of integrating environmental concerns with the development process.[187]

> Principle 3: The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
>
> Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

The international recognition of the need to protect the environment is what Dernbach calls the "*fifth element*" of the international notion of development (Dernbach 1998, p. 21). Using Dernbach's construct, the five (international) concepts of development form the broad idea of sustainable development. Dernbach states that sustainable development "*modifies the purposes of conventional development by adding a wide range of environmental protection goals, by incorporating the environment into social goals, and by insisting that economic goals be compatible with environmental protection. It also modifies the purposes of development by recognizing the present generation's responsibility to future generations*" (ibid, pp. 24-25). Hence, the fifth element seeks to protect the environment and the natural resources upon which the development process depends.

The notion of sustainable development is described in detail by Agenda 21, another product of the 1992 UNCED (see Section 3.4.4.2). Agenda 21 is a comprehensive plan of action that was created to guide and coordinate the work of the UN, governments, and other major groups in their efforts to transition society towards sustainable development. In effect, Agenda 21 is the first blueprint for sustainable development. The preamble to Agenda 21 states that national strategies, plans, policies, and processes are crucial to achieving its successful implementation, and the responsibility for sustainable development consequently lies with national governments.[188] Since the retention of national sovereignty is an essential part of international relations,[189] it is fitting that

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[187] Source: *UNCED Declaration on Environment and Development*, http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm (accessed on 04/08/06).

[188] Source, United Nations, Department of Economic and Social Affairs, Division for Sustainable Development, *Agenda 21*, http://www.un.org/esa/sustdev/documents/agenda21/index.htm (accessed on 04/08/06).

[189] Dernbach (1998, p. 9) states that national sovereignty "*provides the basic context for international relations*" and that the "*ability of states to govern themselves and make decisions based on their understanding of their own interests has been recognized in international law for centuries.*"

Agenda 21 places the responsibility for the achievement of sustainable development with national governments.

By highlighting the transition from conventional development to sustainable development from the perspective of the international community, the national environmental activities discussed in the previous section are given a useful 'development' context. The discussion indicates that while nation states and the international community were taking action to mitigate environmental harm, it was only in the early 1990s that the interrelatedness of development and environmental issues were 'formally' recognized and efforts were made to combine the two issues.

The following sections track the rise of the modern environmental movement, which led to the Stockholm Conference on the Human Environment in 1972 and then to the Rio Conference on Environment and Development in 1992.

3.2 A National Focus on the Human Environment

3.2.1 The U.S. Environmental Agenda (1960 - 1970)

The U.S. environmental movement began when the nation's communities became increasingly aware that the industrial and agricultural processes that fueled the nation's economic growth were simultaneously distressing ecosystem integrity and biological diversity - the first environmental driver of sustainable development (Carson 1962). In essence, as large scale productive capacities in industry and agriculture increased, so did the rates at which these sectors discharged pollution and waste into the environment. Once the environment surrounding the industrial and agricultural land was no longer able to assimilate, or store, this waste, negative impacts soon began to emerge. In some cases the pollution was clearly visible; in others its manifestation occurred through the gradual loss or deterioration of wildlife. Hence, the concern for the environment was driven primarily by local issues such as air, water, and noise pollution, toxic waste disposal sites, oil spills, highway construction, suburban sprawl, etc., and by a concern for the integrity of ecosystems.

However, negative environmental impacts were only one of the factors which led to the creation of a national environmental agenda. Speth (2002) provides a valuable discussion of six critical factors which he argues formed the U.S. environmental movement. These factors are:

1. The increasingly affluent post-war population had rising demands on environmental quality.
2. The negative effects of pollution were visible and difficult to ignore.
3. The social turmoil of the 1960s (e.g., the civil rights and anti-war movements) created a "*new generation of questioning, politically active, and socially concerned young people*" (Speth 2002, p. 5).
4. There was a growing belief that corporate America was generating significant profits at the expense of the environment and the health and safety of [workers and] society.

5. The rapid rate at which the environmental movement developed meant that the business community was unprepared to challenge the new laws that were being created by Congress.
6. There were a series of environmental [and workplace] disasters which increased the pressure on the U.S. government to create legislation to prevent such events from happening in the future.

Speth's bottom-up model of environmentalism provides an insightful summary of the critical factors which led to a national concern for the environment. The following discussion reviews these critical events and publications from the 1960s (Box 3.1) and provides an example of how the bottom-up model can be used to describe the beginning of the U.S. environmental movement.

Box 3.1: The Creation of a National Environment and Development Agenda

Year	Events	Publications	U.S. Legislation
1960	*World population - 3 billion.* The World Bank creates the International Development Association (IDA).		
1961	The OECD (Organisation for Economic Co-operation and Development) is created from the OEEC (Organisation for European Economic Co-operation). The World Wildlife Fund (WWF) is established.		
1962		*Silent Spring* - Carson, R.	
1964	The UN Conference on Trade and Development (UNCTAD) is established.		
1965		*Unsafe at Any Speed: The Designed-In Dangers of the American Automobile* - Nader, R.	
1966			The Freedom of Information Act (FOIA).
1967	The Environmental Defense Fund (EDF) is created.		
1968	The Biosphere Conference is held in Paris under the auspices of the UN Educational, Scientific, and Cultural Organization (UNESCO). The topic of "the human environment" is addressed by the UN Economic and Social Council (ECOSOC). The ECOSOC Resolution 1364 (XLV) eventually leads to the 1972 Stockholm Conference. An explosion occurs at a mine in Farmington, West Virginia, killing 78 people.	*The Tragedy of the Commons* - Hardin, G. *The Population Bomb* - Ehrlich, P.	
1969	An oil spill on the Cuyahoga River in Ohio catches fire. An oil spill occurs off the coast of Santa Barbara, California, discharging some 200,000 gallons of crude oil into the sea. United Mine Workers strike over coal workers' pneumoconiosis, or "black lung." Friends of the Earth is formed.	*Partners in Development* - Report prepared by the Commission on International Development.	The Coal Mine Health and Safety Act. The National Environmental Policy Act (NEPA).

Box 3.1: The Creation of a National Environment and Development Agenda

Year	Events	Publications	U.S. Legislation
1970	First Earth Day - April 22. Natural Resources Defense Council (NRDC) is formed. President Nixon and the Congress form the Environmental Protection Agency (EPA) in the U.S.	*Man's Impact on the Global Environment* - Report prepared by a scientific group assembled at MIT.	The Clean Air Act (CAA). The Occupational and Safety Health Act (OSH Act).

Up until the early 1960s, economic growth was the predominant paradigm driving U.S. public and industrial policy, and the term 'environment' was rarely mentioned in public debates (Gore 1994). Between 1930 and 1970, U.S. income per capita increased by some 180% (measured in chained 1996 Dollars),[190] Figure 3.3. As individual wealth increased, so did the desire to move to the suburbs in search of a better standard of living (U.S. Department of Commerce 1994). Disposable income was directed towards the purchase of automobiles, which made it possible for workers to commute into industrial centers from the more spacious and healthy suburban environment. The increase in wealth that occurred during the 1950s led to conditions of economic security that provided people (especially the young) with the time and opportunity to focus their attention on issues such as the state of the environment, peace, equality, and physical fitness and health (McCormick 1995).

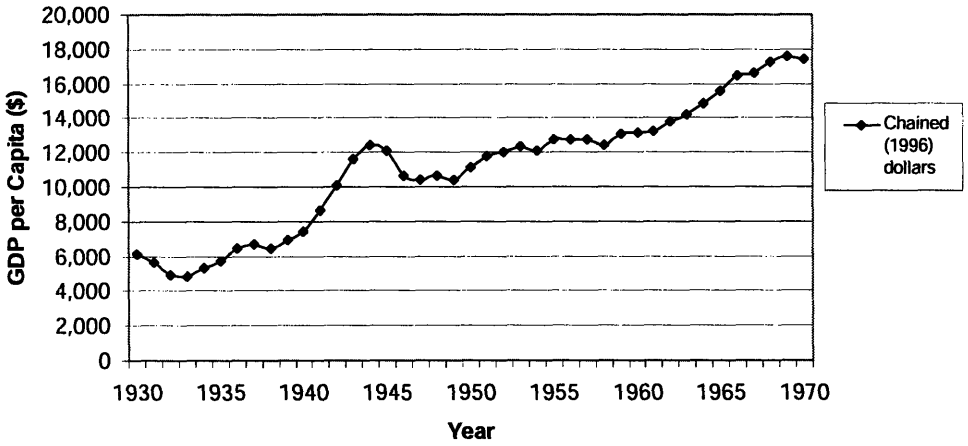

Figure 3.3: GDP per Capita in the U.S. - 1929 to 1970 [191]

However, public acceptance of pollution began to change in 1962 when Rachael Carson published *Silent Spring.* [192] In her book, Carson described the potential dangers of the

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[190] 'Chained dollars' provide a useful way to express a more realistic price of the dollar. "*Real prices are those that have been adjusted to remove the effect of changes in the purchasing power of the dollar; they usually reflect buying power relative to a reference year. ... In 1996, the U.S. Department of Commerce introduced the chained-dollar measure. The new measure is based on the average weights of goods and services in successive pairs of years. It is "chained" because the second year in each pair, with its weights, becomes the first year of the next pair. The advantage of using the chained-dollar measure is that it is more closely related to any given period covered and is therefore subject to less distortion over time.*" Source: EIA, *Annual Energy Review 1999,* http://www.eia.doe.gov/emeu/consumptionbriefs/recs/natgas/chained.html (accessed on 04/08/06).

[191] Source: U.S. Bureau of Economic Analysis, *National Income and Product,* http://www.bea.gov/bea/dn1.htm (accessed on 04/08/06).

[192] Interestingly, some six months before *Silent Spring* was published, Murray Boochin (under the pen name Lewis Herber) published a book called *Our Synthetic Environment.* Boochin's book covered the same material as Carson but he failed to capture the public's interest, partly due to his target audience of scientists and to his more factual writing style (Hynes 1989). In Chapter 1 of his book, Boochin introduces his major concerns: "*Today, employers require a greater output per hour from each worker. The use of machines tends to make work monotonous and sedentary, often exhausting human nerves as completely as*

pesticide DDT (dichlorodiphenyl trichloroethane)[193] and argued that its development and continued use served the interests of chemical companies, industrial agriculture, the military, and universities. The fierce opposition to her book by the chemical industry had the effect of strengthening the public resolve behind her work. "*Silent Spring altered a balance of power in the world. No one since would be able to sell pollution as the necessary underside of progress so easily or uncritically*" (Hynes 1989, p. 3).

Silent Spring was the founding text of the modern environmental movement. Its influence on the history of environmentalism is often compared to the role that *Uncle Tom's Cabin* (Stowe 1982) played in the abolitionist movement (Hynes 1989; Lewis 1985). It mobilized a generation that was already questioning government and industry decision-making in the post-World War II era[194] and refocused the environmental agenda away from the predominant (and somewhat contradictory) environmental views of *conservation* (Pinchot et al. 2001) and *preservation* (Muir 1997), toward ecosystem integrity and biological diversity.[195] In 1964, Carson's premature death from breast cancer seemed to only strengthen public support for her cause, since it was perceived that pollution had contributed to her illness (Davis 2002).

In 1967, the Environmental Defense Fund (EDF) was founded by four scientists on Long Island to develop the legal grounds on which to ban DDT.[196] The scientists went to court

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manual work exhausted human muscles. Modern man is far less physically active than his forebears were. He observes rather than performs, and uses less and less of his body at work and play. His diet, although more abundant, consists of highly processed foods. These foods contain a disconcertingly large amount of pesticide residues, coloring and flavoring matter, preservatives, and chemical "technological aids," many of which may impair his health. His waterways and the air he breathes contain not only the toxic wastes of the more familiar industries but radioactive pollutants, the byproducts of peacetime uses of nuclear energy and nuclear weapons tests" (Boochin 1962).

[193] DDT is most famous for its ability to cause eggshells to weaken and crack, threatening the survival of birds and, hence, the balance of ecosystems. Some bird species affected by DDT include: osprey, eagles, pelicans, falcons, and hawks. Sources: EPA, Related EPA Programs, *Control of Pesticides, Toxic Substances, and Oil Spills*, http://www.epa.gov/owow/birds/epa.html; and the National Safety Council, *DDT Chemical Backgrounder*, http://www.nsc.org/xroads/chemicals_htm/ddt.htm (accessed on 04/08/06).

[194] The defoliation tactics used during the Vietnam War captured the imagination of anti-war activists who saw the potential harm to soldiers (and the Vietnamese people) and the destruction of the environment as a strong rallying point. Lewis (1985) describes how the activists even started using the term "ecology" in reference to a science of the environment, which at this time was still in its infancy.

[195] Before the release of *Silent Spring*, the advice given to politicians from environmental groups was based upon a conservation and preservation ethic. For example, to support John F. Kennedy's presidential campaign in 1960, the Natural Resource Committee of the Democratic Advisory Council prepared a report entitled *Resources for the People*, which advocated the *conservation* and *protection* of the nation's natural resources. Hynes (1989) argues that the Committee "*saw the earth as a warehouse stocked with chemical and physical resources to fulfill the health, industrial, defense, recreational, and aesthetic needs of human consumers. Politicians were charged to conserve present supplies for future use, to manage the store as good stewards*" (ibid, p. 140). *Silent Spring* challenged the very foundation of the conservationism movement. Carson argued that the "*control of nature is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man*" (Carson 1962, p. 261). Her philosophy was that nature should be viewed with respect and not as a form of commodity, and that polluting the environment to satisfy our needs ultimately polluted ourselves since we depend upon the environment for our survival.

[196] Source: Environmental Defense, *Origin and History*, http://www.environmentaldefense.org/aboutus.cfm?subnav=originandhistory (accessed on 04/08/06).

on behalf of the environment - a practice unheard of in 1967 - which led to the nationwide ban of DDT, signed on June 14, 1972.

As the public's distrust of pesticides and the chemical industry grew, so did its distaste for corporate America. Fueled by Ralph Nader's book, *Unsafe at Any Speed*,[197] published in 1965, the growing belief that companies were generating private profits at the expense of the environment and the health and safety of society began to force government to take these allegations seriously.

In parallel with the growing distrust of the government-industrial complex, arguments warning of the environmental problems associated with the prevailing development model of rapid industrialization and economic growth began to surface. Two classic publications which supported this movement were *Tragedy of the Commons* and *The Population Bomb*, both written in 1968. Garrett Hardin's *Tragedy of the Commons* popularized the effect of different regimes of property rights on the exploitation of public domain resources. The basic premise of this paper is that without the private ownership of land or the governmental allocation of usage rights (i.e., regulation), the *free* commons creates an economic incentive for each user to exploit the resource to his/her advantage. The example Hardin uses is the overgrazing of a public common by cattle. Since there are no (grazing) costs to the farmer for adding one additional cow to his herd, the more cows that are added the wealthier the farmer is likely to become through the produce from, and the eventual sale of, his livestock. The inherent problem with these activities is that the eventual overgrazing of a *growing* number of cattle will destroy the public common and bring ruin to all the farmers. In essence, Hardin saw the problem as over population, a point often not mentioned in recitation of his work.

Paul Ehrlich's *The Population Bomb*, as indicated by the title of the book, also saw the problem of the commons in terms of too many people. Ehrlich's argument was the modern exposition of Thomas Malthus' concern that living conditions in nineteenth century England were likely to decline as a result of overpopulation.[198] Ehrlich predicted

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[197] *Unsafe at Any Speed* describes the resistance of automobile companies to introduce safety features, such as seat belts, and their general reluctance to invest in safety. General Motor's Chevrolet Corvair was one of the main targets of the book since its poor suspension system meant it was liable to roll over when traveling around corners at moderate speeds. Nader's work led to the creation of Government mandated safety and environmental regulations for automobiles - i.e., the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966. In addition, in 1970 the National Highway Traffic Safety Administration (NHTSA) was established by the Highway Safety Act of 1970. NHTSA is currently one of eight administrations located under the U.S. Department of Transportation.

[198] One of the most famous examples of how population growth can lead to environmental destruction and the eventual collapse of a civilization is the history of Easter Island. See Clive Ponting's (1991) discussion of the lessons of Easter Island for an informative account of how sustained population growth combined with limited resources led to the overshoot and collapse of ecological systems (as a result of deforestation) upon which the island's inhabitants depended. Research has shown that once the island's forests were depleted, the advanced Polynesian society that had successfully survived on the island for centuries (between the fifth and fifteenth century AD) was gradually forced into primitive living conditions, tribal warfare, and cannibalism. The Story of Easter Island also supports the argument made in *Limits to Growth* (Meadows et al. 1972), that once human activity exceeds (or overshoots) the ecological limits of the earth, humanity will face a rapid decline in population and industrial capacity.

that by the 1970s and 1980s hundreds of millions of people would starve to death as a result of overpopulation and a fixed amount of resources. While Ehrlich's predictions have yet to materialize, his book was influential to the anti-growth movement.

In addition to the above publications, the late 1960s experienced two environmental disasters - the Santa Barbara Oil Spill[199] and the oil fire on the Cuyahoga River[200] - which increased the pressure on the U.S. government for action. Evidence of the growing public support for environmental issues during the 1960s can be identified through opinion surveys and through the growing number of people who joined environmental groups (e.g., the Sierra Club and the Natural Resources Defense Council) during this period (Bosso 2000).

In response to public concern that the government was failing to protect its citizens and the environment, President Nixon signed Executive Order 11472 on May 29, 1969, establishing an Environmental Quality Council and a Citizens' Advisory Committee on Environmental Quality. Lewis (1985) describes how the President was "*stung*" by the criticism "*that these were largely ceremonial bodies*," prompting him to appoint a White House committee in December 1969 to review the idea of creating an independent environmental agency (ibid, pp. 6-7). That same month, Congress passed the National Environmental Policy Act (NEPA) and forwarded it to President Nixon for his signature.

The purposes of NEPA were:

- "[t]*o declare a national policy which will encourage productive and enjoyable harmony between man and his environment*;"
- "*to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man*;"
- "*to enrich the understanding of the ecological systems and natural resources important to the Nation*;" and

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[199] On January 29, 1969, a Union Oil Co. platform stationed some six miles off the coast of Santa Barbara, California, experienced a natural gas blowout while workers extracted a pipe from a 3,500 foot deep oil well to replace a drill bit. While an initial attempt to cap the hole in the sea bed was successful, the pressure in the oil well continued to increase, eventually causing five new breaks to occur on the ocean floor. For eleven days, oil crews attempted to cap the breaks, which were releasing a mixture of natural gas and crude oil. During this period, some 200,000 gallons of crude oil were released, which created an 800 square mile oil slick. Source: Santa Barbra Wildlife Care Network, *Santa Barbara's 1969 Oil Spill*, http://www.sbwcn.org/spill.shtml (accessed on 04/08/06).

[200] On June 22, 1969, sparks from a passing train ignited an oil slick (composed of floating debris and oil from local industrial processes) on the Cuyahoga River in Ohio. While the river had been on fire before (in 1936 and 1952), these prior events managed to escape the attention of the national media, primarily because no pictures were taken and possibly because it was perceived that the *national public* would not be interested in such events. However, several photos of the 1969 fire did make it onto the front pages of two major Cleveland papers. On August 1, 1969, *Time Magazine* ran a story on the fire, giving it national attention. In subsequent years, the concept of a *river on fire* was successfully used by the growing environmental movement to highlight the problems with industrialization without appropriate regulation to protect the environment. The most notable government response to the Cuyahoga River fire occurred in 1972 when Congress passed the Clean Water Act. Source: Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*, June 22, 1969, http://lawwww.cwru.edu/faculty/documents/cuyahoga.pdf (accessed on 04/08/06).

- "*to establish a Council on Environmental Quality*" [201] (Sec. 2 [42 USC § 4321]).

NEPA was Congress's response to the growing public pressure for action (Anderson, 1973).[202] The Act was designed to ensure that the entire federal bureaucracy considered the environmental impacts of its actions (Blumm 1990). It also made the statement that the federal government would "*no longer be a leader in causing environmental degradation*" and would become a model for other governments in the protection of the environment (ibid, p. 448). "*The Federal Government shall ... recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment*" (Sec. 102, (2), (F) [42 USC § 4332]).

The inherent complexity of environmental management led Congress, through NEPA, to initiate an environmental planning policy that was designed to "*utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts*" (Sec. 102, (1), (A) [42 USC § 4332]).

The most influential aspect of NEPA, which had a profound effect on decision-making (Anderson 1973), was the requirement that each federal agency shall make a detailed statement on "*the environmental impact of the proposed* [governmental] *action*" (Sec. 102, (2), (C), (i) [42 USC § 4332]). No longer could agencies make decisions without careful (public) consideration of the impacts of their actions.[203] The requirement to undertake an environmental impact assessment (EIA) is now a critical aspect of any government action which involves the environment.[204] In addition, the EIA process plays a critical role in informing the public of the potential environmental impacts of proposed agency actions, including the impacts of alternative actions.

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[201] The intent of the three-member Council of Environmental Quality (CEQ) was to provide the President with expert advice on environmental affairs. In particular, each member of the committee was required "*to be conscious of and responsive to the scientific, economic, social, aesthetic, and cultural* ***needs and interests*** *of the Nation ...*" (Sec. 202 [42 USC § 4324], emphasis added).

[202] This response can most clearly be seen in the introductory text to NEPA. "*The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans*" (Sec. 101, (a) [42 USC § 4331]).

[203] Note that no policy was articulated on the actions of business and industry. Subsequent legislation addressing air and water pollution, waste, workplace health and safety, and consumer product safety was to follow.

[204] In addition, almost 100 countries have chosen to adopt the environmental impact assessment (EIA) provisions of NEPA, making the Act the most copied legislation in U.S. history (Caldwell and Weiland 1996).

On January 1, 1970, President Nixon made the political decision to sign NEPA, making it the "*first official act of the decade.*"[205] The signing marked the end of almost a decade of intense debate over the process of economic development and its environmental impacts, which would now be considered together in future government decision-making. During President Nixon's State of the Union address on January 22, 1970, he continued to express the importance of finding better ways to manage the nation's resources. He stated that the great question of the 1970s is, "*shall we surrender to our surroundings, or shall we make our peace with nature and begin to make reparations for the damage we have done to our air, to our land, and to our water?*" In discussing the need for a national growth policy, President Nixon argued for making the 1970s "*an historic period when by conscious choice we transformed our land into what we want it to become.*" He also announced that the seventies would be the "*great age of reform of the institutions of American government.*" His commitment to improving the environment was continued on February 10, 1970, when he announced a 37-point environmental action plan designed to strengthen federal programs that manage air and water pollution (Lewis 1985).

On April 22, almost four months after the signing of NEPA, the first Earth Day was held. Some 20 million Americans peacefully demonstrated in streets, parks, and auditoriums for a healthy environment and in support of environmental reform.[206] The event crystallized the views of those who had been protesting against harm to the environment and to humans and provided them with a shared set of common values.

Lewis (1985) suggests that Earth Day further raised the profile of environmental issues, giving support to a report prepared by the President's Commission on Executive Reorganization that called for the establishment of an independent environmental agency. After much consideration, President Nixon submitted the Reorganization Plan No. 3 of 1970[207] to Congress, which led to the establishment of the Environmental Protection Agency (EPA) on December 2, 1970. The rationale behind the creation of a single agency for environmental policy making was that the institutional missions of existing government agencies did not necessarily reflect the interrelatedness of environmental concerns. For example, an agency that is only responsible for air quality is likely to develop regulations that affect the quality of air without considering whether these regulations will increase other forms of pollution (e.g., physical waste or noise pollution). Hence, the EPA was required to pull together "*a variety of research, monitoring, standard-setting and enforcement activities* [that were] ... *scattered through several departments and agencies.*" [208] In the Reorganization Plan, President Nixon also addressed the relationship between the EPA and the Council on Environmental Quality (CEQ), which was established by NEPA. The role of the EPA was defined as protecting the environment by abating industrial pollution through the setting and enforcing of

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[205] President Nixon, January 1, 1970.

[206] Source: Earth Day Network, http://www.earthday.net/about/default.aspx (04/08/06).

[207] See the *Reorganization Plan No. 3 of 1970*, http://www.access.gpo.gov/uscode/title5a/5a_4_93_1_.html (accessed on 04/08/06).

[208] Source: Richard Nixon, July 9, 1970, *Special Message from the President to the Congress About Reorganization Plans to Establish the Environmental Protection Agency and the National Oceanic and Atmospheric Administration*, http://www.epa.gov/history/org/origins/reorg.htm (accessed on 04/08/06).

pollution control standards (whereas the CEQ would continue to focus on what America's *broader* environmental policies should be, as well as oversee the environmental impact statement process). The two were not seen as competing entities and were believed to provide an effective means of coordinating a campaign against environmental pollution.[209]

In 1970, the passage of the Clean Air Act (CAA)[210] provided additional incentives for agencies to comply with NEPA's environmental goals and to work with the newly established EPA. Section 309 [42 U.S.C. 7609] of the CAA provided the EPA with the statutory authority to review and comment on the environmental impact of legislation proposed by any federal department or agency. If the EPA determined that the proposed legislation, action, or regulation did not meet NEPA requirements (from a public health, welfare, or environmental quality perspective), its response was published and referred to the CEQ for review and resolution.

In parallel with the growing concern for the environment, the 1960s also witnessed the rise of occupational health and safety on the political agenda. While not a new subject,[211] the national interest in occupational health and safety grew substantially following the passage of the Coal Mine Health and Safety Act of 1969 and the Occupational Safety and Health Act (OSH Act)[212] of 1970. Ashford (1976) highlights three increasingly important factors which led to the new legislation. First, as the industrial sector grew during the sixties, so did the number of occupational injuries and fatalities (e.g., between 1961 and 1970 the industrial 'accident rate' increased by 29%).[213] This increase in accident rates soon captured the attention of labor unions, insurance companies, and industry itself, which forced Congress (and the Johnson Administration in particular) to take action in the late 1960s. Second, the mining industry experienced two events which raised the

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[209] One of the problems of creating the EPA through an executive order is that it does not have the status of a department and, therefore, has no congressional charter or organic law to help outline and defend its institutional mission (Kraft 2002). This presents the EPA with substantial challenges, since its unreliable financial resources and broad responsibilities make it difficult to secure political support and enforce numerous environmental laws.

[210] See the Clean Air Act (CAA), http://www.epa.gov/oar/caa/contents.html (accessed on 04/08/06).

[211] One of the earliest and most influential works that articulated the severe environmental and occupational health and safety impacts of industrial activities was *The Jungle* by Upton Sinclair, first published in 1906. Sinclair's harrowing account of the Chicago meat packing industry captured the attention of the nation, including that of President Theodore Roosevelt. Upon reading the book President Roosevelt ordered an investigation into the meat packing industry, which led to the creation of the Pure Food and Drugs Act (1906) and the Meat Inspection Act (1906). While Roosevelt disapproved of the manner in which *The Jungle* preached socialism, he told Sinclair that "*radical action must be taken to do away with the efforts of arrogant and selfish greed on the part of the capitalist.*" The publication of *The Jungle* also paved the way for investigative journalism and showed the American people that one person could institute change. Source: Spartacus Educational, *Upton Sinclair*, http://www.spartacus.schoolnet.co.uk/Jupton.htm (accessed on 04/08/06).

[212] See the *Occupational Safety and Health Act (OSHA)* of 1970, http://www4.law.cornell.edu/uscode/29/ch15.html (accessed on 04/08/06).

[213] Source: Hearings on Small Business and the Occupational Safety and Health Act of 1970 Before the Subcommittee on Environmental Problems Affecting Small Business of the H.R. Select Committee on Small Business, 92d Congress, 2d session, June 22, 1972.

profile of worker health and safety.[214] The combination of an explosion at a mine in Farmington, West Virginia in 1968 which claimed the lives of 78 people[215] and a strike by United Mine Workers over coal workers' pneumoconiosis, or "black lung," in early 1969 put worker health and safety at the top of the political agenda adjacent to environmental protection. Finally, the growing problem of occupational disease began to gather momentum in the late 1960s. The most common, and hotly debated, occupational illnesses discussed during this period were black lung, asbestosis, asbestos-caused cancer, and beryllium disease (Ashford 1976). However, MacLaury (1998) argues that the rising number of cancer cases in workers from uranium mines was the catalyst for 'occupational health' concerns of the late 1960s.

In response to the public condemnation of inadequate safety standards for mines and weak government enforcement mechanisms, President Nixon signed the Federal Coal Mine Health and Safety Act of 1969 on December 30, 1969. This Act set mandatory health and safety standards for underground mines (with the Bureau of Mines exercising enforcement authority), provided states with funding to establish or improve local protection or compensation programs, and established federal funding for research into pneumoconiosis (Ashford 1976). The Act also paved the way for more comprehensive legislation for job health and safety and the OSH Act was passed in 1970. The purpose of the OSH Act was to ensure *worker* and *workplace* safety in American industry, including agriculture. In particular, the OSH Act was designed to protect workers from exposure to "*toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions.*"[216]

According to Speth (2002), the rate at which environmental [and worker health and safety] legislation was developed during the late 1960s meant that the business community was disoriented and "*caught off guard, without time to marshal its troops or gather its ammunition. Even environmental NGOs were surprised*" (ibid, p. 6). However, this situation has been reversed over the past 30 years as industrial opposition to government regulation has become increasingly sophisticated and well funded. Corporations now find it essential to challenge every potential environmental [and

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[214] Early concern for worker safety came from the mining sector, which was estimated to have claimed some 100,000 lives in the U.S. between 1900 and 1969. While Congress had toughened mining laws in 1907 - following the death of 362 people in an explosion at the Fairmount Coal Company's mine in Monongah, West Virginia - it was not until 1969 that serious steps were taken to protect the health and safety of miners. Source: U.S. Department of Labor, Mine Safety and Health Administration, *Mining Disasters - An Exhibit*, http://www.msha.gov/DISASTER/DISASTER.HTM (accessed on 04/08/06).

[215] "*At 5:30 a.m. on Wednesday, November 20, 1968, an explosion occurred in the Consol No. 9 Mine at Farmington, West Virginia. There were ninety-nine miners in the mine when the explosion occurred, seventy-eight of whom died as a result of the explosion. Twenty-one miners survived the explosion and escaped to the surface. Seven of the rescued miners were working in A Face Section, four were working near the slope bottom, and two were working near the Athas Shaft (areas not affected by the explosion).*" Source: U.S. Department of Labor, Mine Safety and Health Administration, *1968 Consol No. 9 Mine Mining Disaster, Farmington, West Virginia*, http://www.msha.gov/disaster/farm/farm1.asp (accessed on 04/08/06). Also see *The Presidents Report on Occupational Safety and Health* (1972) G.P.O. Document No. 2915-0011.

[216] Source: EPA, *Occupational Safety and Health Act* (OSHA), http://www.epa.gov/region5/defs/html/osha.htm (accessed on 04/08/06).

occupational health and safety] action that might affect their business, both at the federal and state level (Kraft 2002). The problem here is that non-government environmental organizations, for example, are unable to muster the same financial resources as corporations and are forced to defend only the most important environmental issues (Furlong 1997).

During the 1960s, concern in the U.S. about the environmental impact of industrialization had yet to be discussed by the international community. For example, in 1964 the United Nations Conference on Trade and Development (UNCTAD) was established to integrate developing countries into the world economy in a "*development-friendly*" manner.[217] Here, *development-friendly* should not be confused with *environmentally-friendly development*. The former holds industrialization and economic growth as the main objectives of development, whereas the latter only supports development if it does not *significantly* impact the environment.

However, one could make the argument that the seed for international concern for the environment was planted in 1968 when Sweden's permanent representative to the UN placed the topic of 'the human environment' on the agenda of the UN Economic and Social Council (ECOSOC) (Caldwell and Weiland 1996; Thomas 1992).[218, 219] During its forty-fifth session on July 30, 1968, the ECOSOC adopted Resolution 1346 (XLV) that called for an international conference on the problems of the human environment. Having considered the resolution, the UN General Assembly decided during a plenary meeting on December 3, 1968 "*to convene in 1972 a United Nations Conference on the Human Environment.*"[220] The implications of this conference are considered in the following sections.

While Sweden placed the topic of the human environment on the UN's agenda, the events in the U.S. played a significant role in generating an international interest in the human environment. Interestingly, if the NEPA extracts in this section are considered along with the requirement that the federal government should "*fulfill the responsibilities of each generation as trustee of the environment for succeeding generations*" (Sec. 101, (b), 1 [42 USC § 4331]), we can see that this Act had a important influence on the

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[217] Source: About UNCTAD (United Nations Conference on Trade and Development), http://www.unctad.org/Templates/Page.asp?intItemID=1530&lang=1 (04/08/06).

[218] Source: The United Nations Environment Program, *Constitution of the* [Stockholm] *Conference*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1496 (accessed on 04/08/06); and the United Nations Chronicle, on-line edition, Volume XXXIX, Number 3, 2002, essay by Lars-Göran Engfeldt, *The Road from Stockholm to Johannesburg*, http://www.un.org/Pubs/chronicle/2002/issue3/0302p14_essay.html (accessed on 04/08/06).

[219] In the late 1960s, Swedish scientists identified a series of environmental problems that could only be addressed through international cooperation - e.g., the problem of acid rain, the accumulation of heavy metals and pesticides in fish and birds, and the pollution of the Baltic - which led the Swedish government to call for international action to protect the human environment (UNEP 1982a).

[220] Source: UN General Assembly, Twenty-Third Session, *Resolution 2398 (XXIII)*, 3 December 1968, *Problems of the Human Environment*, 1, http://www.un.org/documents/ga/res/23/ares23.htm (accessed on 04/08/06).

conceptualization of the Brundtland definition of sustainable development that was written almost two decades later.[221]

In conclusion, this section uses a bottom-up model of environmentalism to explain how the modern environmental movement began in the U.S. during the 1960s. The signing of NEPA and the formation of the EPA at the beginning of the 1970s set the scene for a decade of national environmental regulation.[222] The Carter Administration (1976-1980) was especially crucial in formulating an integrated health, safety, and environmental agenda. However, during the 1980s and President Ronald Reagan's administration, concern for the environment lulled as conservative interests and business groups led a successful campaign for deregulation and decreased funding for environmental policy,[223] as well as the removal of Carter Administration policies. The 1980s also saw the emergence of the 'environmental justice' movement after a series of studies showed that poor and minority communities were experiencing some of the worst levels of pollution (Agyeman et al. 2003; Bullard 1990; Ringquist 2000). In the 1990s, concern for the environment returned to the policy agenda, although the focus shifted from command-and-control policies to ones that balanced investments and used more voluntary approaches (Kraft 2002). The 1990s also experienced the explosion of sustainable development onto the international scene, which led to the creation of the President's Council on Sustainable Development in 1993 (see Section 8.3.1). Kraft (2002) explains how the Council, in its report to President Clinton, unanimously concluded that the existing regulatory system should remain, but be improved by a new generation of flexible, consensual environmental policies that incorporate the notion of sustainable development. Hence, the regulatory regimes that were conceptualized in the 1970s are still at the core of modern environmental policies in the U.S. today. Born out of a concern for the integrity of ecosystems, the environmental movement of the sixties paved the way for national environmental agendas around the world and laid the foundations for what later became the concept of sustainable development.[224]

3.3 The Rise of an International Concern for the Human Environment

The purpose of this section is to track the rise of the international concern for the human environment. It begins by introducing the critical events, publications, and U.S. legislation of the 1970s, which is accompanied by a closer look at how the legislation supports the four environmental drivers of the concern for sustainable development. In an

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[221] The Brundtland definition is: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987, p. 43).

[222] Refer to Box 3.2.

[223] For example, in 1981 President Reagan dismissed almost all of the staff on the Council on Environmental Quality (CEQ) and halved its budget (McCormick 1995). In addition, the President reduced the budget of the EPA by 30 percent and its personnel by 23 percent between 1981 and 1983 (ibid).

[224] While the focus here has been on the U.S. environmental movement, it is recognized that the European and Japanese environmental movements also played an influential role in the international formulation of sustainable development (Jordon 2002; Schreurs 2002; Wallace 1995).

effort to capture the debates which formed the international environmental agenda, the following sub-section reviews the influential pre-Stockholm conference deliberations and publications that were released prior to the conference. The subsequent sub-sections highlight issues associated with combining development with a concern for the environment; track the rise of development and environmental issues since the Stockholm conference; and conclude by reflecting on a decade of progress and how this set the stage for the international concern for sustainable development.

It has been argued that the 1960s influence on modern environmentalism is what the 1970s were to the formulation of sustainable development (Speth 2002; 2003). As national environmental agendas began to be established throughout the world, the 1970s witnessed the emergence of a concern for the human environment in the international arena. The impetus for this development was the UN Conference on the Human Environment that was held in Stockholm on June 5-16, 1972.[225] Political scientist Lynton Keith Caldwell[226] attributes such importance to the Stockholm conference for two reasons (Caldwell and Weiland 1996). First, it legitimized the critical need for nation states to establish environmental policy at the national level. Second, it informed the world society of the vital role that a healthy biosphere plays in sustaining life, and hence placed a concern for the environment on national agendas. Caldwell argues that both of these developments were necessary for the international community to legitimately address environmental concerns.[227]

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[225] While the Stockholm conference is seen as a critical factor in the development of international concern for the human environment, many of the initiatives credited to the Stockholm can be traced back to the 1968 Biosphere Conference (the Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of Resources of the Biosphere) held under the auspices of the UN Educational, Scientific, and Cultural Organization (UNESCO) (McCormick 1995). The Biosphere Conference identified the interrelatedness of the environment and concluded that its deterioration was the result of rapid population growth, urbanization, and industrialization (ibid). The Biosphere Conference led to the creation of the UNESCO Man in the Biosphere (MAB) programme in 1971, which was designed to replace the somewhat limited International Biological Programme (IBP) that was scheduled to close in 1974. The Biosphere Conference and the subsequent MAB programme began to raise public awareness about the importance of a healthy biosphere in sustaining life. The Stockholm conference reaffirmed this message through its numerous national environmental reports and its strong endorsement of UNESCO's MAB programme.

[226] Lynton Keith Caldwell had an influential role in drafting NEPA in the late 1960s. For a detailed discussion of the factors which led to the formation of NEPA, see Caldwell (1998).

[227] Caldwell's sentiments are reflected by the Nairobi Declaration that was adopted by the 'session of a special character' of the Governing Council of the United Nations Environment Programme (UNEP) on 18th May, 1982. "*The Stockholm Conference was a powerful force in increasing public awareness and understanding of the fragility of the human environment. The years since then have witnessed significant progress in environmental sciences; education, information-dissemination and training have expanded considerably; in nearly all countries, environmental legislation has been adopted, and a significant number of countries have incorporated within their constitutions provisions for the protection of the environment. ... The principles of the Stockholm Declaration are as valid today as they were in 1972. They provide a basic code of environmental conduct for the years to come.*" Source: The United Nations Environment Programme, *Nairobi Declaration* (1982), http://www.unep.org/DPDL/Law/PDF/NairobiDeclaration1982.pdf (accessed on 04/08/06). Also see the UNEP report entitled *The Environment in 1982: Retrospect and Prospect* (UNEP 1982a) for a similar statement on impacts of the 1972 Stockholm conference.

A summary of the critical events and publications of the 1970s that helped form the international environmental agenda is displayed in Box 3.2. In addition, important environmental legislation passed in the U.S. is displayed, which shows how the nation's environmental agenda was developing during the 1970s.

The U.S. legislation shown in Box 3.2 reflects all four of the environmental drivers of sustainable development. The first driver - that industrialization negatively affects ecosystem integrity and biological diversity and indirectly affects human health - is reflected by the following legislation:

- The 1969 National Environmental Policy Act;
- The 1970 Clean Air Act (CAA);
- The 1972 Federal Water Pollution Control Act Amendments;
- The 1972 Federal Environmental Pesticide Control Act;
- The 1973 Endangered Species Act (ESA); and
- The 1974 Safe Drinking Water Act (SDWA).

The second driver - that the world's resources and energy supplies are finite - is reflected by the 1976 Resource Conservation and Recovery Act (RCRA), which deals with the concern that national resources (e.g., land and recoverable materials lost to landfills in particular) are scarce and must be protected.

The third driver - that toxic pollution directly affects human health and the health of other species - is reflected primarily by the 1976 Toxic Substances Control Act (TSCA) and the 1980 Superfund legislation. TSCA regulates chemicals that pose an unreasonable risk to humans and the Superfund Act created a tax (that is no longer collected) on chemical and petroleum industries to be used to clean up abandoned or uncontrolled hazardous waste sites. The main objective of the Superfund legislation is to "*respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.*"[228] The 1976 RCRA also included provisions that addressed the management of toxic material and the Clean Air Act Amendments (CAAA) of 1977 and 1990 included provisions to control hazardous (i.e., toxic) air pollutants (HAPs) through the application of technology-based performance standards.[229]

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[228] Source: EPA, 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), *CERCLA Overview*, http://www.epa.gov/superfund/action/law/cercla.htm (accessed on 04/08/06).

[229] Note: the Clean Air Act of 1970 focused on controlling air pollution from both stationary industrial sources and mobile sources endangering human health and made mandatory previous voluntary standards contained in legislation whose origin was the late 1960s.

Box 3.2: The Creation of an International Environmental Agenda - 1967 to 1980

Year	Events	Publications	U.S. Legislation
1967	Environmental Defense Fund (EDF) is formed.		
1969	Friends of the Earth is formed.		The National Environmental Policy Act (NEPA).
1970	Natural Resources Defense Council (NRDC) is formed.	*Man's Impact on the Global Environment* - Report prepared by a scientific group assembled at MIT.	The Clean Air Act (CAA). The Occupational and Safety Health Act (OSH Act).
1971	The Man and the Biosphere program (MAB) is founded by UNESCO (UN Educational, Scientific, and Cultural Organization). Greenpeace starts in Canada. The OECD creates the Environment Committee (now the Environment Policy Committee - EPOC) and the Environment Directorate. President Nixon closes the 'gold window' and unilaterally terminates the international gold exchange standard established by the Bretton Woods Agreements. Thus, the dollar is no longer effectively linked - directly or indirectly - to gold.	*Founex Report* - Report by the Preparatory Committee for the United Nations Conference on the Human Environment. *Only One Earth* - Ward, B. & Dubos, R. *The Closing Circle: Nature, Man, and Technology* - Commoner, B. *The Entropy Law and the Economic Process* - Georgescu-Roegen.	
1972	UN Conference on Human Environment is held in Stockholm, Sweden (known as the Stockholm conference). United Nations Environment Programme (UNEP) is formed following the Stockholm conference.	*Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* - Meadows, D.H., Meadows, D.L., Randers, J., and Behrens, W.W. III *Blueprint for Survival* - The Ecologist. *Exploring New Ethics for Survival: The Voyage of the Spaceship Beagle* - Hardin, G. J. *Only One Earth: The Care and Maintenance of a Small Planet* - Ward, B.	The Federal Water Pollution Control Act Amendments (this law is amended in 1977 and becomes known as the Clean Water Act - CWA). The Federal Environmental Pesticide Control Act, which amended the 1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).
1973	OPEC oil embargo begins.	*Small is Beautiful* - Schumacher, E. F.	The Endangered Species Act (ESA).

Box 3.2: The Creation of an International Environmental Agenda - 1967 to 1980

Year	Events	Publications	U.S. Legislation
1974	*World population - 4 billion.* The World Food Council is formed and a reconstituted World Food Programme (WFP) is established following the World Food Conference in Rome.	*Cocoyoc Declaration* - Prepared by a UN-sponsored meeting in Cocoyoc, Mexico, called to discuss how development can be focused on achieving basic human needs. *Stratospheric sink for chlorofluoromethanes-chlorine atom catalyzed destruction of ozone* - Rowland, F. S. and Molina, M. J.	The Safe Drinking Water Act (SDWA).
1975	Worldwatch Institute is established.	*What Now: Another Development* - Report by the Dag Hammarskjöld Foundation, Sweden.	
1976	UN Habitat program is created following the UN Conference on Human Settlements (Habitat I) in Vancouver, Canada.	*Crisis in the Workplace: Occupational Disease and Injury* - Ashford, N. A.	The Resource Conservation and Recovery Act (RCRA). The Toxic Substances Control Act (TSCA).
1977	UN adopts a Plan of Action to Combat Desertification (PACD) following the UN Conference on Desertification in Nairobi, Kenya.		
1978		*World Development Report (WDR)* - The First WDR is published by the World Bank. *The Human Future Revisited* - Brown, H. *The Twenty-Ninth Day* - Brown, L.	
1979	The World Meteorological Organization (WMO) sponsors the first World Climate Conference held in Geneva, Switzerland. Three Mile Island nuclear accident occurs in Pennsylvania, U.S. Second oil shock occurs as the Iranian oil sector reduces its oil exports.	*Banking on the Biosphere* - International Institute of Environment and Development (IIED). *Progress for a Small Planet* - Ward, B.	

Box 3.2: The Creation of an International Environmental Agenda - 1967 to 1980

Year	Events	Publications	U.S. Legislation
1980		*World Conservation Strategy* - Published by IUCN (The World Conservation Union), UNEP, and WWF. *North-South: A Program for Survival* - Report by the Independent Commission on International Development Issues. *The Global 2000 Report to the President* - Report by the Council on Environmental Quality and the Department of State.	The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - also known as Superfund.

Finally, the fourth driver - that greenhouse gases from anthropocentric sources are leading to the disruption of the global climate - is somewhat loosely connected to the CAAA of 1977 and 1990. In the mid 1970s, scientists concluded that chlorofluorocarbons (CFCs) had the potential to deplete stratospheric ozone that provides an essential barrier to the damaging UV-B radiation emitted from the sun (Molina and Rowland 1974). In response to this research, the CAAA of 1977 included a congressional directive to undertake further research on ozone depletion[230] and the later CAAA of 1990 called for a reduction in the amount of chlorofluorocarbons (CFCs) that were being used. The recognition that human activity could change the radiative process of the atmosphere led scientists to consider the potential impact of the vast amount of carbon dioxide (CO_2) that had entered (and continues to enter) the atmosphere since the start of the industrial revolution. While the amendments to the CAA did not address greenhouse gases such as CO_2 and a federal court of appeals has ruled that the act cannot be used to address CO_2 emissions without being amended, it did help raise the importance of the global climate on the international environmental agenda.

In addition to providing the impetus for U.S. environmental legislation, the environmental movement led to the formation of numerous environmental non-governmental organizations (NGOs). Four of the most prominent were the Environmental Defense Fund (EDF) (formed in 1967), Friends of the Earth (formed in 1969), the Natural Resources Defense Council (NRDC) (formed in 1970), and Greenpeace (formed in 1971). Although formed eighty years earlier (in 1892) with John Muir as its first elected President, the Sierra Club was also an active environmental organization during the 1970s. The growing national and international public support for these NGOs meant they were able to leverage substantial influence on environmental issues, which led to some significant victories for the organizations.[231] Besides the formation of activist groups, the 1970s witnessed the formation of organizations dedicated to the synthesis and

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[230] This directive led the EPA to establish the National Ambient Air Quality Standards (NAAQS) for six 'criteria pollutants' that were considered to be harmful to public health and welfare: Carbon Monoxide (CO); Nitrogen Dioxide (NO_2); Ozone (O_3); Particulate Matter (PM); Sulfur Dioxide (SO_2); and Lead (Pb). Source: Environmental Protection Agency, *National Ambient Air Quality Standards (NAAQS)*, http://www.epa.gov/ttn/naaqs/ (accessed on 04/08/06).

[231] For example, in 1971 Friends of the Earth lobbied the U.S. Senate to vote against the proposed fleet of supersonic transports (SSTs) on the grounds that the aircrafts' high speed did not outweigh noise and pollution impacts. [Source: Friends of the Earth, *First 30 Years*, http://www.foe.org/about/history.html (accessed on 04/08/06).] Similarly, in 1971 the National Resource Defense Council (NRDC) won passage of the Clean Water Act, which enables citizens to sue polluters directly. [Source: NRDC, *Victories*, http://www.nrdc.org/about/victories.asp (accessed on 04/08/06).] In 1972, Greenpeace played an influential role in coercing the U.S. government to end nuclear testing in the Aleutian Islands and forced the French government to announce that nuclear testing would be moved underground in 1974. [Source: Greenpeace, *Greenpeace Changing Laws and Opinions*, http://www.greenpeace.org/usa/news/bush-vs-greenpeace-overview/greenpeace-changing-laws-and-o (accessed on 04/08/06).] Finally, in 1973 the Sierra Club launched a successful campaign to defend the Clean Air Act against auto industry opposition and in 1977 joined an effort that strengthened the provisions of the Act. [Source: The Sierra Club, *Highlights of the Sierra Club's History*, http://www.sierraclub.org/history/timeline.asp (accessed on 04/08/06).]

distribution of information on global environmental issues. A notable example is the Worldwatch Institute, formed by Lester Brown in 1975.[232]

3.3.1 The Pre-Stockholm Deliberations (1968 - 1972)

In preparation for the Stockholm Conference on the Human Environment (hereafter called the 'Stockholm conference'),[233] some 86 governments submitted national reports to the UN preparatory committee describing their environmental experiences and concerns and highlighting areas where they saw opportunities for multilateral environmental agreements.[234] These reports were accompanied by papers prepared by various UN agencies/bodies, and a number of documents written by individuals and non-governmental organizations in their specific areas of expertise. In addition, the UN General Assembly, recognizing the importance of including developing nations in pre-conference deliberations, announced that special attention should be given to "*safeguard and promote the interests of developing countries with a view to reconciling the national environmental policies with their national development plans and priorities.*" [235] This policy effectively combined the concepts of national development and environmental protection in the international arena.

However, the combination of development and the environment unleashed a series of contrasting beliefs between developed and developing nations about how the process of "development" should be approached. Developed nations sought to protect the environment by establishing environmental mechanisms based upon those in their homelands. The developing nations, however, rejected this approach since it was seen as placing unnecessary checks upon their development; checks that the developed nations had managed to avoid (Redclift 1996). There were also concerns that the environmental agenda was the agenda of the "North," and that it was based upon an implicit assumption that all nations should follow the development path of the industrialized world. Redclift (1984, p. 45) argues that the environmentalism of the North cannot be extended to developing nations, and might be considered to be "*ethnocentric.*" He illustrates his point by considering the term 'countryside,' which is commonly understood in the U.S. and

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[232] Today the Worldwatch Institute continues to prepare a wide variety of publications on the environmental condition of the world, the most prominent being the annual *State of the World* reports that began in 1984. See Worldwatch Institute, *State of the World*, http://www.worldwatch.org/pubs/sow/ (accessed on 04/08/06). The institute has consistently provided a stark message that all of the indicators of environmental quality and resource availability are pointing in the wrong direction, and that humanity faces problems around almost every corner (Dryzek 1997). As discussed by John Dryzek (1997), the Institute focuses on monitoring forests, grasslands, fisheries, and croplands and identifies ecological limits as being the total amount of photosynthetic energy that can be made available for human use. Hence, the Worldwatch Institute seeks to identify ways in which photosynthetic energy can be used more efficiently.

[233] Rowland (1973) describes how Maurice Strong - the Chair of the Stockholm conference - recognized the importance of defining the term "human environment" to assist with the planning process. Hence, Strong developed the following definition: "*The term 'human environment' refers to those aspects of man's activities which, by affecting the natural ecological systems of which he is part, affect his own life and well being*" (Rowland 1973, p. 38).

[234] Supra note 218.

[235] Source: UN General Assembly, *Resolution 2657 (XXV), United Nations Conference on the Human Environment*, http://www.un.org/documents/ga/res/25/ares25.htm (accessed on 04/08/06).

continental Europe, but is unknown, or is interpreted in a radically different manner, outside these geographic boundaries.[236]

In an attempt to bridge the gap between such views, a panel of 27 experts (lead by Maurice Strong) on development and the environment met at Founex, Switzerland from June 4-12, 1971 to consider how developing nations could *develop* while protecting and improving their environment.[237] Their report, known as the *Founex Report* (UN 1972), became the focus of regional seminars in Africa, Asia, Latin America, and Beirut. Several excerpts from the report, highlighting the difference in the North-South view of development, are presented in Box 3.3.

Box 3.3: Excerpts from the Founex Report, 1971 (UN 1972, pp. 5-10)

Overall Perspective

1.1 The current concern with the Human Environment has arisen at a time when the energies and efforts of the developing countries are being increasingly devoted to the goal of development. ...

1.2 To a large extent, the current concern with environmental issues has emerged out of the problems experienced by the industrially advanced countries. These problems are themselves very largely the outcome of a high level of economic development. The creation of large productive capacities in industry and agriculture, the growth of complex systems of transportation and communication, the evolution of massive urban conglomerations, have all been accompanied in one way or another by damage and disruption to the human environment. Such disruptions have indeed attained such major proportions that in many communities they already constitute serious hazards to human health and wellbeing. In some ways, in fact, the dangers extend beyond national boundaries and threaten the world as a whole.

1.3 The developing countries are not, of course, unconcerned with these problems. ... They have also an interest in them to the extent that they are problems that tend to accompany the process of development and are in fact already beginning to emerge, with increasing severity, in their own societies. The developing countries would clearly wish to avoid, as far as is feasible, the mistakes and distortions that have characterized the patterns of development of the industrialized societies.

1.4 However, the major environment problems of developing countries are essentially of a different kind.

[236] For a useful exposition of the various interpretations of environmentalism, see Redclift (1984). His discussion on the types and positions of environmentalism includes: [1] Transcendentalists (those who "*preach a notion of a bioethic, a sense of responsibility for the earth and a plea for basic ecological understanding before tampering with resources*" (O'Riordan and Turner 1983, p. 3)); [2] Utopian Environmentalists (those who reject the "*core values of industrial society, with its faith in economic growth and political systems*" and yearn to "*resurrect pre-industrial values in work and craftsmanship*" (Redclift 1984, p. 40)); [3] Environmental Fundamentalists (those who believe that nature "*needs to be protected for its own sake, not merely to preserve its potential for man*" (Redclift 1984, p. 40)); [4] Ecological and Scientific Environmentalists (those who attempt "*to influence policy by presenting a valid, scientifically argued case, based upon ecology and systems analysis*" (Sandbach 1980, p. 22)); and [5] Radical Environmentalists (those who are "*less concerned with environmental systems, but more with whether or not science and technology are compatible with humanistic principles*" (Sandbach 1980, p. 23). Regardless of one's positions, Redclift (1984) highlights a major problem with environmentalism, which is that writers/researchers/activists fail to identify both the "*agency*" (i.e., government and other organizations) without which nothing is achieved, and the '*mechanism*" through which environmental policies will be implemented (Redclift 1984, p. 44).

[237] Two months later, the SCOPE/UNCHE (Scientific Committee on Problems of the Environment/UN Conference on the Human Environment) working party met in Canberra, Australia (24th August to 3rd September) to address similar issued raised at the Founex meeting (McCormick 1995). Note: the SCOPE/UNCHE meeting is often referred to as the 'Canberra meeting.'

Box 3.3: Excerpts from the Founex Report, 1971 (UN 1972, pp. 5-10)

They are predominantly problems that reflect the poverty and very lack of development of their societies. They are problems, in other words, of both rural and urban poverty. In both the towns and in the countryside, not merely the "quality of life", but life itself is endangered by poor water, housing, sanitation and nutrition, by sickness and disease and by natural disasters. These are problems, no less than those of industrial pollution, that clamour for attention in the context of the concern with human environment. They are problems which affect the greater mass of mankind.

1.5 It is evident that, in large measure, the kind of environmental problems that are of importance in developing countries are those that can be overcome by the process of development itself. In advanced countries, it is appropriate to view development as a cause of environmental problems. ... But, for the greater part, developing countries must view the relationship between development and environment in a different perspective. In their context, development becomes essentially a cure for their major environmental problems.

...

1.15 The focusing of attention on environmental issues has, therefore, implications that go beyond national policies in developing countries. ... But we would like to stress here that the extent to which developing countries pursue a style of development that is more responsive to social and environmental goals must be determined by the resources available to them. ... If the concern for human environment reinforces the commitment to development, it must also reinforce the commitment to international aid. It should provide a stimulus for augmenting the flow of resources from the advanced to the developing countries. Unless appropriate economic action is taken, there are a number of ways in which the developing countries could suffer rather than profit from the new emphasis on environment. ...

The purpose of the Founex Report was to explore the relationship between development and the environment and to create a framework from which environmental policies could be created. Prescriptive formulations of environmental policies were avoided since it was viewed that such policies could only be created by developing nations themselves.

In describing the environmental side effects of the process of development in agriculture, industry, transport, and human settlement, the panel articulated five areas where harm can occur: [1] resource deterioration; [2] biological pollution (e.g., pollution represented by agents of human disease, and by animal and plant pests); [3] chemical pollution (e.g., air pollutants, industrial effluents, pesticides, metals, and detergent components); [4] physical disruption (e.g., thermal pollution, silting, and noise); and [5] social disruption (e.g., congestion and loss of a sense of community). These side effects were seen to manifest themselves in varying degrees, depending on the sectors concerned, the geography, and the stage of development achieved by a developing nation. While the Founex report covers a wide range of issues, the panel was mainly concerned with the first of the four environmental drivers of sustainable development discussed at the beginning of this chapter - i.e., the negative effect that industrialization has on ecosystem integrity and biological diversity.

An important message from the Founex Report - as implied by the excerpts in Box 3.3 - was that *environmental improvement* is only one of the many objectives of planning and that its priority should be determined by each society depending on its level of development. The objective was to ensure that developed nations did not encroach upon a developing nation's ability to make decisions within its own framework of economic and social planning. In this light, the panel rejected the idea of establishing rigid

environmental guidelines through multilateral or bilateral agreements prepared by donor nations. Instead, the panel opted for minimum environmental standards to be defined by *each* nation. There was also a concern that a heavy focus on environmental problems would lead to a reduction in aid to developing nations, as public opinion in developed nations would force governments to spend their taxpayers' money on alleviating domestic problems. However, a counterpoint to this argument was also presented. "*An emerging understanding of the indivisibility of the earth's natural systems on the part of the rich nations could help strengthen the vision of a human family, and even encourage an increase in aid to poor nations' efforts to improve and protect their part of the global household*" (UN 1972, p. 34).

One of the main concerns articulated in the Founex Report is related to the notion of "*neo-protectionism*" (UN 1972, p. 30). The concern was that a focus on rigorous, and arbitrarily imposed, environmental standards would enable developed nations to erect barriers to products exported by developing nations, which might have been produced using substandard technology or processes. In the words of the panel, if the environmental concern "*spreads from the quality of a product to the environment in which such a product was produced, the alarm bells should ring all over the world, for it would be the beginning of the worst form of protectionism*" (ibid, p. 31). Interestingly, the Founex Report is silent on the topic of occupational health and safety standards, which was a growing concern in developed nations. Hence, the 'environment' the panel refers to is the *natural* - as opposed to the worker - environment.

However, the panel did support the imposition of stricter environmental standards within developed nations, since this presents developing nations with a competitive advantage. "*Such a development opens up an opportunity for the developing countries to move into some of these industries if their natural resource endowments, including relatively less used environmental resources, create a comparative advantage in these fields*" (ibid, p. 35). The theory was that more stringent environmental standards would increase compliance costs, forcing industries to look overseas for more favorable operating environments. This movement of industry would not only benefit developing countries, but it would also redistribute the geographic layout of production centers.[238] Nonetheless,

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[238] The issue of relocating industry to developing countries was hotly debated again in the early 1990s. On December 12, 1991, a controversial memo by Lawrence Summers, the chief economist for the World Bank, was leaked to the news media. The memo begins: "*'Dirty' Industries: Just between you and me, shouldn't the World Bank be encouraging MORE migration of the dirty industries to the LDCs [Less Developed Countries]?*" Summers goes on to support his statement by arguing that: [1] the low wages in developing countries mean that the costs of health-impairing pollution will be lower; [2] developing countries are vastly under-polluted and can, therefore, tolerate more pollutive industries; and [3] that demand for a clean environment is likely to have very high income elasticity, and that industries which cause aesthetic (i.e., visual) pollution - which has "*very little direct health impact*" - could be welfare enhancing. Following the leak of the memo, Summers apologized, arguing that it was intended to be ironic and more of a thought experiment (Mokhiber and Weissman 1999). Subsequent reports claimed that the memo had been drafted by Dr. Lant Pritchett, a lecturer in public policy at Harvard's Kennedy School of Government, and that Pritchett's original (and well balanced) seven-page memo had been doctored by a third party between its approval by Summers' and its dissemination. Pritchett claims that the manner in which the memo was altered "*was a deliberate fraud and forgery to discredit Larry and the World Bank*" (Source: Harvard Magazine, *Toxic Memo*, 103(5), May-June 2001: 36, http://www.harvardmagazine.com/on-

this approach to development was not without its detractors, who argued that "*there should be no export of pollutive industries from the developed to the developing world*" (ibid, pp. 35-36). The panel addressed these concerns by taking the middle ground. First, it stated that the environment in developing nations - which has not been burdened by industrial pollution - is likely to be able to carry a certain amount of industrial activity without substantial damage occurring.[239] Second, the environmental standards and associated compliance costs were likely to be different in developing countries, meaning that they might have a comparative advantage in some industrial areas. Finally, even with lower environmental standards, there is no reason why a developing nation would permit foreign investment by polluting industries if this would result in a "*high rate of remittance of profits and even a lower net transfer of resources*" (ibid, p. 36).

The Founex Report is a clear exposition of the concerns raised by developing nations in the pre-conference deliberations. Its overall conclusion that the contradictions between the environment and development can be mutually supportive secured the attendance of most developing countries at the Stockholm conference, who began to realize that environmental concerns were more widespread and more relevant to their situation than they had appreciated (UNEP 1982c).[240] However, not all of the UN member states attended. The Soviet Union and other Eastern-Block nations (who had been active in the pre-conference deliberations) refused to attend the conference in protest at the exclusion of the German Democratic Republic, which was not a member of the UN (Nayar 1994).[241] Their position was that the environment has no boundaries and therefore the conference should be open to all countries, not just the member states of the UN. To ensure that the Soviet Union was not excluded from discussions, Maurice Strong (the Secretary General of the Stockholm conference) held daily discussions with the Soviet embassy in Stockholm (Strong 2001).

During the UN General Assembly's twenty-sixth meeting in 1971, Resolution 2849 (XXVI) was adopted as a result of the pre-conference deliberations. The resolution stressed that the action plans and proposals to be submitted to the Stockholm conference *must*:

(a) "Respect fully the exercise of permanent sovereignty over natural resources, as well as the right of each country to exploit its own resources in accordance with its own priorities and needs and in such a manner as to avoid producing harmful effects on other countries;

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line/050171.html (accessed on 04/08/06)). Lawrence Summers's memo can be viewed on The Whirled Bank Group's web site, *The Memo*, http://www.whirledbank.org/ourwords/summers.html (accessed on 04/08/06).

[239] Today it is generally understood that even small quantities of toxic chemicals can have devastating effects on both human health and other species (Schettler et al. 1999).

[240] Source: the United Nations Chronicle, on-line edition, Volume XXXIX, Number 3, 2002, essay by Lars-Göran Engfeldt, *The Road from Stockholm to Johannesburg*, http://www.un.org/Pubs/chronicle/2002/issue3/0302p14_essay.html (accessed on 04/08/06).

[241] The UN General Assembly Resolution 2850 (XXVI) asks the Secretary-General to "*invite States Members of the United Nations or members of specialized agencies or of the International Atomic Energy Agency to participate in the conference.*" Source: UN General Assembly, *Resolution 2850 (XXVI)*, http://www.un.org/documents/ga/res/26/ares26.htm (accessed on 04/08/06).

(b) Recognize that no environmental policy should adversely affect the present or future development possibilities of the developing countries;
(c) Recognize further that the burden of the environmental policies of the developed countries cannot be transferred, directly or indirectly, to the developing countries;
(d) Respect fully the sovereign right of each country to plan its own economy, to define its own priorities, to determine its own environmental standards and criteria, to evaluate its own social costs of production, and to formulate its own environmental policies, in the full understanding that environmental action must be defined basically at the national level, in accordance with locally prevailing conditions and in such a manner as to avoid producing harmful effects on other countries; [and]
(e) Avoid any adverse effects of environmental policies and measures on the economy of the developing countries in all spheres, including international trade, international development assistance and transfer of technology" [242]

The pre-conference deliberations had a significant influence on the content and focus of the conference material. The UN resolution addressed the concerns of developing nations, reaffirmed the sovereign right of each nation state to manage its own affairs, and helped set the stage for the first international conference on the human environment.

3.3.2 Influential Publications Released Prior to the Stockholm Conference (1971 - 1972)

In an effort to make the Stockholm conference more manageable, it was broken down into three levels (Rowland 1973, pp. 38-39). Level I was to emphasize the intellectual content of the conference. Level II was to focus on national and international *action items* that would arise from the conference. Level III was to consider the *action completed* items that could be realistically agreed upon during the conference.

To help establish the intellectual content for the conference, Lady Jackson (writing under the pen name Barbara Ward) and Rene Dubos prepared a report on the human environment which was published in 1971 under the title *Only One Earth.* Rowland (1973) explains that while the report was not an official UN document, it managed to summarize the critical issues of the day and capture the attention of the international community, providing the conference with its well known motto. In the final chapter of the report - *Strategies for Survival* - Ward and Dubos make the argument that understanding our planetary interdependence might hold the key to the survival of mankind.

> "*There are three clear fields in which we can already begin to perceive the direction in which our planetary policies have to go. They match the three separate, powerful and divisive thrusts* - ***of science, of markets, of nations*** -

[242] Source: UN General Assembly, twenty-sixth meeting in 1971, *Resolution 2849 (XXVI)*, http://www.un.org/documents/ga/res/26/ares26.htm (accessed on 04/08/06).

which have bought us, with such tremendous force, to our present predicament. And they point in the opposite direction - to a deeper and more widely shared knowledge of our environmental unity, to a new sense of partnership and sharing in our sovereign economies and politics, to a wider loyalty which transcends the traditional limited allegiance of tribes and peoples. There are already pointers to these necessities. We have now to make them the new drivers and imperatives of our planetary existence" (Ward and Dubos 1971, p. 213, emphasis added).

That same year saw the publication of *The Closing Circle: Nature, Man, and Technology* by Barry Commoner and *The Entropy Law and the Economic Process* by Georgescu-Roegen. Commoner saw environmental problems as a side effect of industrialization and the use of polluting (or *flawed*) technology. He argued that it was economic - as opposed to ecological - considerations that had led to the development of polluting technology[243] and that over-population was not the major cause of environmental degradation (1971; 1972; Commoner 1991). This position is different to that of Paul Ehrlich and his colleague John Holdren, who argued that environmental degradation was caused by a combination of three factors - technology, affluence, *and* population (Ehrlich and Holdren 1972).[244]

In the pre-conference deliberations on the relationship of population growth to natural resource depletion, Ehrlich was effectively ignored by Commoner (the chair of the UN-sanctioned Environmental Forum) who refused to accept Ehrlich's call for an open debate on their disagreements (Rowland 1973).[245] The Commoner-Ehrlich interaction provides a

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[243] Commoner further argued in later writings that it was the *nature* of the chemicals produced by a petrochemical-based economy, not the amount of chemical pollution per se, that was at the root of the environmental problem (Commoner 1974; 1979; 2000). He was particularly concerned with chlorinated hydrocarbons, not abundant in nature, that he deemed a problem because they were not part of our 'evolutionary soup.' Much later, Colborn et al. (1996) identified chlorinated chemicals as problematic from the perspective of endocrine disruption.

[244] The debate between Commoner on one side and Ehrilch and Holdren on the other is one of the classic environmental feuds. In essence, all three recognized that growth in population, affluence, and technology were jointly responsible for environmental degradation, but they differed on which of these three factors was most important (Kates 2000). Commoner's view was that the economic system was creating technology that caused environmental degradation. In contrast, Ehrlich and Holdren saw the importance of all three factors and argued for a more comprehensive approach to understanding how they caused environmental degradation. However, due to Ehrlich's book, *The Population Bomb*, published in 1968, the different positions are often incorrectly described as an argument between whether technology or population was the major cause of environmental harm (ibid). Today, there is a general recognition that population, affluence, and technology are intimately connected and the focus has shifted to the factors which influence each of these variables. For an insightful discussion of the Commoner-Ehrlich debate, see John McCormick's (1995) book *The Global Environmental Movement.*

[245] The UN summary of the general debate at the Stockholm conference highlights that several speakers "*expressed regret that population problems took so minor a place in the agenda of the Conference.*" In addition, the report highlighted three distinct positions that delegates took on the issue of population: [1] all strategies for development and environment would be adversely affected if the rate of population growth was not reduced; [2] the real challenge was not population growth, but the fact that so many people of the world had such low expectations of a fruitful, happy, and long life; and [3] there is no incompatibility between population growth and the preservation of the environment. Source: United Nations Environment Programme, *Brief Summary of General Debate,*

good example of the contention behind some of the issues debated (or not) at the *alternative* conferences held during the Stockholm conference (Emmelin 1972). However, due largely to the efforts of Commoner and his colleagues, the output from the Stockholm conference was rather silent on the effects that population growth might have on the environment.

Nicholas Georgescu-Roegen, an American economist, adopted a similar construct to Commoner, Ehrlich, and Holdren of the factors which impact the environment in his pioneering book *The Entropy Law and the Economic Process*.[246] Using the two fundamental laws of thermodynamics - i.e., [1] the total amount of energy in the universe is constant, and [2] the entropy (i.e., disorder) of the universe is always increasing towards a maximum - Georgescu-Roegen developed a theory that the "*basic nature of the economic process is entropic and that the Entropy Law rules supreme over this process and over its evolution*" (Georgescu-Roegen 1971, p. 283). Under this premise, the economic process "*neither creates nor consumes matter or energy, but only transforms it from low to high entropy*" (ibid, p. 281).

Georgescu-Roegen argued that technological progress, guided by socio-economic conditions and opportunistic human wants, has chosen to exploit the earth's finite mineral resources instead of the more abundant solar radiation - both of which are forms of *low entropy* (ibid, p. 304). It is possible to view these forms of low entropy as sources of wealth for present and future generations (ibid, p. 303). However, the two forms have very different properties. The mineral resources that constitute the earth's surface are fixed and can be used when needed, a property highly desired by the economic system. In contrast, solar radiation is outside of man's control, its intensity varies (slightly) depending on the position of the earth in its solar orbit, and has a life span of some 5 billion years - an incomprehensibly long amount of time, especially in economics. While solar radiation is, for the sake of argument, abundant,[247] the problem lies in the rate at which solar energy creates the matter that makes up organisms (such as flora and vegetation). This slow conversion rate is not conducive to the modern industrialized lifestyle that demands large amounts of energy at the flick of a switch, meaning that the only tangible option is to extract mineral resources to generate the energy required to advance the development process.[248] As the low entropy mineral resources are

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http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1497 (accessed on 04/08/06). In an article entitled the 'Politics of Sustainable Development,' Nayar (1994, p. 1327) argues that the pre-conference literature took the position that population growth was the major concern for the environment, which meant that the "*non-sustainable resource intensive production system of the north and its implications for the environment*" would not be the center of attention at Stockholm.

[246] See Section 4.2.2 for a discussion of Georgescu-Roegen's (1971) theories in relation to ecological economics.

[247] The energy stored in mineral resources on the earth is equivalent to the amount of solar energy that is delivered to the earth during a period of four days (ibid, 304).

[248] In the words of Herman Daly, we "*cannot 'mine' the sun to use tomorrow's sunlight today, but we can mine terrestrial deposits and, in a sense, use up tomorrow's petroleum today. There is thus an important asymmetry between our two sources of low entropy. The solar source is stock-abundant, but flow-limited. The terrestrial source is stock-limited, but flow abundant (temporarily). Peasant societies lived off the abundant solar flow; industrial societies have come to depend on enormous supplements from the limited terrestrial stocks*" (Daly 1996, p. 30).

'transformed' (into high entropy) to fuel industrialization and economic development,[249] the human environment suffers the side effects of industrial/agricultural waste and pollution. Hence, Georgescu-Roegen argued that even if the world's population and the rate of resource usage remain constant, natural capital will ultimately be exhausted, bringing "*the career of the human species nearer to its end*" (ibid, p. 304). It follows that as the rate of economic development increases, so too does the rate at which natural resources will be used (ibid, p. 305).

The implications of Georgescu-Roegen's (1971) theory are somewhat alarming:

> "*If we stampede over the details, we can say that every baby born now means one human life less in the future. But also every Cadillac produced at any time means fewer lives in the future. Up to this day, the price of technological progress has meant a shift from the more abundant source of low energy - the solar radiation - to the less abundant one - the earth's mineral resources. ... The faster the economic process goes, the faster the noxious waste accumulates. ... There is a vicious circle in burning coal for industrial processes and then having to use more coal to produce the energy necessary to blow the smog away. ... At least, the industrial energy we derive or may derive from solar radiation does not produce by itself noxious waste. Automobiles driven by batteries charged by the sun's energy are cheaper both in terms of scarce low entropy and healthy conditions - a reason why I believe they must, sooner or later, come about*" (ibid, pp. 305-306).

Hence, the conclusion Georgescu-Roegen reaches is that humankind must conserve the earth's limited mineral resources and transition to a reliance on solar energy.[250]

Georgescu-Roegen also reacted strongly to the notion that industrial development is the *only* way to achieve economic development (ibid, p. 329). He denounced the economic rhetoric of what is good for one country will be good for another by stating that "*the greater the industrial development achieved by an underdeveloped nation plagued by a predominant, over-populated, and disorganized agricultural sector, the stronger the evidence such a nation offers of the fallacy of the industrialization axiom*" (ibid, p. 329).

Georgescu-Roegen believed that economists face moral decisions at every point in the economic process (Daly 1992). By asking critical questions such as who should pay for the long-term costs of production, and more philosophical questions such as what type of development is truly in the interests of mankind (ibid), he brought moral inquiry into the realm of economics. In his closing statement to the Stockholm conference, his concern about a lack of ethics in economics was evident. "*Even the clear formulation from the*

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[249] *Economic development* is defined as consisting of two elements: [1] "*development proper*," i.e., increasing the efficiency by which low entropy is transformed, and [2] "*pure growth*," i.e., increasing the scale of industrial operations and the rate of resource usage, all else being equal (Georgescu-Roegen 1971, p. 294).

[250] In Georgescu-Roegen's (1993) subsequent work which focused on the prudent management of resources and a transition to solar energy, he advocates the stabilization of population sizes and a reduction in the scale of human consumption as part of his preservation ethic (Kysar 2001).

economist's perspective of the choices before us is an ethical task, not a purely analytical one, and ***economists ought to accept the ethical implications of their work****. ... We must have a new economics whose purpose is the husbanding of resources and the achievement of rational control over the development and application of technology to* ***serve real human needs*** *rather than expanding profits, warfare, or national prestige*" (Georgescu-Roegen from Daly 1992, pp. 11-12, emphasis added).

The view that prevailing development paths were leading towards disaster for mankind was the topic of two influential and controversial publications in 1972. Some six months before the Stockholm conference the British magazine *The Ecologist* published the *Blueprint for Survival*,[251] which was shortly followed by the Club of Rome's[252] report entitled *The Limits to Growth*.

The *Blueprint for Survival* argues that if the prevailing trends in world population, industrialization, pollution, agricultural production, and resource depletion continue, there will be an inevitable "*breakdown of society and the irreversible disruption of the life-support systems on this planet, possibly by the end of the century, certainly within the lifetimes of our children*" (The Ecologist 1972, p. v). It calls for an immediate change to the "*deep rooted beliefs in continuous* [economic] *growth*" and states that the political unfeasibility of such a position is only due to the fact that the British "*government has yet to acknowledge the impending crisis*" (ibid, pp. 18-19).

This fixation with economic growth was believed to rest upon two notions. First, that economic growth is essential for survival and is a good way to measure progress and human well-being. Second, that any actions, policies, etc. which challenged the first notion are designed to solve problems that do not exist and, therefore, should be disregarded. It is argued that such a paradigm generates a reinforcing feedback loop in which the government's desire to continually expand is creating the need for more economic growth. The *Blueprint for Survival* (1972, pp. 19-22) presents six ways in which this reinforcing feedback loop operates:

1. The introduction of technological devices leads to the destruction of the ecosphere, creating a need for new devices to mitigate the pollution;
2. Industrial growth promotes population growth, which creates the need for more jobs for the additional people - leading to further economic growth;

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[251] Interestingly, the *Blue Print for Survival* was prepared in response to the early release of data by the Club of Rome's research team based at MIT (Massachusetts Institute of Technology), headed by Dennis and Donella Meadows (Reid 1995; Rowland 1973).

[252] In 1972, the Club of Rome was an informal international association of approximately seventy-five members from twenty-five nations (Meadows et al. 1972; Forrester 1971). The group formed in 1968 after a meeting in Italy that was called to discuss the present and future predicament of mankind. The purpose of the group was not to express a single ideology, or political or national point of view, but to undertake impartial (and international) research into the major problems facing humanity. The group's view was that these problems "*are of such complexity and are so interrelated that traditional institutions and policies are no longer able to cope with them, nor even to come to grips with their full content*" (Meadows et al. 1972, pp. 9-10). Hence, by creating a group consisting of scientists, educators, economists, humanists, industrialists, and national and international civil servants, they hoped to better understand and articulate the complexities behind the problems to "*spark debate in all societies*" (ibid, p. 12).

3. To avoid widespread unemployment, without drastically changing the basis of the industrial society, governments need to stimulate economic growth;
4. Business enterprises tend to be self-perpetuating, meaning they generate profits for expansion, further promoting the growth of the industrial sector;
5. Governments are measured by their ability to increase the standard of living via GDP (Gross Domestic Product) growth;[253] and
6. Economic growth is needed to maintain confidence in the economy, without which the stock market would crash and social collapse would ensue.

To address the growth paradigm, the *Blueprint for Survival* called for the creation of a "*stable society*," which it argued can be achieved through four principle conditions (ibid, p. 23).[254] First, there must be minimal disruption to ecological processes. Second, materials and energy resources must be seen by economists as a finite stock, as opposed to a resource of unlimited supply - a condition likely to have gained the support of Georgescu-Roegen. Third, and possibly the most controversial condition, the population must stabilize. It was argued that Britain's population should not be greater than 30 million in the next 150 to 200 years (ibid, p. 46), some 25 million less than the population in 1971. This reduction was to be achieved by ending immigration, through educational material explaining the potential impacts of having more than two children, and the introduction of various contraceptive campaigns (including free contraceptives, sterilization, and abortion on demand) (ibid, pp. 48-49). Finally, society must ensure that individuals can enjoy life and not be constrained by the first three conditions.

It does not take a great stretch of the imagination to understand why the *Blueprint for Survival* caused so much controversy in Britain. It was heavily criticized by eminent scientists and political leaders for being a kind of quasi-political document - "*a sort of manifesto*" (Rowland 1973, p. 20).[255] In effect, the *Blueprint for Survival* called for radical economic, industrial, and social change and argued that a failure to make a transition to a stable society is a failure of government to recognize the true problems at hand. The reaction to *Blueprint for Survival*, however, paled in comparison to the global response to the *Limits to Growth* report, which became a best seller in a number of countries. Using the latest system dynamics techniques developed by Prof. Jay Forrester at MIT (Massachusetts Institute of Technology),[256] the *Limits to Growth* report discussed

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[253] In 1975, the UN established the Human Development Index (HDI) in an effort to quantify dimensions of human development. The HDI consists of three indicators, one of which is GDP per capita. The first HDI was published in the Human Development Report of 1990 (UN 1990). Refer to Section 2.1.3 for a more detailed discussion of the HDI.

[254] Some ten years later the notion of a 'stable' society had transitioned to a 'sustainable' society (Brown, 1981). While the concept had evolved, the influence of the *Blueprint for Survival* in this later work is evident.

[255] It should be noted that the *Blueprint for Survival* was endorsed, in principle, by thirty-three of Britain's most eminent scientists. Hence, the critiques it received from equally eminent scientists meant that much of the debate was between academic peers, which was interpreted by politicians to suit their own political interests.

[256] In 1971, the book *World Dynamics* presented the results of a computer model developed by Prof. Forrester and his colleagues at MIT called 'World 2.' Forrester describes how the model was created to support a two week workshop at MIT (which began July 20, 1970) during which the Executive Committee from the Club of Rome was invited to *learn* the process of model formulation and computer simulation.

the results of a computer model entitled 'World 3'[257] designed to address the future predicament of mankind.

The three salient conclusions from *Limits to Growth* were:

1. "*If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.*
2. *It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential.*
3. *If the world's people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success*" (Meadows et al. 1972, pp. 23-24).

An important concept raised in *Limits to Growth* is the idea of "*overshoot and collapse*" (ibid, p. 144) - i.e., to inadvertently go beyond the system's limits, creating a situation that is nearly impossible to reverse. Overshoot has three primary causes: [1] growth leading to rapid change within the system; [2] there is a limit to the system beyond which it becomes unstable; and [3] delays in feedback mechanisms mean that the system's limits are exceeded before the problems are identified. For example, "[p]*ollution*

The 'World 2' model was designed to analyse the problems facing the 'world system,' which was defined as incorporating mankind, his social systems, his technology, and the natural environment. Using five key variables - population, capital investment, natural resources, the fraction of capital devoted to agriculture, and pollution - the model provided evidence that within the next 100 years "*man may face choices from a four-pronged dilemma - suppression of modern industrial society by a natural-resource shortage; decline of world population from changes wrought by pollution; population limitation by food shortage; or pollution collapse from war, disease, and social stresses caused by physical and psychological crowding*" (Forrester 1971, p. 11). In addition, the simulations indicated that the high standard of living in developed countries is likely to fall as industrialization reaches a "*natural-resource limit*," and that developing countries might have "*no realistic hope*" of reaching the standard of living experienced in developed nations (ibid, p. 12). These predictions only fueled the developed-developing country debate about the sovereign right to, and best process of, development. Following the workshop at MIT, the Club of Rome, convinced that Forrester's model had identified many of the factors behind the 'world problematique,' decided to launch Phase One of its study into the predicament of mankind (Meadows et al. 1972). This phase, headed by Dennis Meadows, led to the creation of a 'World 3' model upon which the *Limits to Growth* report was based. The 'World 3' model contained about three times as many mathematical equations as its predecessor and used empirical data for many of its numerical relationships (Cole 1973). Note: The phrase 'world problematique' was created by the Club of Rome to describe the set of the crucial problems - political, social, economic, technological, environmental, psychological, and cultural - facing humanity.

[257] The most common criticism of the first 'World 3' model was that it underestimated the influence of technology and did not adequately represent the adaptive nature of the market. Some twenty years later, Meadows et al. (1992) designed a new version of the model that did not rely solely on technology or solely on the market, but instead on a smooth interaction between the two. The outcome from the new model showed that in many cases resource and pollution flows had already surpassed levels that are physically sustainable.

generated in exponentially increasing amounts can rise past the danger point, because the danger point is first perceived years after the offending pollution was released. A rapidly growing industrial system can build up a capital base dependent on a given resource and then discover that the exponentially shrinking resources reserves cannot support it" (ibid, p. 145). However, Meadows et al. (1992)[258] argued that the limits to growth were not physical limits (e.g., limits to population growth or the number of automobiles on the road). Instead, they were limits to *throughput* (i.e., limits to the flows of energy and materials required to keep people alive or to build more automobiles). Hence, the limits to growth are not only limits to the ability of the earth to provide the *resource streams* of energy and materials necessary to meet predicted consumption levels, but also limits to the ability of the earth to absorb the *pollution and waste streams* in natural *sinks* such as forests and oceans.

The implications of these conclusions are far reaching. In essence, *Limits to Growth* stated that nothing short of a radical restructuring of the prevailing trends of industrialization and economic growth would suffice to prevent the sudden decline in both population and industrial capacity. In addition, the achievement of a condition of ecological and economic stability could only be realized if limited natural resources are shared prudently and equally amongst the world population and the economic system provides the opportunity for each individual to achieve his/her full potential through employment. Finally, the sooner change begins the better. Such stark predictions[259] and

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[258] In 1992, twenty years after the release of *Limits to Growth*, Meadows et al. published *Beyond the Limits*, which argued that the conclusions they reached in 1972 were still valid but needed to be strengthened. The revised conclusions are: [1] "*Human use of many essential resources and generation of many kinds of pollutants have already surpassed rates that are physically sustainable. Without significant reductions in material and energy flows, there will be in the coming decades an uncontrolled decline in per capita food output, energy use, and industrial production*; ... [2] *This decline is not inevitable. To avoid it two changes are necessary. The first is a comprehensive revision of policies and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used*; ... [and 3] *A sustainable society is still technically and economically possible. It could be much more desirable than a society that tries to solve its problems by constant expansion. The transition to a sustainable society requires a careful balance between long-term and short-term goals and an emphasis on sufficiency, equity, and quality of life rather than on quantity of output. It requires more than productivity and more than technology; it also requires maturity, compassion, and wisdom*" (Meadows et al. 1992, pp. xv-xvi). Recently, the 30 year update of *Limits to Growth* was published. "*Now, three decades later, we are into the 21st century within 20 years of the time when our scenarios suggest that growth will near its end. The basic conclusions are still the same. ... The world's use of materials and energy has grown past the levels that can be supported indefinitely. Pressures are mounting from the environment that will force a reduction. Rising oil prices, climate change, declining forests, falling ground water levels - all of these are simply symptoms of the overshoot.*" Source: AlterNet, *Facing the Limits to Growth*, by Meadows, Randers, and Meadows, http://www.alternet.org/story/18978/ (accessed on 04/08/06).

[259] Forrester (1971) and Meadows et al. (1972) argue they were not developing their models to accurately predict the future; instead their models were designed to indicate the behavior of the world system if certain changes were made to the system's structure and policies. Limits to Growth "*was intended to be, and is, an analysis of current trends, of their influence on each other, and of their possible outcomes.* [Its] ... *goal was to provide warnings of potential world crisis if these trends are allowed to continue, and thus offer an opportunity to make changes in our political, economic, and social systems to ensure that these crises do not take place*" (Meadows et al. 1972, pp. 185-186).

conclusions[260] presented negative connotations for both developed and developing nations. For developed nations, the idea of using less resources (to allow developing nations to use their fair share of the terrestrial stock) presented a potential lowering of existing standards of living. For developing nations, the concept that they would never be able to achieve the standard of living experienced by developed nations was equally distressing.

Rowland (1973) presents an interesting response to *Limits to Growth* by Sir Solly Zucker, who argued (during the distinguished lecture series at the Stockholm conference) that the "*only kind of exponential growth with which the book ... does not deal, and which I for one believe is a fact, is the growth of human knowledge and of the increase in the kind of understanding with which we can imbue our efforts as we see to it that our increasing numbers do not become incompatible with a better life. ...* [T]*he alarm which we now experience in fact comes from our increased knowledge of what we are doing*" (ibid, p. 18). Similarly, Jahoda (1973) argued that the introduction of an extra variable - man - into the 'World 3' model might change the structure of the debate which has been limited (by Forrester and Meadows et al.) to physical properties. "*It is in the nature of purposeful adaptation that the course of events can be changed dramatically if social constraints are experienced as intolerable, if aspirations remain unfulfilled and if confidence in the ruling political powers disintegrates. It makes no sense in this context to talk of exponential growth in a finite world. Man's inventiveness in changing social arrangements is without limits, even if not without hazards*" (Jahoda 1973, p. 215). If we consider the events in the U.S. which led to the formation of a national environmental agenda in the 1960s/1970s, Jahoda's insights are not without precedent. A problem, however, is whether the international community, with its competing sovereign interests, can form consensus on how to adequately respond to these intolerable events. In addition, we need to ask the question of whether humankind can risk the formation of global 'hazards' in the first place - which brings us back to the original purpose of *Limits to Growth*.

Three classic publications which critique Limits to Growth are *The Doomsday Syndrome - An Attack on Pessimism* (Maddox 1972); *Thinking about the Future - A Critique of the Limits to Growth* (Cole et al. 1973); and *The Computer that Printed Out W*O*L*F** (Kaysen 1972).

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[260] Whereas *Blueprint for Survival* makes clear recommendations on how a 'stable society' could be achieved, *Limits to Growth* does not make any explicit recommendations for how a 'state of equilibrium' could be obtained. "*It presents a bold step toward a comprehensive and integrated analysis of the world situation, an approach that will now require years to refine, deepen, and extend*" (Meadows et al. 1972, p. 186). On the pessimistic conclusions of the report, Meadows et al. (1972, p. 189) gave the following comments. "*Many will believe that, in population growth, for instance, nature will take remedial action, and birth rates will decline before catastrophe threatens. Others may simply feel that the trends identified in the study are beyond human control; these people will wait for "something to turn up." Still others will hope that minor corrections in present policies will lead to a gradual and satisfactory readjustment and possibly to equilibrium. And a great many others are apt to put their trust in technology, with its supposed cornucopia of cure-all solutions. ... We welcome and encourage this debate.*"

The Doomsday Syndrome presents a contrasting (i.e., optimistic) view to *Limits to Growth* where resources are more abundant and human ingenuity leads to an increase in human well-being. In addition, the book argued that nations facing food shortages were likely to have a food surplus by the 1980s - a prediction which sadly did not materialize for countries such as Somalia and Ethiopia.

Thinking about the Future is more of an academic critique of *Limits to Growth*.[261] A main concern expressed in *Thinking about the Future* is the scientific authority that advocates of *Limits to Growth* seemed to grant to the work undertaken by the research group based at MIT. Freeman (1973) argued that prestige of the computer and of MIT meant that *Limits to Growth* was often cited in doomsday literature as an "*authoritative source for views which otherwise might be rather difficult to justify*" (ibid, p. 9). His main contention was that the *Limits to Growth* computer model was a model of a social system, which necessarily involved critical assumptions about the workings of that system - assumptions that were influenced by the attitudes and values of the researchers. Hence, the output of the 'World 3' model was only as good as the 'mental models' that were used to develop it, which also encapsulated the modelers' ideological positions.[262] Other concerns raised by the authors of *Thinking about the Future* included the following: the 'World 3' model failed to adequately consider the effects of politics, economics, and sociology; it did not, on the whole, provide an accurate representation of real world phenomena and behavior; the aggregation of inadequate data presented a gross over-simplification of the real world situation; its use of deterministic - as opposed to probabilistic - projections meant that it was impossible to determine how probable the output was; and it underestimated the impact of technological innovation.

*The Computer that Printed Out W*O*L*F** is a technologically optimistic critique of *Limits to Growth*. Kaysen (1972), like Maddox, argued that the limits defined in the 'World 3' model are not fixed and could be extended by investment into new land and into exploration and discovery. He argued that once the problem is recognized as one of 'cost limits' - as opposed to 'physical limits' - the forces of increasing extraction costs and advancing technology would combine to identify new resources that were previously out of reach. Such action extends the physical limits, or supplies of fixed resources, which Kaysen argued has been occurring throughout human history.

Kaysen (1972) also highlighted two other flaws in the 'World 3' model. First, the price of resources was not adequately represented. Sharp adjustments to the price of a resource could lead to large shifts in the location and type of resources used, in population, and in

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[261] It should be noted that while *Thinking about the Future* is a critique of *Limits to Growth*, the authors of the former praise the MIT work by stating that it is a "*courageous and pioneering attempt to make a computer model of the future of the world*" (Cole et al. 1973, p. 6). They actually accused the MIT-based research team for not being interdisciplinary enough by failing to adequately represent the fields of economics and sociology in their work.

[262] During a lecture by Jay Forrester on "System Dynamics and Sustainability" held at MIT on 18th January 2002, Forrester explained how he never strayed from the capabilities and limitations of the 'World 3' model when answering the criticism unleashed upon the Club of Rome once the report was published. While the 'World 3' model had limitations, which were clearly articulated in the report, the model's output could easily be defended by clearly articulating the foundations upon which the output was based.

the patterns of consumption. Hence, prices could make smooth transitions occur as limits begin to emerge. Second, the researchers did not use available knowledge effectively. Specific attention is drawn to the manner in which population growth was formulated, and to the fact that birth to death rates in the Western world have adjusted with rising income, a trend overlooked by the model. However, Kaysen does acknowledge the magnitude of the population problem.

Reid (1995) argues that even though *Limits to Growth* could be criticized on points of detail, the basic assumption that increasing rates of resource consumption cannot continue in a finite world had to be right. He also discusses how critics were not receptive to the idea that pollution - as opposed to energy shortages or scarcity of resources - would be a key factor in the eventual collapse of the world system.

Regardless of the position taken by advocates of and opponents to *Blueprint for Survival* and *Limits to Growth*, the fact of the matter is that both publications stimulated national and international debates on the prospects for the human environment - an outcome which Maurice Strong, the chairman of the Stockholm conference, took great comfort in.

> "[W]*hatever view is taken of the seriousness of mankind's environment predicament, it is encouraging that the issues are now being discussed in public forums in many countries. One example is the debate stirred in Britain by The Ecologist magazine's "Blueprint for Survival", which was supported by many eminent British scientists and challenged by others, also eminent. Another is the result of the computer model developed at the Massachusetts Institute of Technology and published under the title, "The Limits to Growth". There is no need to agree to disagree to believe that, whether or not a crisis in the very terms of human survival is on the horizon, the engagement of public concern at the overarching issues is essential. Only in this way can a sufficient degree of political consensus be achieved - at the international level - to produce from the myriad differences of conception and opinion a programme of concerted global action*" (Strong 1972, p. 74).

The challenge of integrating the often contradictory views of developed and developing nations, scientists, economists, and politicians provided the Stockholm conference with some of its finest, and most traumatic, hours (Rowland 1973).

In summary, this section highlights how *two* of the four environmental drivers of sustainable development discussed at the start of this chapter grew in importance prior to the Stockholm conference. First, the concern that industrialization was having a negative impact on ecosystem integrity and biological diversity (the first environmental driver of sustainable development) was an underlying theme in all of the publications presented, especially Barry Commoner's *The Closing Circle*. Second, the *Entropy Law and the Economic Process*, *Blueprint for Survival*, and *Limits to Growth* were all primarily concerned with the world's finite resources (the second environmental driver of sustainable development) and raised the question of whether there are sufficient resources to fuel a growing economy into the future. While Commoner's later work (Commoner

1974; 1979; 2000) began to address the concern that toxic pollution directly affects human health and the health of other species (the third environmental driver of sustainable development), this problem was only just being conceived in the early 1970s. Finally, the fourth environmental driver of sustainable development - that greenhouse gases from anthropocentric sources are leading to a disruption of the global climate - had not yet been identified as a critical issue.

3.3.3 The Stockholm Conference on the Human Environment (1972)

In his message to the Stockholm delegates, Pope Paul VI commented that *Only One Earth* was a "*fine motto of the conference.*" [263] The vision of a united world was a powerful rallying call for the protection of the human environment, although achieving unanimity on the tradeoffs between development and environmental protection was, at the very least, a daunting prospect.

Given the contentious pre-conference debates between developed and developing countries and their representative organizations, and the somewhat polarized academic debate over whether population or technology was the major cause of environmental harm, it is surprising that anything of value was achieved at Stockholm. However, against this backdrop, four outcomes arose from the conference that played a significant role in assembling an international assault on the problems of the human environment. These were as follows:

1. the Declaration of the UN Conference on the Human Environment;[264]
2. the Action Plan for the Human Environment;[265]
3. the formation of United Nations Environment Programme (UNEP);[266] and
4. the establishment of the Environment Fund.[267]

The following sections review the Stockholm Declaration, the Action Plan, the UNEP, and the Environment Fund; discuss the UNEP/UNCTAD (United Nations Commission on Trade and Development) symposium on *Patterns of Resource Use, Environment and Development Strategies* that was held two years after the Stockholm conference; and highlight some of the key events that occurred during the 1970s as the international community began to grapple with development and environmental issues.

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[263] Source: Pope Paul VI, *Message to the Stockholm Conference on Human Environment*, June 1, 1972, http://conservation.catholic.org/pope_paul_vi.htm (accessed on 04/08/06).
[264] See the *Declaration of the UN Conference on the Human Environment*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1503 (accessed on 04/08/06).
[265] See United Nations Environment Programme, *Action Taken by the Conference*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1492 (accessed on 04/08/06).
[266] See the United Nations Environment Programme, http://www.unep.org/ (accessed on 04/08/06).
[267] See the United Nations Environment Programme, *Environment Fund*, http://www.unep.org/rmu/en/Financing_environmentfund.htm (accessed on 04/09/06).

3.3.3.1 The Declaration of the UN Conference on the Human Environment

The *Declaration of the UN Conference on the Human Environment* (commonly known as the Stockholm Declaration) is a statement consisting of a preamble and 26 principles that discuss ways to ensure the preservation and improvement of the human environment.[268] The Declaration was developed within 'Level I' of the conference architecture - the "*intellectual-conceptual level*" - and was created to be a "*comprehensive affirmation of the human right to a livable world*" (Rowland 1973, p. 38). The Declaration is (politically) sensitive to many of the concerns raised during the pre-conference deliberations in a deliberate attempt to secure maximum attendance at the conference and international support for the protection of the environment.

The preamble begins by recognizing that man, "*through the rapid acceleration of science and technology,*" now has the ability to create and mold the natural environment to suit our needs. With such a power comes a great responsibility to protect the environment upon which our lives depend. The Declaration gives this responsibility to "*citizens, communities, enterprises, and institutions at every level,*" but particularly to local and national governments who "*bear the greatest burden for large-scale environmental policy and action within their jurisdictions.*"

The Stockholm Declaration provides further support to Dernbach's (1998; 2004) model of *conventional development* in an international context.[269] Table 3.3 shows how the model's four related concepts are covered by specific principles of the Declaration. Note that a fifth row has been added to the table to present those principles that are connected to environmental protection. We recall that Dernbach's (1998) model of sustainable development "*modifies the purposes of conventional development*" by adding a comprehensive set of environmental protection measures, incorporating environmental protection goals into social and economic development objectives, and altering the purpose of development to include a responsibility for future generations (ibid, p. 24). Since the Stockholm Declaration's principles do not *comprehensively* combine social and economic development goals with environmental protection, the Stockholm Declaration falls under the category of 'conventional' development. For example, Principle 8 of the Stockholm Declaration clearly recognizes that "[e]*conomic and social development is essential for ensuring a favorable living and working environment for man,*" but there is no explicit recognition that a healthy environment is a prerequisite for economic and social development. Hence, environmental degradation is regarded, to a certain extent, as a tolerable event by the Stockholm Declaration (Dernbach 1998). While the Declaration is clearly a positive step forward, it would take 20 years for the international community to fully articulate sustainable development at the UN Conference on Environment and Development in Rio de Janeiro.

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[268] For a detailed discussion of the debates that informed the Stockholm Declaration during the pre-conference deliberations, see Rowland (1973) and Sohn (1973).

[269] For a more detailed discussion of Dernbach's model, refer to Section 3.1.1.

Table 3.3: Dernbach's Model of 'Conventional Development' and the Principles of the Stockholm Declaration[270]

Component of *Conventional* Development	Principles of the Stockholm Declaration
Peace and Security	**Principle 26** - Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.
Economic Development	**Principle 8** - Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life. **Principle 18** - Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind.
Social Development	**Principle 1** - Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations. In this respect, policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial and other forms of oppression and foreign domination stand condemned and must be eliminated. **Principle 16** - Demographic policies which are without prejudice to basic human rights and which are deemed appropriate by Governments concerned should be applied in those regions where the rate of population growth or excessive population concentrations are likely to have adverse effects on the environment of the human environment and impede development. **Principles 8 and 18** - above.
National Governance that Secures Peace and Development	**Principle 13** - In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population. **Principle 14** - Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment. **Principle 15** - Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. In this respect projects which are designed for colonialist and racist domination must be abandoned. **Principle 17** - Appropriate national institutions must be entrusted with the task of planning, managing or controlling the environmental resources of States with a view to enhancing environmental quality. **Principles 16 and 26** - above. The preamble to the Declaration also reinforces the importance of national governance.

[270] Principles 9, 10, 11, 12, 19, 20, 21, 22, 23, 24, and 25 of the Stockholm Declaration are not included in the table since they do not fit within any of the categories listed - see supporting text for a discussion of these principles.

Component of *Conventional* Development	Principles of the Stockholm Declaration
'Weak' Environmental Protection Measures (Note: The principles of the Stockholm Declaration do not explicitly link the development process with the environment. Hence the title 'weak' environmental protection measures. What might be termed 'strong' environmental measures emerged in the 1992 Rio Declaration on Development and Environment, where it was declared that environmental protection is an integral part of the development process and cannot be considered in isolation.)	**Principle 2** - The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate. **Principle 3** - The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved. **Principle 4** - Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development. **Principle 5** - The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind. **Principle 6** - The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill countries against pollution should be supported. **Principle 7** - States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Principle 1 of the Declaration provides the first international recognition of the connection between human rights and the right to a healthy environment (Kiss 1994), which had the effect of extending the scope of basic human rights from the UN Charter (Linner and Selin 2003).

Principles 9, 10, 11, and 12 of the Declaration respond directly to the debate about how developing countries should develop while simultaneously protecting the environment. Principle 9 states that environmental problems that stem from "*under-development and natural disasters*" should be addressed "*through the transfer of substantial quantities of financial and technological assistance*" to developing nations. Principle 12 reinforces the need to provide such financial and technical development assistance, but adds the requirement that such assistance must take "*into account the circumstances and particular requirements of developing countries.*" With regards to the international economy, Principle 10 stresses the importance of establishing "*stability of prices and adequate earnings for primary commodities and raw materials,*" which are essential if developing nations are to invest in environmental management. Finally, Principle 11 focuses on the "*environmental policies of all States*" and stipulates that these policies "*should enhance and not adversely affect the present or future development potential of developing countries.*" Such a comprehensive package of policies was warmly received by developing nations who were seeking assurances that their daily struggle to provide food, basic health care, housing, education, and jobs would not be overlooked by the conference, and that the industrialized nations' focus on their own environment would not reduce the flow of finances to aid their development.

The Stockholm Declaration also recognized the importance of national sovereignty. Principle 21 affirms that nation states have the "*sovereign right to exploit their own resources pursuant to their own environmental policies,*" but they must ensure that their activities "*do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.*" This recognition of national sovereignty helped secure the participation of developing countries who were concerned that industrialized nations were threatening their ability to govern their own development by establishing invasive environmental standards.

While Stockholm was not a lawmaking conference,[271] the Declaration and the Action Plan did establish the moral and political grounds for future legal actions (Strong 1972). With regards to the Declaration, Principle 22 calls for the development of "*international law regarding liability and compensation for the victims of pollution and other environmental damage*" caused by activities within the jurisdiction of a nation state to "*areas beyond their jurisdiction.*" In addition, Principle 23 states that environmental standards should be determined with a full understanding of the impact of such standards on developing countries, since standards that are "*valid for the most advanced countries*" might impart an "*inappropriate and ... unwarranted social cost for the developing countries.*"

[271] Indeed, few international conferences result in the formation of international law. In addition, if laws are developed as a result of a summit, conference, or meeting, they are generally not subject to strict enforcement mechanisms, which tends to encourage non-compliance.

Finally, the Declaration also made clear statements on educating the public on environmental matters (Principle 19), undertaking scientific research into environmental problems (Principle 20), and establishing international cooperation with regards to environmental protection (Principles 24 and 25).

While the Stockholm Declaration focuses on the preservation and improvement of the human *living* environment, 28 years earlier the 1944 Declaration of Philadelphia developed by the International Labour Organization (ILO) was adopted to enhance the condition of the human *working* environment. These two declarations provide the major intellectual underpinnings of the concept of sustainable development.

The Declaration of Philadelphia expanded the aims and purposes of the ILO "*based on the relationship between labor and social, and economic and financial problems*," and outlines the principles that should guide the national policies of its members (Bartolomei de la Cruz et al. 1996, p. 5).[272]

A core belief behind the Declaration of Philadelphia is that peace can only be achieved if it is based upon 'social justice,' a concept which is much broader than 'human rights' and focuses on human aspirations as a struggle between the individual and the State (Bartolomei de la Cruz et al. 1996). Social justice is defined in terms of human values and aspirations: "*all human beings, irrespective of race, creed or sex, have the right to pursue both their material well-being and their spiritual development in conditions of freedom and dignity, of economic security and equal opportunity.*"[273] In addition, achieving these conditions "*must constitute the central aim of national and international policy*" and these "*policies and measures, in particular those of an economic and financial character*," should be assessed against the fundamental objective of social justice.[274]

The notion of social justice supports the fundamental principles upon which the ILO was based, namely that:

(a) "labour is not a commodity;
(b) freedom of expression and of association are essential to sustained progress;
(c) poverty anywhere constitutes a danger to prosperity everywhere;
(d) the war against want requires to be carried on with unrelenting vigor within each nation, and by continuous and concerted international effort in which the representatives of workers and employers, enjoying equal status with those of governments, join with them in free discussion and democratic decision with a view to the promotion of the common welfare."[275]

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[272] On 1st November 1945, all members of the UN automatically became members of the International Labour Organization (ILO). In addition, any nation state that subsequently joined the UN could also become a member of the ILO if it accepted the obligations under the ILO's Constitution. Non-UN member states could join the ILO by a majority vote of the ILO Conference (Bartolomei de la Cruz et al. 1996).
[273] Source: *The Declaration of Philadelphia*, Section II, (a), http://www.ilo.org/public/english/about/iloconst.htm#annex (accessed on 04/08/06).
[274] Source: *The Declaration of Philadelphia*, Section II, (b) and (c).
[275] Source: *The Declaration of Philadelphia*, Section I.

In concert with the Stockholm Declaration, the Declaration of Philadelphia supports economic and social development and the creation of a stable international market. In particular, it calls for international and national "*measures to expand production and consumption, to avoid severe economic fluctuations to promote the economic and social advancement of the less developed regions of the world* [see Principle 8 from the Stockholm Declaration], *to assure greater stability in world prices of primary products* [see Principle 10 from the Stockholm Declaration], *and to promote a high and steady volume of international trade.*"[276] However, whereas the Declaration of Philadelphia explicitly links development concerns to human welfare, including the protection of workers in all occupations, the Stockholm Declaration links such concerns to the projection and improvement of the natural environment. Hence, taken together, the declarations protect both aspects of the human environment - that in which we live and work.

There is also a positive tension between the two declarations with regard to economic growth. The Declaration of Philadelphia calls for the expansion of the international economy to improve human welfare and to create more jobs,[277] and the Stockholm Declaration qualifies this by stating that economic development should occur in such a way that the environment is protected. Hence, taken together, both declarations provide the major intellectual underpinnings of the concept of sustainable development. In many ways it is surprising that it took the international community so long to connect these two different strains of human welfare - employment and a healthy environment - with economic development.

3.3.3.2 The Action Plan for the Human Environment

The *Action Plan for the Human Environment* (hereafter called the 'Action Plan') contains 109 recommendations from the conference that are divided among three sections of the plan.[278] Each component is briefly described below:

- **Earthwatch** - a program designed to identify, monitor, and exchange information on the condition of the environment, and to undertake research to create new knowledge that can inform the decision-making process;[279]

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[276] Source: The Declaration of Philadelphia, Section IV.

[277] A position recently reaffirmed in a report by the ILO, which suggests that globalization's "*potential for good is immense. ... Wisely managed,* [the global market economy] *can deliver unprecedented material progress, generate more productive and better jobs for all, and contribute significantly to reducing world poverty.*" (WCSDG 2004, p. x)

[278] The Action Plan was the focus of 'Level II' of the pre-conference planning and was developed to capture any recommendations that arose from the conference (Rowland 1973).

[279] While initiated in 1972 at the Stockholm conference, the Earthwatch program was officially introduced by the United National Environment Programme (UNEP) in 1973. The purpose of the program was to coordinate and act as a catalyst for all environmental monitoring and assessment activities throughout the entire UN system, with the final objective of providing *integrated* information relevant for policymaking. The program was subsequently reinforced at the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro - see Agenda 21, Chapter 40, 'Information for Decision Making.' For more information on Earthwatch, see http://earthwatch.unep.net/ (accessed on 04/08/06).

- **Environmental Management** - actions under this component were created to facilitate comprehensive (national) planning that combines the environmental impacts of human activity with the objective of protecting and enhancing the human environment for present and future generations; and
- **Supporting Measures** - actions under this component identified measures that supported the activities in the other two categories. These actions were grouped into three main sub-categories: education, training, and public information; organizational arrangements; and financial and other forms of assistance.

The Action Plan stressed the urgent need to start monitoring the environment and to undertake research into the ways in which the environment was being affected by human activity. For example, the Man in the Biosphere programme (MAB)[280] - established by UNESCO (UN Educational, Scientific and Cultural Organization) in 1971 to research the structure and functioning of ecosystems under natural or managed conditions - was highlighted as a research project to be vigorously pursued, supported, and emulated throughout the world.[281]

The Action Plan also stressed the importance of national initiatives to protect the natural environment.[282] It is reported that many of the documents prepared by governments, UN agencies/bodies, individuals, and non-governmental organizations for the pre-conference deliberations constituted "*the first environmental survey of certain areas ever made*" (Strong 1972, p. 75). These preparations helped nation states identify their domestic environmental problems, which led to more comprehensive domestic legislation (Linner and Selin 2003). This increase in legislative activity was supported, in many cases, by the creation of national environmental ministries and environmental agencies (Frank et al. 2000). For example, in the early 1970s less than 10 countries had established such bodies, but by 1974 this number had risen to about 60, and at the end of the 1970s the number was nearer 100 (UNEP 1982a, p. 9). This trend was accompanied by a sharp rise in the number of environmental non-governmental organizations, which increased from some 2,500 in 1972 to around 15,000 by 1981 (ibid, p. 9). While there were other events which raised governments' interest in the human environment - such as the rise of the environmental movement in the U.S. during the 1960s and a series of environmental disasters that occurred throughout the world - the Stockholm conference played an influential role in putting a concern for the environment on national policy agendas.

In addition to identifying the gaps in scientific knowledge and stimulating national environmental initiatives, the Action Plan also recommended that governments pay attention to the need for international conventions and treaties. In particular, it called for

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[280] See United Nations Educational, Scientific and Cultural Organization (UNESCO), *UNESCO's Man and the Biosphere Programme (MAB)*, http://www.unesco.org/mab/mabProg.shtml (accessed on 04/08/06).
[281] See Recommendations 15 (b, i), 21 (a, i), 24 (a), 42 (a), 43 (3, c), 45 (2, d), 65, 80 (b, d), 96 (2) of the *UN Action Plan for the Human Environment*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1504 (accessed on 04/08/06).
[282] Refer to Section 3.1 for a discussion of national environmental activities that occurred during the twentieth century.

the protection of migratory species and those which inhabit international waters;[283] the safeguarding of the marine environment and its resources;[284] and the conservation of the world's natural resources and cultural heritage.[285] The negotiations which formed these recommendations led to the establishment of a number of influential conventions, including:

- The 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter;
- The 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage;
- The 1973 Convention for the Prevention of Pollution from Ships (known as MARPOL); and
- The 1974 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Finally, while the Action Plan did provide eight recommendations that specifically addressed 'development and the environment,' it did not provide a "*comprehensive approach to reconciling the two concepts*" (Dernbach 1998, p. 18). Colby (1991, p. 201) describes Stockholm's rather limited attempt at combining environment and development concerns as having a "*remedial focus*" designed to limit environmental damage: "*the principle strategy was to* ***legalize the environment as an economic externality.***"

Although the Declaration and the Action Plan were clearly influential in advancing concerns for the human environment, many suggest that the conference's major impact came from the intense pre-conference deliberations and the explosion of literature which raised the world's consciousness about the natural environment (Dernbach 1998; Emmelin 1972; Strong 1972; 1982a; UNEP 1982b).

3.3.3.3 The United Nations Environment Programme (UNEP) and the Environment Fund

The idea of establishing an intergovernmental body on the human environment was generally welcomed by delegates at the Stockholm conference.[286] The United Nations Environment Programme (UNEP) was subsequently formed (with its headquarters

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[283] See *Recommendation 32* of the UN Action Plan for the Human Environment, section entitled *Recommended Actions at the International Level*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1506 (accessed on 04/08/06).
[284] See *Recommendations 47, 86,* and *92* of the UN Action Plan for the Human Environment, sections entitled *Recommended Actions at the International Level and Marine Pollution*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1504 (accessed on 04/08/06).
[285] See *Recommendations 98* and *99* of the UN Action Plan for the Human Environment, section entitled *Educational, Informational, Social and Cultural Aspects of Environmental Issues*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1511 (accessed on 04/08/06).
[286] Source: UNEP, Report of the United Nations Conference on the Human Environment, *Brief Summary of the General Debate*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1497 (accessed on 04/08/06).

located in Nairobi, Kenya)[287] to provide the UN with the institutional capacity needed to address and coordinate the recommendations put forward in the Action Plan and, more generally, to advocate for the protection and improvement of the environment. In particular, UNEP was created to attend to the following:

(a) "*To promote international co-operation in the field of the environment and to recommend, as appropriate, policies to this end;*
(b) *To provide general policy guidance for the direction and co-ordination of the environmental programs within the United Nations system;*
(c) *To receive and review periodic reports from the Executive Director of ...* [UNEP] *... on the implementation of environmental programs within the United Nations system;*
(d) *To keep under review the world environmental situation ...;*
(e) *To promote ... the acquisition, assessment, and exchange of environmental knowledge and information;*
(f) *To maintain under continuing review the impact of national and international environmental policies and measures on developing countries ...; and*
(g) *To review and approve annually the programme of utilization of resources of the Environment Fund ...*"[288]

The Environment Fund, referred to above, was a voluntary fund established to "*provide additional financing for environmental programmes*" which included the environmental initiatives recommended in the Action Plan.[289] While the Environmental Fund was supported by many conference delegates - some of whom announced their intention of contributing to the Fund - developing countries expressed a concern that the "*Fund might be regarded by some developed countries as an alternative to development assistance.*"[290] Developed countries responded by stating that the Fund was necessary to help developing countries meet the additional environmental costs incurred by the proposed environmental programs. The 'polluter pays principle' was also put forward by several delegates as a financing mechanism that had significant merit.

During the pre-conference deliberations (especially at the Founex meeting in Switzerland) on the relationship between the environment and development, there was a general recognition that since almost all nations needed to undergo some form of development, sound approaches to environmental planning needed to be established (UNEP 1982b). From these deliberations and the debates that ensued during the Stockholm conference, the term 'eco-development' was created to describe the process of

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[287] The UNEP headquarters in Nairobi, Kenya was the first UN headquarters to be located in a developing country. While this represents a significant step forward and a sign that developed nations were serious in their conviction to help developing nations, some commentators were not so supportive of the action. "*UNEP has no operational power and no responsibility for truly changing the ways in which development activity is organized and measured. It is an information-gathering agency, ensconsed in Nairobi, far from the corridors of power, financial resources, and decision making*" (Colby 1991, p. 201).

[288] Source: UN General Assembly, twenty-seventh meeting in 1972, *Resolution 2997 (XXVII), Instructional and financial arrangements for international environmental cooperation,* http://www.un.org/documents/ga/res/27/ares27.htm (accessed on 04/08/06).

[289] Supra note 288.

[290] Supra note 286.

"*ecologically sound development,*" which included the "*positive management of the environment for human benefit*" (UNEP 1982b, p. 7). 'Eco-' is used to signify both 'economic' and 'ecological,' since both words stem from the same Greek root (Colby 1991). The term eco-development was subsequently adopted and advocated by UNEP during the 1970s.[291] In a sense, eco-development could be described as the predecessor to sustainable development. UNEP defined eco-development as "[d]*evelopment at regional and local levels ... consistent with the potentials of the area involved, with attention given to the adequate and rational use of the natural resources, and to applications of technological styles*" (UNEP 1975, from Redclift 1987, p. 34).[292] Hence, eco-development focused on satisfying basic human needs in an "*environmentally sound* [regional] *production system*" (Nayar 1994, p. 1327).

However, as Linner and Selin (2003) point out, the concept of eco-development proved to be somewhat symbolic and was rarely used to guide policy-making post-Stockholm. A study by Farvar and Glaeser (1979) of the commitment made by international organizations to eco-development objectives provides some indication of why this might have occurred. Farvar and Glaeser (1979, p. 6) found that when fundamental approaches to development like land reform were considered by international organizations, the real issues were "*obscured and neutralized by sterile language and wrong premises.*" They suggest that the ineffectiveness of these organizations was connected to factors such as budgetary cuts[293] and the resistance of developed nations to any programs which tried to enhance the self-reliance of developing countries, thus reducing their technological dependence on industrialized nations. In addition, Linner and Selin (2003) present two other factors that they suggest contributed to the failure of eco-development to gain traction in the international community. First, there was recurring friction between

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[291] While UNEP was an advocate of eco-development, Colby (1991, p. 200) argues that its predominant practices were still locked in the realm of environmental protection which focused on "***damage control**: on repairing and setting limits to harmful activity. Rather than focusing on ways to **improve** both development actions and ecological resilience, this approach was inherently **remedial** in practice.*"

[292] Like Colby (1991), Redclift (1987) suggests that UNEP's notion of eco-development was somewhat limited, and later conceptions (by the Centre International de Recherche sur l'Environnement et le Developpement - CIRED) sought to extend UNEP's notion by combining a "*paternalistic*" development methodology with the necessity to "*incorporate social and cultural*" variables (Redclift 1987, p. 35). He also discusses how other advocates of eco-development argued that the needs and priorities of people, especially the poor, should be put at the forefront of planning, and economists and biologists should focus their attention on creating sustainable livelihoods. In this construct, needs satisfaction and the avoidance of risk should be placed before sustainability or higher productivity, which tend to be ideas advocated by the "*enlightened rich*" (ibid, p. 35). Hence, "*short-term improvements in living create conditions for later livelihood-intensive human use of the environment which is sustainable*" (Redclift 1987, p. 36, from Chambers 1986, p. 13). The challenge, however, is how to make the livelihoods of the poor a priority (which requires a focus at the local level), when the effect of international development "*systematically marginalizes*" the poor (Redclift 1987, p. 36). Therefore, Redclift (1987) argues that "*unless we pitch our conception of sustainable development at a level which recognizes international structures, it is in danger of being yet another discarded development concept*" (Redclift 1987, p. 36).

[293] When discussing the work of Farvar and Glaeser (1979), Redclift (1987) highlights that the budget of UNEP was halved between 1975 and 1979. In addition, McCormick (1995) describes how UNEP's average annual income between 1979 and 1987 of $30 million was worth less and less when set against inflation. Further, McCormick (1995) describes how the shortfalls in funding were aggravated by contributions arriving late, or at the end of the financial year, or in non-convertible currency (meaning that it had to be spent in the donor nation).

developed and developing nations with regards to the prioritization of environment and development issues and financial responsibilities. Second, the energy crises and economic recessions of the 1970s reduced a nation state's ability to invest in costly action on environment and development issues.

Notwithstanding the problems associated with UNEP's early conceptualization of eco-development, UNEP remains a prominent advocate for the environment and a leader of environmental initiatives within the UN system. Today, it advocates for the *sustainable development* of the global environment[294] and works with a wide range of partners, including UN entities, international organizations, national governments, non-governmental organizations, the private sector, and civil society.[295]

3.3.4 The Cocoyoc Symposium on Patterns of Resource Use, Environment, and Development Strategies (1974)

Two years after the Stockholm conference, UNEP and the United Nations Commission on Trade and Development (UNCTAD) organized a *Symposium on Patterns of Resource Use, Environment and Development Strategies* that was held in Cocoyoc, Mexico, 8-12 October 1974.[296] The symposium (often referred to as 'Founex II') was chaired by

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[294] UNEP used the term 'sustainable development' for the first time in an official document in 1975: "*The Governing Council, ...* [c]*onsiders that: (a) The issues of population, resources, environment and development are interrelated problems. Solutions to these problems must form part of an integrated strategy directed towards harmonized objectives, to which the ...* [UNEP] *will contribute within the framework of its specific environmental tasks. Fundamental to these objectives is the importance of meeting the aspirations of man for the fulfillment of his basic needs; (b) Environmental management implies* ***sustainable development*** *of all countries, aimed at meeting basic human needs without transgressing the outer limits set to man's endeavours by the biosphere; (c) The ...* [UNEP] *must be concerned with prompt and effective implementation of coordinated and integrated strategies to enhance ... and safeguard the environment for the benefit of present and future generations of man*" (emphasis added). Source: UNEP, Governing Council of the UNEP, 3rd Session, 1975, *20 (III) Programme policy and implementation*, paragraph 9, http://www.unep.org/Documents/Default.asp?DocumentID=93&ArticleID=1371 (accessed on 04/08/06). The concept of sustainable development is discussed in detail in Chapter 4.

[295] The UNEP is also the host for several environmental convention secretariats including the Ozone Secretariat and the Montreal Protocol's Multilateral Fund; CITES; the Convention on Biological Diversity; the Convention on Migratory Species; and a number of chemicals-related agreements, such as the Basel Convention on the Transboundary Movement of Hazardous Wastes and Stockholm Convention on Persistent Organic Pollutants (POPs). Source: UNEP, *About UNEP*, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=43&ArticleID=3301&l=en (accessed on 04/08/06).

[296] Some six months earlier in April 1974, a UNEP-UNCTAD Expert Group on the Impact of Resource Management Problems and Policies in Developed Countries on International Trade and Development Strategies met in Geneva, Switzerland. McCormick (1995) describes how the meeting concluded that the physical availability of resources would not be a serious problem in the foreseeable future, and that the distribution of natural resources would likely constrain development well before resources would start to run out. This conclusion was opposite to that presented in the Club of Rome's publication entitled *Limits to Growth*, which stated that resources would run out if prevailing development trends continued. In the backdrop of the 1973-74 oil crisis, the meeting also recognized the important role that natural resources were going to have in international affairs. McCormick (1995) describes how the oil crisis had given developing nations a new sense of commodity power. One month after the UNEP-UNCTAD meeting, the UN General Assembly adopted the Declaration on the Establishment of a New International Economic

Barbara Ward, the coauthor of *Only One Earth*. The objective of the symposium was to address the links between environment and development that were exposed by the Stockholm conference. It was the first serious attempt by experts to articulate a development concept that integrated economic, social, and environmental concerns and provide some guidance to international institutions, governments, academia, industry, and civil society on the actions needed to achieve this new definition of progress. The broad strategy for development that resulted was presented in what is known as the Cocoyoc Declaration[297] - arguably one of the earliest expositions on the concept of sustainable development even though its formulation was consistent with the prevailing notion of eco-development.[298, 299]

The Cocoyoc Declaration highlights a clear dissatisfaction with the prevailing development model that was firmly rooted in economic growth, which "*concentrated economic power so overwhelmingly in the hands of a small group of* [developed] *nations.*"[300] It argues that the "*evils which flow from excessive reliance on the market system*" have frustrated the UN's mission of creating a better quality of life for humankind. The Declaration identified "*economic and social maldistribution and misuses*" to be the root cause of the problems, as opposed to a shortage of physical resources. However, it recognized that continual environmental degradation and resource consumption presented a potential threat to the "*outer limits of the planet's physical integrity.*" Thus, the Declaration reflects the strong influence of the *Limits to Growth* report published two years earlier.

Since the 'market system' was identified as a mechanism through which many of the problems had arisen, the Declaration argued that solutions to the problems could not "*be left to the automatic operation of market mechanisms.*" As a result, a series of changes in economic policy, in the direction of development, and in the conservation of resources, were outlined as being "*essential components of the new system.*" Box 3.4 presents excerpts from the Declaration on the purpose and diversity of development which touch upon each of the three areas where change was required.

Order (via Resolution 3201 (S-VI)), on 1 May 1974. The UN Declaration recognized that the interests of developed and developing countries "*can no longer be isolated from each other, that there is a close interrelationship between the prosperity of the developed countries and the growth and development of the developing countries, and that the prosperity of the international community depends on the prosperity of its constituent parts*" (UN General Assembly, *Resolution 3201*, 3). The Declaration also called for an international economic order that was more balanced and was based upon "*equity, sovereign equality, interdependence, common interest and co-operation among all States*" (ibid).

[297] The *Cocoyoc Declaration* can be viewed at http://www.southcentre.org/publications/conundrum/conundrum-06.htm#P719_166711 (accessed on 04/08/06).

[298] The Cocoyoc Declaration was largely drafted by Barbara Ward and was released at the end of the symposium to summarize the issues raised during the discussions (McCormick, 1995).

[299] Redclift (1984) states that the term 'sustainable development' was first used around the time of the UNEP/UNCTAD symposium; however, it would take over a decade for the international community to adopt the term.

[300] Supra note 297.

Box 3.4: Excerpts from the *Cocoyoc Declaration*, 1974, on Development

The Purpose of Development

Our first concern is to redefine the whole purpose of development. This should not be to develop things but to develop man. Human beings have basic needs: food, shelter, clothing, health, education. Any process of growth that does not lead to their fulfilment - or, even worse, disrupts them - is a travesty of the idea of development. ... The primary purpose of economic growth should be to ensure the improvement of conditions for ... [the poorest sections of each society]. A growth process that benefits only the wealthiest minority and maintains or even increases the disparities between and within countries is not development. It is exploitation. And the time for starting the type of true economic growth that leads to better distribution and to the satisfaction of the basic needs for all is today. We believe that 30 years of experience with the hope that rapid economic growth benefiting the few will "trickle down" to the mass of the people has proved to be illusory. We therefore reject the idea of "growth first, justice in the distribution of benefits later."

The Diversity of Development

Many of these more than material needs, goals and values, depend on the satisfaction of the basic needs which are our primary concern. ... We reject the unilinear view which sees development essentially and inevitably as the effort to imitate the historical model of the countries that for various reasons happen to be rich today. For this reason, we reject the concept of "gaps" in development. The goal is not to "catch up" but to ensure the quality of life for all with a productive base compatible with the needs of future generations.

We have spoken of the minimum satisfaction of basic needs. But there is also a maximum level, there are ceilings as well as floors. Man must eat to live. But he can also overeat.

...

Consequently, the world is today not only faced with the anomaly of underdevelopment. We may also talk about overconsumptive types of development that violate the inner limits of man and the outer limits of nature. Seen in this perspective, we are all in need of a redefinition of our goals, of new development strategies, of new life styles, including more modest patterns of consumption among the rich. Even though the first priority goes to securing the minima we shall be looking for those development strategies that also may help the affluent countries, in their enlightened self-interest, in finding more human patterns of life, less exploitative of nature, of others, of oneself.

One year before the UNEP/UNCTAD symposium, E. F. Schumacher published *Small is Beautiful*, which challenged the prevailing patterns of development and global economics.[301] Schumacher rejected the idea that what "*is best for the rich must be best for the poor*" and redefined the conventional view of development towards human needs (Schumacher 1999, p. 139). "*Development does not start with goods; it starts with people and their education, organization, and discipline. Without these three, all resources remain latent, untapped, potential*" (ibid, p. 139).

Schumacher's ideas are clearly reflected by the Cocoyoc Declaration which establishes human needs as the focus of development efforts. The Declaration rejects economic development that maintains or increases the disparities between and within countries and argues for economic growth that benefits the poorest sections of each society. Like

[301] The influence of Schumacher's work is clearly evident throughout the Cocoyoc Declaration. Schumacher's call for a "*metaphysical reconstruction*" (Schumacher 1999, p. xi) - i.e., the need to reconstruct the meaning of ideas such as development, economics, knowledge, wealth, employment, and technology - is present in the Cocoyoc Declaration's redefinition of development in terms of self-reliance.

Schumacher, the Declaration also rejects what might be called the 'developed nation model' in favor of development that supports a nation state's societal and cultural norms. In this sense, the Declaration asks the international community to respect the diversity of each country and criticizes the belief that there is only one development trajectory - to follow in the footsteps of industrialized nations. This sentiment echoes the Stockholm Declaration's affirmation that nation states have the 'sovereign right' to use their resources as they see fit as long as their actions do not damage the environment beyond their jurisdiction.

However, the Cocoyoc Declaration goes one step further than the Stockholm Declaration in that it raises the notion of "*justice in the distribution of benefits,*" an issue incorporated today in the concept of 'environmental justice.' The Cocoyoc Declaration describes the unequal distribution of economic gains as contributing to environmental degradation and social inequality within and between nation states. In addition, it questions the very foundation of development strategies in affluent countries on the grounds that the 'overconsumptive' behavior is pushing ecological limits, reducing individual psychological well-being, and even threatening health through overindulgence. Hence, the Cocoyoc Declaration argues that the new [sustainable] development paradigm should not only address the needs of the poorest sections of each society, but also the psychological and physiological needs of the wealthiest sections.

One fundamental strategy for [sustainable] development put forward by the Declaration is the idea of national self-reliance (Box 3.5).

Box 3.5: Excerpts from the *Cocoyoc Declaration*, 1974, on Self Reliance

Self Reliance

We believe that one basic strategy of development will have to be increased national self-reliance. It does not mean autarky. It implies mutual benefits from trade and co-operation and a fairer redistribution of resources satisfying the basic needs. It does mean self-confidence, reliance primarily on one's own resources, human and natural, and the capacity for autonomous goal-setting and decision-making. It excludes dependence on outside influences and power that can be converted into political pressure. It excludes exploitative trade patterns depriving countries of their natural resources for their own development. There is obviously a scope for transfer of technology, but the thrust should be on adaptation and the generation of local technology. It implies decentralization of the world economy, and sometimes also of the national economy to enhance the sense of personal participation. But it also implies increased international co-operation for collective self-reliance. Above all, it means trust in people and nations, reliance on the capacity of people themselves to invent and generate new resources and techniques to increase their capacity to absorb them, to put them to socially beneficial use, to take a measure of command over the economy, and to generate their own way of life.

...

Self-reliance at national levels may ... imply a temporary detachment from the present economic system, it is impossible to develop self-reliance through full participation in a system that perpetuates economic dependence. Large parts of the world of today consist of a centre exploiting a vast periphery and also our common heritage, the biosphere. The ideal we need is a harmonized co-operative world in which each part is a centre, living at the expense of nobody else, in partnership with nature and in solidarity with future generations.

The concept of national self-reliance addresses the dependence of industrialized nations on the resources of developing nations. By becoming more self-reliant, the Declaration argues that [developing] countries will benefit from their own resources, which are at risk of being diminished by exploitative trade patterns [that are guided by the needs and wants of industrialized nations]. In this sense, self-reliance is an affront against the overconsumptive behavior of developed nations and the perverse incentives built into the international economy. The exploitative trade patterns also establish a wealthy elite within developing nations who further support free trade and the exploitation of the country's resources, creating a 'dual economy' that separates society.

In addition, the concept of national self-reliance raises the idea of distributed micro economies that are capable of operating independently of the international economy; a notion that rejects the belief that free trade and industrialization will eventually solve the problems of the poorest members of the world society - an argument still debated by many leading economists. Schumacher argued against the idea that development was a primary concern for economists, "*least of all for economists whose expertise is founded on a crudely materialistic philosophy*" (Schumacher 1999, p. 140). He believed that economists will undoubtedly have a role to play, "*but only if the general guidelines of a development policy to involve the entire population are already firmly established*" (ibid, p. 140). In this respect, economic development is seen as being "*much wider and deeper than economics alone, let alone econometrics. Its roots lie outside the economic sphere, in education, organisation, discipline and, beyond that, in political independence and a national consciousness of self-reliance*" (ibid, p. 170).

The Cocoyoc Declaration also raises the importance of what Schumacher called intermediate technology. This term refers to technology that is more advanced than a primitive hand tool, but is much cheaper than the price of a modern combine harvester and is designed to gainfully employ a vast number of the most deprived people (Schumacher 1999).

> "*The technology of mass production is inherently violent, ecologically damaging, self-defeating in terms of non-renewable resources, and stultifying for the human person. The technology of production by the masses, making use of the best of modern knowledge and experience, is conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources, and designed to serve the human person instead of making him the servant of machines*" (Schumacher 1999, p. 126).

The Declaration makes numerous suggestions for action, the most prominent being the need to:

- develop programs that conserve resources and protect the environment;
- manage resources and the environment on a global scale;
- establish international regimes for the exploitation of common property resources that do not fall under any national jurisdiction;
- begin research (that should be undertaken in developing countries where possible) that focuses on alternative consumption patterns, technological styles, and land-

use strategies as well as the institutional framework and the educational requirements needed to sustain them;
- strengthen local capabilities for research and technology assessment in developing countries; and
- create public awareness campaigns that explain both the origins and the severity of the critical situation facing humankind today.

In addition, the Declaration endorses UNEP's objective of designing strategies and assisting projects for "*ecologically sound socio-economic development (eco-development) at the local and regional level.*" It also endorses the Declaration on the Establishment of a New International Economic Order,[302] and gave its support to the Charter of Economic Rights and Duties of States,[303] which was subsequently adopted by the UN General Assembly during its twenty-ninth session in December 1974. Both resolutions consolidate the economic rights of developing nations. Article 30 of the Charter of Economic Rights and Duties of States is of particular interest,[304] since it is the first UN General Assembly resolution to integrate the importance of protecting the environment and resources for present and future generations with the recognition that developed nations have permanent sovereignty over their national resources. The protection of the environment and resources within the framework of national sovereignty are critical aspects of sustainable development, although this term was not used in the Charter.

A year after the UNEP/UNCTAD symposium, the Dag Hammarskjöld Foundation in Uppsala, Sweden published a report on 'development and international co-operation' entitled *What Now: Another Development.*[305] Building on the Founex and Cocoyoc conferences, it argued that there was a "*crisis of development*" that affected both developed and developing nations (Dag Hammarskjöld Foundation 1975, p. 5). The crisis was evidenced by the "*poverty of the masses,*" where basic needs were not being met; by the "*alienation, whether in misery or in affluence, of the masses, deprived of the means to understand and master their social and political environment;*" and by the "*growing feelings of frustration that are disturbing the industrialized societies*" (ibid, p. 5).

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[302] See the *Declaration on the Establishment of a New International Economic Order*, 1 May 1974, *Resolution 3201 (S-VI)*, http://www.un.org/Depts/dhl/resguide/resins.htm (accessed on 04/08/06).
[303] See the *Charter of Economic Rights and Duties of States*, 12 December 1974, *Resolution 3281 (XXIX)*, http://www.un.org/documents/ga/res/29/ares29.htm (accessed on 04/08/06).
[304] See the Charter of Economic Rights and Duties of States, *Resolution 3281 (XXIX)*, Article 30: "*The protection, preservation and enhancement of the environment for the present and future generations is the responsibility of all States. All States shall endeavour to establish their own environment and development policies in conformity with such responsibility. The environmental policies of all States should enhance and not adversely affect the present and future development potential of developing countries. All States have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. All States should co-operate in evolving international norms and regulations in the field of the environment.*" Source: http://www.un.org/documents/ga/res/29/ares29.htm (accessed on 04/08/06).
[305] See the Dag Hammarskjöld Foundation, *What Now: Another Development*, http://www.dhf.uu.se/pdffiler/75_what_now.pdf (accessed on 04/08/06). Also see the Dag Hammarskjöld Foundation, http://www.dhf.uu.se/default.html (accessed on 04/08/06).

In addition, the report argues that there is an international crisis in the unequal distribution of economic power "*between a few dominant countries and the majority of dominated countries*" (ibid, p. 5), and a crisis in institutions that fail to keep apace of the dynamic world that is continually changing. Further, the report advocates that "[t]*he situation cannot be properly understood, much less transformed, unless it is seen as a whole: in the final analysis, the crises are the result of a system of exploitation which profits a power structure based largely in the industrialized world, although not without annexes in the Third World; ruling 'elites' of most countries are both accomplices and rivals at the same time*" (ibid, p. 5).

Box 3.6 provides excerpts from the Dag Hammarskjöld Foundation's report in which the basic elements of 'another development' - or what might be called eco-development - are articulated.

Box 3.6: Excerpts from *What Now: Another Development* (1975), p. 5.

Development of *what*? Development for *whom*?

Development of every man and woman - of the whole man and woman - and not just the growth of things, which are merely means. Development geared to the satisfaction of needs beginning with the basic needs of the poor who constitute the world's majority; at the same time, development to ensure the humanization of man by the satisfaction of his needs for expression, creativity, conviviality, and for deciding his own destiny.

Development how?

Development is a whole; it is an integral, value-loaded, cultural process; it encompasses the natural environment, social relations, education, production, consumption and well-being. The plurality of roads to development answers to the specificity of cultural or natural situations; no universal formula exists. Development is endogenous; it springs from the heart of each society, which relies first on its own strength and resources and defines in sovereignty the vision of its future, cooperating with societies sharing its problems and aspirations. At the same time, the international community as a whole has the responsibility of guaranteeing the conditions for the self-reliant development of each society, for making available to all the fruits of others' experience and for helping those of its members who are in need. This is the very essence of the new international order and the justification for a reform of the United Nations system.

In keeping with the ideas of Schumacher and the Cocoyoc Declaration, *What Now: Another Development* (1975, p. 28) presents three central elements to the new development paradigm which the report argues must be viewed as a whole so as not to obscure the "*inextricable bonds which bind them.*" The three elements are:

- development that is "[g]*eared to the satisfaction of needs, beginning with the eradication of poverty*;"
- development that is "[e]*ndogenous and self-reliant, that is, ...* [it relies] *on the strength of the societies which undertake it*;" and
- development that is "[i]*n harmony with the environment*" (ibid, p. 28).

In addition, the report identifies that "*structural transformations*" of the institutions that guide social progress and economic development are required, and that "*immediate action is necessary and possible*" (ibid, p. 28).

The Cocoyoc Declaration, *Small is Beautiful*, and *What Now: Another Development* all present a consistent message of the need to redefine the whole purpose of development. They reject development that is focused on economic growth in favor of development which aims to satisfy the basic physiological and psychological needs of humankind. While the primary focus is on meeting the basic needs of the poorest sections of each society, there is recognition that the needs of affluent sections of society are also not being satisfied. Free trade is rejected in favor of an international economic system which allows nation states to enter and exit the economic system in concert with their own development strategies. Such an economic system is also seen to promote a more equitable distribution of economic gains and respond to concerns about environmental justice. In parallel, national sovereignty, the right to diversity, self-reliance, and endogenous development are all recognized as essential components to the satisfaction of human needs. Finally, there is a unanimous recognition that development must be in harmony with the environment.

In an article on the politics of sustainable development, Nayar (1994) presents an insightful discussion on how the Stockholm and Cocoyoc Declarations contained an "*ecological vision combined with third world demands for development and social justice*" (Nayar 1994, p. 1327). In particular, he highlights Principles 1, 9, and 11 from the Stockholm Declaration that were "*totally in favor of developing countries*" (ibid, p. 1327). However, Nayar argues that the radical tone of these principles meant that no positive action programs materialized. The positivism of the eco-development concept, which grew from the Stockholm conference, was subverted by the action programs of global institutions such as the UNEP which weakened the component of self-reliance. "*Self-reliance would have tilted the balance of international power to the south which was dependent on multination companies. Allowing self-reliance meant that the north would lose the dominance, and therefore it was redefined to micro self-reliance keeping the macro dependency intact*" (ibid, p. 1327).

Lynton and Weiland (1996) suggest that eco-development was more an "*ideal to be realized than a process readily administered*" (ibid, p. 274), and present three obstacles to its implementation. First, the unrelenting pressure from population and economic growth had put the natural environment under significant distress. This pressure proved too great for the eco-development concept to make any significant progress on the problems at hand. Second, governments did not have the institutional capacity to effectively integrate planning and management objectives. Third, the political and economic policies and structures that had been developed over the previous decades promoted a nonecological form of development that was hard to counteract. In addition, Lynton and Weiland (1996) suggest that governments might not have adopted the concept "*because it was believed to imply a subordination of development activities to ecological considerations*" (ibid, p. 274).

Similarly, *What Now: Another Development* is critical of the political weakness of the UN Charter of Economic Rights and Duties of States, which was only a declaration of intent and therefore implied no commitment on the part of those who approved it. The report also argues that the lack of action damaged the credibility of most industrialized nations. However, one cannot help but be a little cynical about whether developed nations were concerned about their credibility. Since the eco-development philosophy of the mid-1970s was anti-rich, it was not in the interests of developed countries to endorse the new concept, as it would ultimately reduce their opportunities for economic growth.

Hence, the early formulation of sustainable development - eco-development - was destined for redefinition since it presented little opportunity for industrialized nations to advance their prospects for economic growth, the predominant objective of those in power.[306]

If we look at the output from the Stockholm conference and the subsequent UNEP/UNCTAD symposium, it can be argued that during the first half of the 1970s the emergence of global environmental issues was driven, to varying degrees, by *three* of the four environmental drivers of sustainable development discussed in the introduction to this chapter. First, all of the declarations, actions plans, and publications discussed are based upon a fundamental concern that the scale of industrial activity is stressing ecosystem integrity and biological diversity (the first environmental driver of sustainable development). Second, both the Stockholm and Cocoyoc Declarations formally recognize that many natural resources are finite and irreplaceable and, therefore, must be safeguarded for the benefit of present and future generations. Thus, the second environmental driver of sustainable development, the concern that the world might exhaust the nonrenewable resources upon which the economy is based, was central to debates about the development process. Third, the Stockholm Action Plan recognized that the release of toxic or dangerous substances into the environment should be minimized "*until it has been demonstrated that their release will not give rise to unacceptable risks or unless their use is essential to human health or food production, in which case appropriate control measures should be applied.*"[307] This recognition highlights the third environmental driver of sustainable development, the concern that toxic pollution directly affects human health and the health of other species. The concern over toxic pollution began to arise in a substantive manner during the second half of the 1970s. For example, in 1976 the U.S. Congress passed the Toxic Substances Control Act "*to regulate chemical substances and mixtures which present an unreasonable risk of injury to health or the environment.*"[308, 309] In parallel with the emergence of a concern

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[306] This conclusion is supported by Farvar and Glaeser's (1979) research, which showed how the funding for international organizations, such as UNEP, was cut during the drive for eco-development, seriously undermining its effectiveness.

[307] Source: UN Action Plan for the Human Environment, *Pollution Generally, Recommendation 71*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1509 (accessed on 04/08/06).

[308] Source: 1976 Toxic Substances Control Act, Section 2601, *Findings, Policy, and Intent*, http://www4.law.cornell.edu/uscode/15/2601.html (accessed on 04/08/06).

[309] It took more than twenty-five years for the European Union (EU) to develop comparable legislation. In 2003 the European Commission adopted a proposal for a new EU regulatory framework for chemicals - entitled 'COM (2003) 644.' The proposal outlines a new program entitled REACH (Registration,

for toxic chemicals, the seed for the fourth environmental driver of sustainable development - that greenhouse gases from anthropocentric sources are leading to a disruption of the global climate - was planted during the early 1970s with the discovery that CFCs (chlorofluorocarbons) were thinning the ozone layer. However, as the following section discusses, it was decades before the international community took any substantive action to address global climate change.

3.3.5 The Emergence of a Concern for the Global Climate

The 1970s witnessed the early formation of the fourth environmental driver of sustainable development - the concern that greenhouse gases from anthropocentric sources are leading to a disruption of the global climate. However, during the 1970s the catalyst for this concern did not begin with a focus on greenhouse gases per se, but with the human-induced destruction of ozone in the stratosphere and the resulting increased risk of cancer from the increased intensity of ultraviolet light.

Briefly, ozone is a molecular form of oxygen (O_3) that absorbs the biologically damaging ultraviolet (UV)-B radiation from the sun (Kowalok 1993). The vast majority of ozone (about 90%) is found in the stratosphere, a region that begins about 10-16 km above Earth's surface and extends up to about 50 km altitude (Fahey 2002). This region forms the 'ozone layer' around the earth. While scientific theories about ozone date back into the 1930s (Dotto and Schiff 1978), research into the catalytic destruction of ozone intensified during the late 1960s and through the 1970s. During this period, hydrogen oxides (HO_x) (Hampson 1964; Hunt 1966); nitrogen oxides (NO_x) from tropospheric N_2O and oxides of chlorine, sodium, and bromine (Crutzen, 1970); NO_x from supersonic aircraft, or supersonic transport (SST) (Johnston 1971); and chlorofluorocarbons (CFCs or 'Freon' gases) (Molina and Rowland 1974) were identified as catalysts in the destruction of ozone. Of these, the destructive effects of NO_x and CFCs on ozone proved to be the most influential discoveries.[310]

After Crutzen (1970) showed that nitrogen oxides NO and NO_2 can hasten the destruction of ozone without themselves being consumed, Johnston (1971) extended the research to highlight the potential impact that NO_x from the exhaust gases of supersonic aircraft, or SST, might have on stratospheric ozone. Since the aircraft would fly at an altitude of 20 km, inside the ozone layer, it was feared that an increasing level of NO_x might destroy a sufficient amount of ozone to impair the ozone layer's ability to shield against the

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Evaluation and Authorisation of Chemicals) that requires "*enterprises that manufacture or import over one ton of a chemical substance per year*" to register it in a central database. The objective of the regulation is to "*improve the protection of human health and the environment while maintaining the competitiveness and enhancing the innovative capability of the EU chemicals industry.*" In addition, the regulation requires industry to manage the risks of the chemicals they use and to provide safety information on the substances. Source: EURPOA, Enterprise, *The New EU Chemicals Legislation - REACH*, http://europa.eu.int/comm/enterprise/reach/overview.htm (accessed on 04/08/06).

[310] Paul Crutzen, Mario Molina, and Sherwood Rowland would later receive a Nobel Prize in Chemistry "*for their work in atmospheric chemistry, particularly concerning the formation and decomposition of ozone.*" Source: Nobel e-Museum, Nobel Prize in Chemistry 1995, http://www.nobel.se/chemistry/laureates/1995/index.html (accessed on 04/08/06).

dangerous UV-B radiation.[311] There was also a concern that the aircraft emissions would eject water vapor into the atmosphere that might cause ozone depletion or lead to excessive cloud cover (Kowalok 1993; MIT 1970). Johnston's research led to intense debates among scientists, decision-makers, and environmental groups (e.g., Friends of the Earth), which prevented the expansion of the SST due to its seemingly poor economic and environmental performance.[312]

The implication of Molina and Rowland's (1974) research, however, was much more far reaching. They suggested that the synthetically produced, and chemically inert, CFC gases released at ground level upwardly diffuse their way into the stratosphere through normal air circulation. There, the extreme intensity of ultraviolet light could break up the molecules (a process known as photodissociation), releasing significant amounts of chlorine (Cl) atoms that would then catalytically destroy ozone (in the same way that NO_x does). Molina and Rowland suggested that the release of CFCs into the environment had already been sufficient to begin ozone depletion. In addition, since the only natural sink for CFCs seemed to be the stratospheric photodissociation process, the full impact of the compounds would not be immediately felt since CFCs could remain in the atmosphere for 40-150 years before reaching the stratosphere. Thus, even if the production of CFCs were to reduce immediately, a "*lengthy period (of the order of calculated atmospheric lifetimes) may ... be required for natural moderation*" to be achieved (Molina and Rowland 1974, p. 812). This delay highlights the intergenerational nature of ozone depletion. The leading concern was that a thinning ozone layer would gradually increase the risk of skin cancer due to the greater amounts of damaging UV-B radiation reaching the earth's surface.

Since CFCs were widely used in refrigerants, insecticides, plastic foams, and aerosol propellants, industry's opposition to Molina and Rowland's research was fierce. However, the opposition's argument that CFCs were environmentally ideal since they are unreactive and insoluble did not hold since these same characteristics enable CFCs to reach the stratosphere. Once there, the extreme conditions in the stratosphere deconstruct these compounds, releasing chlorine that leads to ozone depletion.[313]

The opponents to CFCs were silenced in 1985 when Farman et al. (1985) published an article in the journal *Nature* that documented a rapid depletion in ozone above the Antarctic.[314] The article proved that Molina and Rowland's theory was correct and that they had underestimated the scale of the problem. Soon thereafter, satellite measurements

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[311] Source: Nobel e-Museum, Press Release: *The 1995 Nobel Prize in Chemistry*, http://nobelprize.org/chemistry/laureates/1995/press.html (accessed on 04/08/06).

[312] In October 2003, the only commercial supersonic aircraft, the Concord, took its final flight marking the end of the supersonic transport era that was envisioned in the 1960s/1970s.

[313] Source: California Institute of Technology, NASA Jet Propulsion Laboratory, *Ozone Milestones*, http://remus.jpl.nasa.gov/milestones.htm (accessed on 04/08/06).

[314] While the journal article in *Nature* by Farman et al. (1985) brought the depletion of the ozone layer above Antarctica to the attention of the international community, the initial findings were first published in reports by the British Antarctic Survey and the Japan Meteorological Agency in the early 1980s (Fahey 2002).

confirmed that ozone depletion was occurring over a large region of the South Pole during the spring months, creating what was perceived as an 'ozone hole' (Fahey 2002).

Actions to counter the problem with the ozone layer began after the publication of Molina and Rowland's (1974) theory. For example, in 1977 the U.S. Clean Air Act was amended to restrict the use of CFCs in aerosols (Caldwell and Weiland 1996). That same year, UNEP convened an international expert meeting to discuss ways to mitigate ozone depletion. This meeting led to the formation of the Co-ordinating Committee on the Ozone Layer that was to be chaired by the Director of Environment Assessment for UNEP.[315] Between 1979 and 1985, the Committee undertook a continual assessment process that annually reported the latest findings in the area of ozone depletion. These assessments provided a vital source of information that was used by governments during the negotiating process for the Convention for the Protection of the Ozone Layer, which was opened for signature in Vienna on 22 March 1985. The Vienna Convention laid the foundations for future actions by recognizing that the depletion of the ozone layer is potentially harmful to human health and the environment. It called for international cooperation with regards to observations of the ozone layer, research, and information exchange to better understand the problem and its implications for humankind. Further, it called for nation states to adopt "*appropriate legislative or administrative measures ... to control, limit, reduce or prevent human activities under their jurisdiction or control should it be found that these activities have or are likely to have adverse effects resulting from modification or likely modification of the ozone layer.*" [316] This obligation is based upon Principle 21 of the Stockholm Declaration.[317]

Two years after the Vienna Convention was opened for signing, the Montreal Protocol on Substances that Deplete the Ozone Layer was adopted on 16 September 1987.[318] The protocol fixed emissions of several CFCs (11, 12, 113, 114, and 115) to 1986 levels and set a phase-down level of 50% for developed nations by the end of 1999. Fortunately, the protocol was designed to enable the phase-down schedules to be altered as new scientific and technological assessments arose. This provision led to several amendments - in 1990 (London), 1992 (Copenhagen), 1997 (Montreal), and 1999 (Beijing) - which drastically reduced the phase-down period of CFCs to 100% for developed and developing nations

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[315] Source: UNEP, *Earthwatch 1972-1992, A review of the development of Earthwatch prepared for the UNEP Annual Report 1992*, http://earthwatch.unep.net/about/docs/annrpt92.htm (accessed on 04/08/06).

[316] Source: The Vienna Convention for the Protection of the Ozone Layer, Article 2, *General Obligations*, http://www.unep.org/ozone/viennaconvention2002.pdf (accessed on 04/08/06).

[317] Principle 21 of the Stockholm Declaration: "*States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.*" Source: UNEP, Declaration of the United Nations Conference on the Human Environment, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1503 (accessed on 04/08/06).

[318] See *Montreal Protocol on Substances that Deplete the Ozone Layer*, http://www.unep.org/ozone/pdfs/Montreal-Protocol2000.pdf (accessed on 04/08/06).

by 1996 and 2010, respectively. These provisions also inserted phase-down schedules or control measures for numerous other ozone depleting substances (ODS).[319]

The early debates about the ozone layer in the 1970s exposed a much broader question of whether human activities in general were affecting the global climate. Having realized that industrial processes could change the radiative process of the atmosphere, the potential impact of increasing atmospheric carbon dioxide (CO_2) from the combustion of fossil fuels took on added importance. While many had considered the effects that an increasing amount of CO_2 entering the atmosphere might have on the climate (Arrhenius 1896; Bolin and Keeling 1963; 1938; 1940; Callendar 1949; Plass 1956; President's Science Advisory Committee 1965; Revelle and Suess 1957; Tyndall 1863a; 1863b; 1873), the topic had yet to be officially recognized by the international community. Apathy towards the idea that human activities might affect the global climate began to change, however, in the second half of the 1970s.

In 1979 the World Meteorological Organization (WMO), after issuing an authoritative statement on global climate change in 1976,[320] convened the first World Climate Conference in Geneva, Switzerland. The purpose of the meeting was to share scientific knowledge and data on the causes of climate change and to identify the potential impacts that climate change might have upon human activities. The conclusions of the conference were presented in the Declaration of the World Climate Conference, which "*highlighted the international community's emerging perception of the climate as a vital natural resource.*"[321] The Declaration stated that it is urgently necessary for nation states around the world "*to foresee and to prevent potential man-made changes in climate that might be adverse to the well-being of humanity*" (Figueres 2002, p. 7). The Declaration also identified increasing atmospheric concentrations of CO_2 from the combustion of fossil fuels, deforestation, and changes in land use as the leading cause of global climate change.[322] The Conference led to the formation of the World Climate Programme (WCP)[323] that was to be jointly administered by the WMO, UNEP, and the International Council of Scientific Unions (ICSU) to improve understanding of the climate system.

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[319] Ozone depleting substances that were added to the Vienna Convention include: Halogenated CFCs; Carbon Tetrachloride; Methyl Chloroform; Methyl Bromide; Hydrochlorofluorocarbons (HCFCs); Perfluorocarbons (PFCs); Hydrofluorocarbons (HFCs); Hydrobromofluorocarbons (HBFCs); and Bromochloromethane (BCM). Source: UNEP, Ozone Secretariat, *Treaties and Ratifications*, http://ozone.unep.org/Treaties_and_Ratification/index.asp (accessed on 04/08/06).

[320] Source: World Meteorological Organization (WMO), *Statement at the First Session of the Conference of the Parties to the UN Framework Convention on Climate Change*, G.O.P. Obasi, Secretary-General, WMO, Berlin, 28 March 1995, http://www.wmo.ch/web/Press/BERLIN.html (accessed on 04/08/06).

[321] Source: United Nations Environment Programme, Information Unit on Climate Change (IUCC), *Climate Change Fact Sheet 213*, http://unfccc.int/resource/ccsites/senegal/fact/fs213.htm (accessed on 04/08/06).

[322] Supra note 321.

[323] The World Climate Programme (WCP) has four primary components: the World Climate Data and Monitoring Programme (WCDMP); the World Climate Applications and Services Programme (WCASP); the World Climate Impact Assessment and Response Strategies Programme (WCIRP); and the World Climate Research Programme (WCRP). Source: the World Climate Programme (WCP), http://www.wmo.ch/web/wcp/wcp_prog.htm (accessed on 04/08/06).

The first World Climate Conference marked the beginning of worldwide concern for global climate change, the fourth environmental driver of sustainable development. Interestingly, while ozone depletion and global climate change were initially seen as separate issues, the international protocols developed (or amended) for both issues during the 1990s began to formally link the two problems. For example, PFCs (perfluorocarbons) and HFCs (hydrofluorocarbons) were treated as greenhouse gases by the 1997 Kyoto Protocol[324] and as ozone depleting substances (ODS) in the Montreal Protocol (Malabed et al. 2002). Similarly, while CFCs and HCFCs (hydrochlorofluorocarbons) have global warming potential, they are not covered by the Kyoto Protocol since they are adequately addressed by the Montreal Protocol (UNEP 1999). In addition, both Protocols recognize the importance of HCFCs as "*transitional*" substances that play a crucial role in phasing out ODS (ibid, p. 4).

In addition to providing an essential barrier to UV-B radiation, ozone is a greenhouse gas that contributes to both the warming and cooling of the troposphere - the region from the earth's surface to 10-16km altitude that contains approximately 10% of the total ozone column - and stratosphere (Fahey 2002).[325] While stratospheric ozone is often referred to as 'good' ozone due to its ability to absorb dangerous UV-B radiation, tropospheric ozone that is produced by the chemical reaction between NO_x and volatile organic compounds (VOCs) in the presence of heat and sunlight is called 'bad' ozone due to its destructive capabilities.[326] Since good ozone is required for protective properties and bad ozone is a *secondary pollutant*, neither stratospheric nor tropospheric ozone is covered by

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[324] The Kyoto Protocol calls upon Annex I parties (i.e., developed nations) to cut their greenhouse gas emissions by 5% from 1990 levels in the commitment period 2008-2012. See the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), Annex A, for a list of greenhouse gases, http://unfccc.int/resource/docs/convkp/kpeng.html (accessed on 04/09/06).

[325] "*Changes in stratospheric and tropospheric ozone both represent radiative forcings of climate change. Stratospheric ozone absorbs solar radiation, which heats the stratosphere and affects air motions and chemical reactions. Stratospheric and tropospheric ozone both absorb infrared radiation emitted by the Earth's surface, effectively trapping heat in the atmosphere below. Overall, the depletion of stratospheric ozone represents a negative radiative forcing. In contrast, increases in tropospheric ozone due to surface pollution represent a positive radiative forcing. The radiative forcing due to tropospheric ozone increases is larger than that associated with stratospheric ozone depletion. Both forcing terms are significant, but are small in comparison with the total forcing from all other greenhouse gases* [such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and Halogen-containing gases (including CFCs)]" (Fahey 2002, pp. Q34-Q35).

[326] The atmospheric chemistry of tropospheric ozone is complex and remains the focus of much scientific research. Since both VOCs and NO_x are produced by natural and anthropocentric sources, the mitigation of tropospheric ozone is difficult since it depends upon controlling human activity in relation to the natural environment. Thus, national clean air legislation must be able to adapt to regional and local conditions. However, since NO_x is only produced naturally in small quantities, the impact of NO_x from fuel combustion in automobiles and power plants can have a large impact on the production of ozone if VOCs is present in the troposphere. In some cases, VOCs might be produced by human sources; however, it may also be produced in large amounts from vegetation. The major problems with tropospheric ozone are that it can react with other molecules and severely damage the living tissue of plants and animals; advance respiratory problems such as asthma; and destroy certain materials such as rubber and nylon.
Sources: The NOAA Aeronomy Laboratory, *Regional Air Chemistry*, http://www.al.noaa.gov/WWWHD/Pubdocs/TropoRural.html, and the U.S. Environmental Protection Agency, *How Ground-level Ozone Affects the Way We Live and Breathe*, http://www.epa.gov/air/urbanair/ozone/index.html (accessed on 04/09/06).

the Kyoto Protocol, which deals specifically with 'emissions' of greenhouse gases. In general, bad tropospheric ozone is dealt with by clean air legislation, such as the U.S. Clean Air Act, where ozone is treated as one of six 'criteria' pollutants.[327]

Finally, since CFCs were produced in relatively small quantities and greenhouse gases (especially CO_2) are often inherent byproducts of major components of the economy (e.g., energy production, vehicle combustion engines, agriculture, etc.), the potential impact of the Kyoto Protocol on the international economy is far greater than that of the Montreal Protocol. Similarly, whereas the Montreal Protocol controls consumers and producers, the Kyoto Protocol focuses on the controls (or containment) of emissions, which is much more difficult to manage due to the scale of greenhouse gas emissions. These differences make integrating the objectives of the protocols more challenging, leading to a call for more "*flexible approaches*" to potential solutions to global climate problems (UNEP 1999, p. 5).

Regardless of the difficulties faced when trying to implement and integrate the Montreal and Kyoto Protocols, both Protocols signal that concern for the global climate has become a major component of the international environmental - and, hence, sustainable development - agenda.

3.3.6 The Emergence of a Concern for Occupational Safety and Health

The emergence of international concerns for the global climate in the 1970s was paralleled by the continual rise in concern for occupational health and safety in the U.S.

Formulated in the late 1960s and passed in 1970, the Occupational Health and Safety Act (OSH Act) was established to "*to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources.*"[328] The OSH Act created three agencies to manage occupational health and safety issues on a national level: [1] the Occupational Safety and Health Administration (OSHA);[329] [2] the National Institute for Occupational Safety and Health (NIOSH);[330]

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[327] The other pollutants are NO_x, particulate matter, nitrogen dioxide, sulfur dioxide, and lead.

[328] Source: Occupational Safety and Health Act, *Congressional statement of findings and declaration of purpose and policy*, Section 651 (b), http://www4.law.cornell.edu/uscode/29/651.html (accessed on 04/09/06).

[329] "*OSHA's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.*" Source: the Occupational Safety and Health Administration (OSHA). Source: OSHA, http://www.osha.gov/ (accessed on 04/09/06).

[330] "*NIOSH is in the U.S. Department of Health and Human Services and is an agency established to help assure safe and healthful working conditions for working men and women by providing research, information, education, and training in the field of occupational safety and health. NIOSH provides national and world leadership to prevent work-related illness, injury, disability, and death by gathering information, conducting scientific research, and translating the knowledge gained into products and services.*" Source: the National Institute for Occupational Safety and Health (NIOSH), *NIOSH Origins and Mission*, http://www.cdc.gov/niosh/about.html (accessed on 04/09/06).

and [3] the Occupational Safety and Health Review Commission (OSHRC).[331] The intent of the OSH Act was to separate research on occupational health risks and regulatory standard-setting between NIOSH and OSHA to ensure that scientific activities were kept neutral (OTA 1985). While other regulatory agencies combined scientific [risk] assessment and risk management in the same agency, the designers of the OSH Act were especially concerned about compromising worker protection through political manipulation of the science. In 1976, Nicholas Ashford published a seminal work funded by the Ford Foundation entitled *Crisis in the Workplace: Occupational Disease and Injury*,[332] which criticized the agencies for the poor coordination of their efforts.

The OSH Act and subsequent debates about the best mechanism for ensuring that occupational health and safety is achieved highlights what might be called an 'underemphasized element' of social and economic development.[333] Whereas environmental considerations became an integral part of economic and social development objectives post-Rio (Dernbach 1998), occupational health and safety has yet to be recognized by the international community in a comparable manner.[334] As with environmental standards, the idea of establishing a set of international occupational health and safety standards raises similar concerns about neo-protectionism. It is perceived that imposing such standards could increase the cost of labor in developing countries, making their industries less cost effective when compared to developed countries which would be able to compete through continual process and product innovations.

Regardless of the potential barriers to implementation, occupational health and safety should be integrated into development objectives in the same way that environmental protection considerations have been (WHO 1992). The key is to ensure that national sovereignty remains intact so that nations can implement such standards in a manner that

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[331] "*The Occupational Safety and Health Review Commission (OSHRC) is an independent Federal agency created to decide contests of citations or penalties resulting from OSHA inspections of American work places. The Review Commission, therefore, functions as an administrative court, with established procedures for conducting hearings, receiving evidence and rendering decisions by its Administrative Law Judges (ALJs).*" Source: the Occupational Safety and Health Review Commission (OSHRC), *Welcome*, http://www.oshrc.gov/ (accessed on 04/09/06).

[332] *Crisis in the Workplace: Occupational Disease and Injury* was based upon other significant works including: [1] Report of a Special Task Force to the Secretary of Health, Education, and Welfare (1973) *Work in America*, The MIT Press, Cambridge; [2] Page, J. A. and O'Brien, M. (1973) *Bitter Wages*, Grossman, New York; [3] Wallick, F. (1972) *The American Worker: An Endangered Species*, Ballantine Books, New York; [4] Davidson, R. (1970) *Peril on the Job: A Study of Hazards in the Chemical Industries*, Public Affairs Press, Washington, D.C.; and [5] Brodeur, P. (1973) 'Annals of Industry,' *New Yorker*, October 29-Novermber 26, 1973.

[333] We recall that social and economic development are two of the five components of sustainable development as defined by Dernbach (1998). The other components are peace and security, national governance that ensures peace and development, and environmental protection measures. In addition, for sustainable development to be realized, environmental protection must be integrated with economic and social development objectives.

[334] While the International Labour Organization (ILO) does represent an international concern for occupational health and safety, the failure of the U.S. to pay dues to the ILO, the general low priority given to worker protection by many nations, and the absence of strong labor unions in many countries – especially in the developing world – has left occupational health and safety on a weak footing.

suits their own development objectives. However, this stipulation may also prove to be the Achilles heel of such standards since there would be no legal mechanism to enforce them.

It is only by integrating seemingly disparate aspects of human life that core interdependencies are realized. Just as ozone depletion and global climate change are connected to development objectives and ecosystem integrity depends upon development decisions, the health and safety of workers (who constitute the majority of humankind) is also as dependent upon, and therefore must be integrated with, development objectives. Without this integration, it is hard to imagine a situation in which sustainable development - in a holistic sense - can be realized. In addition, the health and livelihood of workers would continue to be subordinate to [economic] development considerations. Such an outcome would run counter to the objectives of development outlined by the Cocoyoc Declaration and *What Now: Another Development*, which place human development before all other forms of development.

3.3.7 The 1973/4 and 1979 Oil Shocks

The OPEC oil embargo that began on October 17, 1973 and ran until its resolution on March 18, 1974 woke the international community to the realization that the oil upon which developed economies were (and still are) based is finite and, more ominous can be controlled. In response to the support that the U.S. and its Western European allies gave to Israel during its conflict with Egypt and Syria in the Yom Kippur War,[335] the Arab members of OPEC decided to cease their oil shipments to these countries.[336] In addition, the members of OPEC used their influence over the world price-setting mechanism for oil to successfully quadruple the price of oil. The impact of these measures was felt throughout the developed world, especially by the unemployed and low income members of society who could ill afford the sharp increases in the price of oil and gasoline. Governments were forced to install oil and gasoline rationing mechanisms, greatly affecting transportation and energy sectors and damaging economic growth.[337] "*The noncommunist industrial world saw sudden inflation and economic recession. Moreover, it underscored the interdependence of the world societies and economies.*"[338]

In response to the oil crisis, developed nations began to create more energy efficient transportation (e.g., automobiles in particular) and energy systems and reexamine their development objectives. We recall that the Cocoyoc Declaration was prepared five months after the oil embargo, which called into question the prevailing development

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[335] Source: Wikipedia, *Yom Kippur War*, http://en.wikipedia.org/wiki/Yom_Kippur_War (accessed on 04/09/06).
[336] Source: Wikipedia, *1973 Energy Crisis*, http://en.wikipedia.org/wiki/1973_energy_crisis (accessed on 04/09/06).
[337] For example, in the U.S., a license plate system was used to ration the distribution of gasoline. Drivers of automobiles that had an odd number as the last digit on their license plate were only allowed to purchase gasoline on odd-numbered days of the month, and vice versa. Source: Wikipedia, *1973 Energy Crisis*, http://en.wikipedia.org/wiki/1973_energy_crisis (accessed on 04/09/06).
[338] Supra note 336.

paradigm. The oil embargo brought home the message of *Limits to Growth* and provided some indication of what it might be like when a system begins to exhibit the symptoms of overshoot and collapse. However, in this instance, one might argue that political limits, rather than ecological and resource limits, caused the problem. Nevertheless, the realization that the finite resources upon which the international economy was based *could* run out (the second environmental driver of sustainable development) was a rude awakening for many and a source of redemptions for others.[339]

Some six years later, the world experienced a second oil shock as oil exports from Iran were drastically reduced following the Iranian Revolution in 1979.[340] In response to the oil shortage in the U.S., President Carter announced a program to encourage the use and development of solar energy, established temperature restrictions in nonresidential buildings, and proposed an $88 billion decade-long effort to enhance production of synthetic fuels from coal and shale oil reserves - all designed to encourage energy conservation and reduce the reliance on international oil.[341]

The energy shocks of the 1970s forced nations to question the assumptions upon which they had planned their development (UNEP 1982b). A reliance on finite resources was generally understood as being a recipe for disaster and conservation became a leading concern of many governments. Furthermore the two oil shocks set in motion a series of events that would later lead to the eventual collapse and restructuring of the world market during the second half of the 1980s (Boughton 2001; Redclift 1996; Riesenhuber 2001).[342]

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[339] The topic of oil supply was debated at the Transportation Research Board (TRB) 82nd Annual Meeting in Washington, D.C., January 2003. During the session entitled "*Transportation Energy Use in the Long Term, Part 3: Oil Supply - How Limited Is the Resource Base?*," Roger Bentley from the University of Reading (UK) stated that the world has used approximately 46% of all known oil reserves (estimated to be between 2000 - 3000 billion barrels of oil) and that oil use (or extraction) would peak around 2010. John Wood, from the U.S. Department of Energy, presented a somewhat more optimistic scenario with oil use peaking sometime between 2010 and 2020. Both scenarios confirm the finality of oil supplies and that a rapid increase in the number of gasoline/diesel powered vehicles will ultimately be unsustainable in the long-term (i.e., in the next 50 years).

[340] Source: Wikipedia, *1979 Energy Crisis*, http://en.wikipedia.org/wiki/1979_energy_crisis (accessed on 04/09/06).

[341] Source: U.S. Department of Energy, *Department of Energy 1977 - 1994, A Summary History*, http://www.cfo.doe.gov/me70/history/Summary_History.pdf (accessed on 04/09/06).

[342] The high price of oil during the 1970s meant that oil-exporting nations had gradually built up large amounts of surplus income. This "*investable surplus*" was subsequently invested in foreign assets and was deposited back in the banks of oil-importing nations from which a large proportion of the money had originated (Riesenhuber 2001, p. 28). The increase in the liquidity of western banks corresponded with a lull in their domestic investment demand, forcing them to look for other avenues for lending (ibid, p. 28). The oil-importing developing nations were identified as a prime candidate for increased lending, which took advantage of the loans for balance of payment purposes at the expense of increasing their overall external debt. At this point in time, the common wisdom was that a 'nation' could not default on its loans, which partly explains the ease with which these loans were given to the already in debt oil-importing developing nations (Boughton 2001). As interest rates began to rise in developed nations during the early 1980s, the heavily indebted nations were unable to make their debt payments and Mexico was the first to default on a loan payment in 1982. The ensuing debt crisis lasted until 1989 and involved almost 20 nations around the world (ibid, p. 274). The crisis led to the restructuring of international markets and redefined the

3.3.8 Reflection on a Decade of Debate (the 1970s)

The previous sections discussed how the 1972 Stockholm conference on the Human Environment played an influential role in formulating the international environmental agenda. This section summarizes the major themes that emerged during the 1970s and highlights the progress that was made in addressing environmental problems in the decade after the Stockholm conference.

Before discussing the impacts of the Stockholm conference, it is useful to recall the factors that led to its formation. Arguably, one of the most critical factors was the growing disquiet about the local/regional environmental side effects of industrial processes in developed nations - particularly in the U.S. During this period, the prevailing wisdom that environment damage was simply an unfortunate consequence of economic development came under intense scrutiny. The outcome of this concern was the formation of numerous national environmental agendas which gave the UN and the international community all the impetus they needed to consider the broader picture of the human environment at Stockholm.

However, at the time of the Stockholm conference, the environmental concerns of developing nations were of a different kind. They were mainly connected to rural and urban poverty and to the lack of development. Therefore, in the pre-Stockholm deliberations, the UN made a conscious effort to promote the interests of developing nations. Hence, developing nations were given an opportunity to articulate their vision of what development encompassed and what this meant to the human environment.

The combination of developed and developing country interests over the protection of the environment unleashed a series of contrasting beliefs about how the process of 'development' should be approached. Developed nations sought to establish measures to protect the environment similar to those that they themselves had adopted. Developing nations interpreted this proposition as a potential form of neo-protectionism. They argued that environmental improvement was only one of the many objectives of development and that its priority should be determined by each society depending on its level of development. Their objective was to ensure that developed nations did not encroach upon their ability to make decisions within their own framework of, and priorities for, economic and social planning.

Largely as the result of the Founex Report and the UN General Assembly's 1971 Resolution 2849 (XXVI), the intense debates between developed and developing nations were resolved by the conclusion that the contradictions between the environment and development could be addressed by mutually supportive initiatives. In particular, these documents stated that each nation has permanent sovereignty over its natural resources; that environmental policies of developed nations should not affect the present or future development possibilities of the developing nations; and that each nation state has the right to develop its own economy, priorities, and environmental standards and criteria,

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purpose and role of institutions such as the International Monetary Fund (IMF) (Boughton 2001; Riesenhuber 2001).

and place its own value on its social costs of production. In addition, there was a clear recognition that the actions taken by each nation state should not generate harmful effects in other nations. These basic principles were later formalized in the Stockholm Declaration, which also called for the transfer of substantial quantities of financial and technological assistance to developing nations to help them develop while protecting the environment. In addition, the Stockholm conference published an Action Plan to guide future government action and established UNEP and the Environment Fund in which developed nations could deposit financial aid to assist developing countries.

As well as legitimizing the importance of national environmental policies and engendering public support for environmental initiatives, Stockholm raised the question of what 'development' actually is. The publications *The Entropy Law and the Economic Process*, *Blueprint for Survival*, and *Limits to Growth* made a clear statement that the prevailing development process was fatally flawed and would lead humanity to self-destruct (in one way or another) if radical changes were not taken to achieve a steady-state society. Such a society might be described as one in which technology, affluence, and population are in balance and do not lead to negative environmental and social impacts or the squandering of vital natural resources. In particular, *The Entropy Law and the Economic Process* argued that humanity had selected the wrong source of low entropy - i.e., finite terrestrial resources - upon which to base development. It called for a shift to solar energy, but realized that such a transition would not be easy since the modern economy required vast amounts of energy to fuel its growth. Similarly, the message that *Blueprint for Survival* and *Limits to Growth* gave was that the lifestyle of developed nations was likely to fall as natural limits are reached, and, therefore, developing nations had no realistic hope of achieving such a standard of living. Such a stark message did not bode well with people from either developed or developing nations. Governments were also affronted by *Blueprint for Survival's* statement that the fixation with economic growth would ultimately lead to more economic growth and an entrenchment in the industrial processes that were destroying ecosystems and harming human health.

The emergence of the notion of *eco-development* (post-Stockholm) combined with the Cocoyoc Declaration (1974) and a number of influential publications (such as *Small is Beautiful* and *What Now: Another Development*) presented a new vision of development. Primarily, the emerging theme of the mid-1970s was that development should focus on meeting basic physiological and psychological human needs - of both the poor *and* the affluent. It called for *national self-reliance* and for *ecological* and *economically* sound regional and local development (eco-development). It warned of the dangers of relying on economic growth as an indicator of development and rejected an international economic system that stripped nation states of their natural resources and exploited human capital. The theory was that enabling developing nations to separate (temporally) from the international economy would allow them to become reliant on their own natural and human resources. In addition, the international financial and technological assistance promised at Stockholm would help accelerate this process and protect the environment. This reformulation of development also rebutted the belief that there is only one

development trajectory - that of the developed nations - and argued that the international community must respect and welcome cultural diversity between nation states.

However, this new vision of eco-development was destined to fail in a world where economic growth was still the mainstay of development. Further, it tilted the balance of international power to developing nations, which up until this time were dependent on the multinational companies based in developed nations. Allowing national self-reliance would have reduced opportunities for economic growth at a time when developed nations were experiencing energy shortages and economic recession. Thus, as the financial support for international bodies such as UNEP waned during the 1970s, so too did the international enthusiasm for eco-development.

In 1980, the UN General Assembly decided "*to convene, in 1982, a session of a special character of the Governing Council of the United Nations Environment Programme, open to all states, to commemorate the tenth anniversary of the United Nations Conference on the Human Environment.*"[343] The meeting was designed to [1] review progress in implementing the Stockholm Action Plan, and [2] make recommendations with respect to prevailing environmental trends for the future actions of UNEP. On 10-18 May 1982, the meeting (often referred to as Stockholm +10) was held in Nairobi, Kenya.

In preparation for this tenth-anniversary meeting, UNEP published two reports: one that addressed the implementation of the Stockholm Action Plan - *The Environment in 1982: Retrospect and Prospect* (UNEP 1982a) - and another that documented major research efforts and environmental trends and problems - *The World Environment 1972-1982: A Report by the United Nations Environment Programme* (UNEP 1982c). In addition, two years earlier in 1980, the World Conservation Union,[344] UNEP, and WWF (World Wildlife Fund) published the *World Conservation Strategy*. This report focused on living resource conservation and charted the destruction of the natural environment by human activity. These reports subsequently informed the Nairobi Declaration that was adopted by the 'session of a special character' of the Governing Council of UNEP on 18 May 1982. Box 3.7 presents a series of excerpts from the Nairobi Declaration that discusses the Stockholm conference and the progress achieved since 1972. The excerpts focus specifically on the Stockholm Declaration and the Action Plan, UNEP, and the Environmental Fund.

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[343] Source: UN General Assembly, 35th Session, *International Co-operation in the Field of the Environment*, A/RES/35/74, 5 December 1980, http://www.un.org/documents/ga/res/35/a35r74e.pdf (accessed on 04/09/06). Also see UN General Assembly, 36th Session, *Session of a special character of the Governing Council of the United Nations Environment Programme*, A/RES/36/189, 5 December 1980 http://www.un.org/documents/ga/res/36/a36r189.htm (accessed on 04/09/06).

[344] The World Conservation Union was formerly known as the International Union for the Conservation of Nature and Natural Resources.

Box 3.7: Excerpts from the Nairobi Declaration, 1982 [345]

The world community of states, ... having reviewed the measures taken to implement the Declaration and Action Plan adopted at ... [the Stockholm] Conference, solemnly requests Governments and people to build on the progress so far achieved, but expresses its serious concern about the present state of the environment worldwide, and recognizes the urgent necessity of intensifying the efforts at the global, regional and national levels to protect and improve it.

1. The Stockholm Conference was a powerful force in increasing public awareness and understanding of the fragility of the human environment. ... The principles of the Stockholm Declaration are as valid today as they were in 1972. They provide a basic code of environmental conduct for the years to come.

2. However, the Action Plan has only been partially implemented, and the results cannot be considered as satisfactory, due mainly to inadequate foresight and understanding of the long-term benefits of environmental protection, to inadequate co-ordination of approaches and efforts, and to unavailability and inequitable distribution of resources. For these reasons, the Action Plan has not had sufficient impact on the international community as a whole. Some uncontrolled deterioration, deforestation, soil and water degradation and desertification are reaching alarming proportions, and seriously endanger the living conditions in large parts of the world. Diseases associated with adverse environmental conditions continue to cause human misery. Changes in the atmosphere – such as those in the ozone layer, the increasing concentration of carbon dioxide, and acid rain-pollution of the seas and inland waters, careless use and disposal of hazardous substances and the extinction of animal and plant species constitute further grave threats to the human environment.

...

10. The world community of states solemnly reaffirms its commitment to the Stockholm Declaration and Action Plan, as well as to the further strengthening and expansion of national efforts and international co-operation in the field of environmental protection. It also reaffirms its support for strengthening the United Nations Environment Programme as the major catalytic instrument for global environmental co-operation, and calls for increased resources to be made available, in particular through the Environments [F]und, to address the problems of the environment. ...

The Nairobi Declaration and UNEP reports presented a clear message that while nation states had made progress towards environmental protection, their actions were insufficient to reverse the rate of environmental degradation occurring throughout the world. Thus, the answer to the first objective of the Nairobi meeting was that little substantive progress had been made towards implementing the Action Plan since Stockholm.

However, this pessimistic conclusion should be tempered by the fact that it is unrealistic to expect the priorities of national governments to be redirected and the environmental and social problems faced throughout the world to be solved in only one decade (Caldwell and Weiland 1996). To provide an example of the progress that was made with regards to the international environmental agenda, Box 3.8 presents the major treaties and conventions signed between 1963 and 1979. During the 1970s there was a decisive shift in the content of treaties/conventions towards the protection of the human environment and wildlife. However, at the time of the Nairobi meeting, many remained skeptical that the progress made during the 1970s could be sustained into the 1980s due to the

[345] Source: United Nations Environment Programme, *Nairobi Declaration* (1982), *Resolution of the Governing Council at its Session of a Special Character*, 18 May 1982. http://www.unep.org/DPDL/Law/PDF/NairobiDeclaration1982.pdf (accessed on 04/09/06).

prevailing economic, financial, and political problems facing the international community.[346]

Box 3.8: Major Treaties and Conventions - 1963 to 1979

Year	Treaty/Convention/Protocol
1963	The Treaty Banning Nuclear Weapon Tests in the Atmosphere, Outer Space and Under Water
1965	The International Covenant on Economic, Social and Cultural Rights (ICESCR)
1967	The Convention for the Protection of Industrial Property
1968	The Treaty on the Non-proliferation of Nuclear Weapons
1971	The Convention on Wetlands of International Importance especially as Waterfowl Habitat
1972	The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
	The Convention Concerning the Protection of the World Cultural and Natural Heritage
1973	The Convention for the Prevention of Pollution from Ships (MARPOL)
1974	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	The Nordic Environmental Protection Convention
1979	The Convention on Long-Range Transboundary Air Pollution (Geneva Convention)
	The Convention on the Conservation of Migratory Species of Wild Animals

The response to the second objective of the Nairobi meeting - to make recommendations for the future actions of UNEP - seemed equally pessimistic.[347] In an editorial in *The Ecologist* magazine, Edward Goldsmith reported that the delegates present in Nairobi "*had undoubtedly received specific instructions to underplay environmental problems in order to justify their government's environmentally destructive policies*" (Goldsmith 1982, p. 99). Goldsmith cites the German delegation's report to the Ministry of Foreign Affairs in Bonn that apologized "*for not having been able to prevent a debate on the issue of Armaments and the Environment, as they had been instructed to do*" (ibid, p. 99). Similarly, Caldwell and Weiland (1996) argue that the elements of the Action Plan that had been implemented were those connected to monitoring, information exchange,

[346] Source: UNEP, *Report of the Governing Council on its Tenth Session, General Debate*, 44, http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=70&ArticleID=702 (accessed on 04/09/06).

[347] In a review of the first 20 years of UNEP, John McCormick (1995) describes four sources of problems that impeded UNEP's ability to carry out its mission effectively: [1] there was a continual lack of funding; [2] UNEP was hindered by management that was inefficient, did not adequately outline its priorities, and tried to address far more than its human and financial resources could handle; [3] UNEP's location in Nairobi tended to isolate it from the industrialized nations where many decisions that affected the global environment were made, the location made it difficult to recruit highly qualified staff, and it tended to divide UNEP between the wishes of developed and developing nations (Note: Due to its location, developing nations adopted UNEP as their 'own' UN agency); and [4] UNEP's constitution divided the attention of its headquarters between the Programme proper and the management of the Environment Fund (which were to be considered separately), and did not provide UNEP with adequate executive powers, meaning that it had to work through other UN specialized agencies with little incentives to encourage cooperation and with no powers of program enforcement. Notwithstanding these problems, McCormick (1995) highlights UNEP's 1974 Regional Seas Programme (designed to reduce pollution and coastal degradation in shared seas) and its involvement in the 1985 Vienna Convention and 1987 Montreal Protocol (designed to protect the ozone layer by limiting the production of CFCs and halons) as two of its most notable successes.

research, and public awareness - what one might call the low-hanging fruit. Governments had been reluctant to address issues that affect "*economic or development interests or required a major reorientation of policy and administration at national levels, ...* [except] *in those infrequent cases of urgent popular demand*" (ibid, p. 97). In a somewhat cynical tone, Caldwell and Weiland suggest that in the future "*the state of the environment would worsen, but UNEP would be able to monitor the where and why of its decline*" (ibid, p. 97). Thus, while the Nairobi Declaration and the subsequent UN General Assembly Resolution (37/219)[348] called for enhanced national efforts and international co-operation in the field of environmental protection and for the strengthening of UNEP, there were grounds upon which one could question whether nation states would answer this call in good faith.

In addition, the Nairobi meeting also raised several other important issues that warrant discussion. First, the negative impacts of over-population were formally recognized as a growing problem. Whereas population had been largely overlooked at the Stockholm conference,[349] it played a much more prominent role at the Nairobi meeting. In particular, the Nairobi Declaration made an explicit connection between population, resources, and the health of the environment: "*During the last decade, new perceptions have emerged: the need for environmental management and assessment, the* [proposition of a] ... *complex interrelationship between environment, development, population and resources and the strain on the environment generated, particularly in urban areas, by increasing population have become widely recognized.*"[350]

Second, during the decade since Stockholm, developing countries that had previously rejected the imposition of strict environmental standards had now become worried about the damage that was being done to their environment (Redclift 1984, p. 49). Their concern was that this environmental damage was affecting both the health of their people and their future development prospects. This transition in opinion is most clearly reflected in the report of the Governing Council of UNEP on the general debate at the Nairobi meeting: "*Differences of views between developed and developing countries with regard to environmental perceptions had to a large extent faded over the last 10 years, and the concepts of sustainable development and rational management of natural resources were now widely accepted as the cornerstones of environmental policies.*"[351] Hence, it was unlikely that developing nations would continue to disagree, in principle, with the creation of standards to protect the environment upon which their livelihoods depended.

Finally, of most importance, the Nairobi meeting highlighted a reversal of the perceived impacts of economic growth. The UNEP report entitled *The Environment in 1982:*

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[348] Source: UN General Assembly, 37th Session, *Session of a special character of the Governing Council of the United Nations Environment Programme*, A/RES/37/219, Adopted at the 113th plenary meeting, 20 December 1982. http://www.un.org/documents/ga/res/37/a37r219.htm (accessed on 04/09/06).
[349] Supra note 244.
[350] Supra note 345.
[351] Source: UNEP, *Report of the Governing Council on its Tenth Session, General Debate*, 36, http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=70&ArticleID=702 (accessed on 04/09/06).

Retrospect and Prospect, provides a succinct description of the turnaround in opinion: "*A decade ago the desirability of further economic growth was questioned in some quarters but the negative effects of the recent slow-down in economic growth, have reinforced the view that it is an essential instrument in achieving social goals. In developing countries particularly, economic growth is vitally important and remains a major force for improving the health and welfare of people. It is now perceived that economic growth can often be managed not only to avoid environmental degradation but also, in many cases, to improve the environment*" (UNEP 1982a, p. 37).[352] The notion that economic growth was essential to environmental protection was also recognized by the Resolution of the UNEP Governing Council at its Session of a Special Character in May 1982. In particular, the Resolution stated that the past decade had experienced a "*worsening of environmental problems in developing countries arising from the present international economic order which has slowed down their development and the protection of their environment.*"[353]

If we recall that the initial concerns for the human environment grew from the negative impacts of industrialization in developed countries, the shift in the international focus towards the environmental problems faced by developing nations is of significant importance. By identifying poverty as a major contributor to environmental degradation,[354] the importance of economic growth grew since it was the only pragmatic way of alleviating poverty. Developing countries argued that if poverty and underdevelopment were made a priority, it would enable them to break free from the poverty trap in which poverty and environmental degradation were continually worsening. However, since no progress had been made during the 1970s on creating a new form of environmentally sound development, the only way to grow the economy was to follow the path of conventional development (Dernbach 1998). This meant a reliance on technology that is fueled by non-renewable resources and generates a significant amount of pollution which would likely damage ecosystems and human health. Whereas

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[352] The slow growth of the world economy during the early 1980s, combined with rising debt service obligations and a reduction in the inflow of finance, meant that many developing nations faced severe economic crises and were forced to reduce social spending and curtail environmental protection efforts (Redclift 1996; WECD 1987). The 1991 UNEP report on *The State of the World Environment* described the 1980s as being the "*lost decade*" (UNEP 1991, p. 2). The report criticized the structural adjustment policies of developing nations that were designed to dampen demand, devalue the currency, remove subsidies from fuel and food stuffs, and reduce government spending (ibid, p. 3). In particular, it stated that the poor tended to bear the brunt of such policies, which had the result of increasing malnutrition and reducing health services and school enrollment rates. It concluded that these negative affects of structural adjustment were "*inhuman and ultimately inefficient*" and that future adjustment policies must have a "*human face - which protects the poor*" (ibid, p. 4).

[353] Source: UNEP, *Report of the Governing Council on its Tenth Session, Resolution of the Governing Council at its Session of a Special Character*, Section 1 (e), http://www.unep.org/Documents/Default.asp?DocumentID=70&ArticleID=723 (accessed on 04/09/06).

[354] Returning to the report of the Governing Council of UNEP on the general debate at the Nairobi meeting: "*There was broad agreement on the need to make a direct attack on poverty, which was the main source of environmental degradation in the third world*[;] *breaking the vicious circle of extreme poverty would help to unravel the tangled interrelationships between population, resources, development and the environment.*" Source: UNEP, *Report of the Governing Council on its Tenth Session, General Debate*, 51, http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=70&ArticleID=702 (accessed on 04/09/06).

developing nations made the case in the 1971 Founex report that since their environment had not been burdened by industrial pollution they could carry a certain amount of industrial activity, their position changed during the next decade as studies revealed the worsening condition of their environment (UNEP 1982b; 1982c). Thus, developing countries faced a paradox. They needed to develop to protect and improve their environment - upon which their future depended - but in doing so they would ultimately damage the very environment they wished to safeguard. This contradiction led to the birth of sustainable development, the idea that development and environmental protection could advance in unison. Hence, sustainable development would not only be able to meet the needs of the present, but do so in a manner that does not damage the environment and compromise the ability of future generations to meet their needs (WCED 1987, p. 43).[355]

Hence, national self-reliance - a key element of eco-development - had lost to the pressures of the international economy. The strong political support for economic growth (mainly from developed nations which dominated the international economy), combined with the economic potential that the international economy afforded, provided a more attractive and rapid development path than that offered by eco-development. One might argue, however, that in abandoning eco-development, humanity lost its ability to develop alternative pathways of development that could have been nurtured within developing nations throughout the world. Critics of the Nairobi meeting suggest that developed nations had successfully argued that it was poverty that was the major problem, not the damaging consumptive behavior of the affluent, and since economic growth was seen as the only way to alleviate poverty, it must also be the only way to protect the environment (Goldsmith 1982).[356]

In summary, the 1970s played an influential role in establishing the global environmental and sustainable development agendas. By the end of the 1970s, all four environmental drivers of sustainable development had been recognized to varying degrees. However, the concept of sustainable development had yet to be formulated in any rigorous manner. A good example of the impact of the 1970s international environmental agenda is the *World*

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[355] In 1982, the International Institute for Environment and Development (IIED) presented its definition of sustainable development: "*the process of improving the living conditions of the poorer majority of mankind while avoiding the destruction of natural and living resources, so that increases of production and improvements in living conditions can be sustained in the longer term*" (IIED 1982, p. 7). This definition provides a clear indication that the concept of sustainable development was initially focused towards the plight of developing nations and the 'poorer majority of mankind.' The IIED definition does not make any reference to the impacts that industrial processes were having on the environment, neither does it mention the associated environmental impacts from high levels of consumption. In fact, it calls for an increase in production without any mention of the necessity of cleaner production processes. McCormick (1995) suggests that a simpler and more appropriate version of the IIED definition of sustainable development might be "*economic development that takes place within the carrying capacity of the natural environment*" (ibid, p. 180). While this does cover the actions of both developed and developing nations, identifying the carrying capacity of the environment is difficult at best. For more discussion on the definitions of sustainable development, see Section 4.1.

[356] In addition, the lack of any attempt to define poverty during the 1970s was criticized since there was seen to be a tremendous difference between impoverished Americans, for example, and an indigenous society living in harmony with the natural environment (Goldsmith 1982). Monetary income would have little meaning for the latter group, who might be described as living in extreme poverty if income was the only measure of wealth.

Charter for Nature, adopted by the UN General Assembly on 28 October 1982.[357] The Charter was adopted by a majority of 111 to 1, with 18 abstentions (Caldwell and Weiland 1996). The U.S., a world leader in environmental issues since 1972, was the only nation state to vote against the Charter in fear that it would negatively affect economic growth.[358]

The Charter, originally proposed by the President of Zaire at the Twelfth General Assembly of the International Union for Conservation of Nature and Natural Resources (IUCN) in 1975 (Caldwell and Weiland, 1996), was designed to ensure that nation states could exercise "*their permanent sovereignty over their natural resources, ...* [and] *conduct their activities in recognition of the supreme importance of protecting natural systems, maintaining the balance and quality of nature and conserving natural resources, in the interests of present and future generations.*"[359] However, the language used in the Charter was idealistic, making it almost impossible to operationalize. The word 'shall' is used no less than forty-six times. Notwithstanding the Charter's exhortative vision of how humanity can live with nature, it does provide a set of general principles, functions, and guidance on the implementation of these principles and functions that remains relevant to this day. Caldwell and Weiland (1996, p. 100) suggest that the Charter did not reflect prevailing political realities, but instead laid out "*standards of ethical conduct*" and provided a "*symbolic expression of hope.*" Further, they suggest that the Charter might be regarded as the "*decalogue of the International Environmental Movement and the World Conservation Strategy as its expression in practice*" (ibid, p. 100).

To conclude, while the 1970s formulated the international environmental agenda by highlighting the divisive thrusts of *science*, *markets*, and of *nations* (Ward and Dubos 1971), the following decades would turn to these critical factors of development as a source of renewed hope that the process of development can become *sustainable*.

3.4 The Rise of an International Concern for Sustainable Development

We begin this section with a discussion of events in 1980, the year that the term sustainable development gained common parlance in the international arena. Although the term had been used around the time of the Cocoyoc meeting in 1974, it was not until the publication and worldwide launch (in more than 40 countries) of the *World Conservation Strategy* (WCS) in March of 1980 that it began to be used by the international community. The purpose of this section is to chart the formulation and rise

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[357] Source: UN General Assembly, 37th Session, *World Charter for Nature*, A/RES/37/7, Adopted at the 48th plenary meeting, 28 October 1982, http://www.un.org/documents/ga/res/37/a37r007.htm (accessed on 04/09/06).

[358] The U.S. position was indicative of the actions undertaken during the Reagan Administration of the 1980s where the government's concern for the environment lulled as conservative interests and business groups led a successful campaign for deregulation and decreased funding for environmental policy (Kraft 2002).

[359] Supra note 357.

of the notion of sustainable development and document some of the influential events, publications, and U.S. legislation that occurred between 1980 and 2004 (Box 3.9).

3.4.1 U.S. Environmental Legislation and International Treaties and Conventions: 1980 to 2004

The purpose of this section is to highlight major U.S. environmental legislation and international treaties and conventions that were established during the last two decades of the twentieth century. The rationale behind the focus on U.S. legislation is to continue to present an example of how national environmental agendas developed during this period. In addition, this section takes a brief look at the institutionalization of the U.S. environmental movement during the 1980s and 1990s.

Box 3.9 indicates that during the 1980s and 1990s, new environmental legislation in the U.S. focused on:

1. *decontaminating hazardous waste sites* - with the enactment and amendment of the Superfund legislation in 1980 and 1986, respectively;
2. *informing and protecting society from dangerous chemicals* - with the enactment of the 1986 Emergency Planning & Community Right to Know Act (EPCRA) and the 1999 Chemical Safety Information, Site Security and Fuels Act;
3. *preventing industrial pollution* - with the enactment of the 1990 Oil Pollution Act (the year following the Exxon Valdez oil spill) and the Pollution Prevention Act;
4. *strengthening the regulation of pesticides* - with the enactment of the 1996 Food Quality Protection Act (FQPA) which amended the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972; and
5. *creating sector-specific legislation designed to protect the environment while facilitating development* - the U.S. surface transportation legislation enacted in 1991, and reauthorized in 1998, provides an example of sector-specific legislation that attempted to integrate transportation planning and programming with a concern for the environment.[360]

The development of legislation in the U.S. reflects the major events of the 1970s, 1980s, and 1990s. The rise of a concern for toxic (or hazardous) chemicals in the 1970s (the third environmental driver of sustainable development) clearly remained an important issue during the 1980s and 1990s, as did the need to reduce industrial pollution. In addition, the emergence of sustainable development during the 1980s is reflected by

[360] For example, the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 declared that it "*is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient and environmentally sound, provides the foundation for the nation to compete in the global economy, and will move people and goods in an energy-efficient manner. ... The National Intermodal Transportation System shall consist of all forms of transportation in a unified, interconnected manner, including the transportation systems of the future, to reduce energy consumption and air pollution while promoting economic development and supporting the Nation's preeminent position in international commerce.*" Thus, this 'declaration of policy' established a clear intent for the Department of Transportation to follow the objectives of sustainable development. Source: ISTEA, 1991, Section I, http://ntl.bts.gov/DOCS/istea.html (accessed on 04/09/06).

sector-specific legislation that began to incorporate the principles of the new development paradigm.

A look at the U.S. environmental movement during this period is informative. We recall from Section 3.2.1 that the U.S. environmental movement of the 1960s was predominantly a grassroots movement. Established in response to a series of influential environmental publications and a number of highly visible environmental disasters, the movement was successful in forcing the U.S. government to establish the National Environmental Policy Act (NEPA) and the Environmental Protection Agency (EPA) in the early 1970s. The subsequent environmental legislation formed between the signing of NEPA in 1970 and the enactment of the Superfund legislation in 1980 (Box 3.2) created what became, and still is, virtually the entire environmental regulatory framework in the U.S. (Coglianese 2001, p. 12). This decade of environmental legislative activity led to the "*institutionalization of the environmental movement*" and to some notable improvements in the environment (ibid, p. 29).

Since environmental protection measures were now codified into law, environmental groups were forced to focus their attention on insider political strategies, lobbying, and other tactics often used by industry groups. This shift in attention also led to a transformation in the structure of grassroot environmental groups, which now needed scientists, economists, lawyers, fundraisers, media consultants, and recruitment specialists to maintain the laws they had fought so hard to establish (Coglianese 2001, pp. 14-16).

During the 1980s and 1990s, there were several attempts by elected officials to weaken the legal protection of the environment in order to reduce the burdens of federal regulation (Coglianese 2001, pp. 16-18). These attempts occurred mainly during the Reagan Administration's 'countermovement' and the Clinton Administration when Republicans captured both the Senate and the House of Representatives. However, each time environmental regulations came under serious threat, the environmental groups were able raise public awareness and use court-based challenges to protect the environmental regulatory framework. As Coglianese (2001, p. 18) argues, "*even though the environment may not have been foremost in their minds during the early 1990s, Americans were still very much concerned about the environment.*"[361]

During this same period, there were growing divisions within the environmental movement, which rejected the institutionalization of environmental concerns and saw the

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[361] Coglianese (2001) presents an interesting set of data that indicates the relatively high level of public support for environmental concerns during the 1980s and 1990s: "*In 1980, sixty-two percent of the public surveyed in a national poll were sympathetic to the environmental movement or active within it, while only four percent said they were unsympathetic. ... In 1992, a national poll found that eighty-one percent of respondents viewed themselves as sympathetic to the movement or active within it, with only two percent claiming to be unsympathetic. ... In 2001, even in the face of concerns about an economic slowdown, sixty-eight percent of Americans still claimed to be sympathetic to the environmental movement or active within it, while only five percent reported that they were unsympathetic. ... According to a 1991 poll, as many as nine out of ten Americans are willing to identify themselves, at least weakly, as environmentalists*" (ibid, pp. 22-23).

mainstream environmental groups as being "*insular, bureaucratized, and out of touch*" (Coglianese 2001, p. 19).[362] The concern was that the environmental movement's focus on protecting established environmental laws meant that it was unable to pursue litigation designed to achieve "*transformational results*" (ibid, p. 15). Whereas the movement had once been a minority (activist) player in the political process, it was now an established part of the "*American political and social fabric*" (ibid, p. 16). Being an established member of the political process meant that the environmental movement entered a period of "*steady state environmentalism*" (ibid, p. 21) in which changes to the "*institutional status quo*" were vigorously resisted (ibid, p. 22).[363] The success in combating the environmental problems of the 1970s had also created a certain amount of public complacency regarding the need to address new, and serious, environmental problems. Hence, the transition into 'steady state environmentalism' has meant that new advances in environmental legislation are unlikely; however, it also means that the U.S. environmental framework will largely remain intact for the years to come.

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[362] In particular, three new strands of environmentalism were formed within the broader environmental movement (Coglianese 2001, pp. 18-21). First, there was the 'deep ecology' movement that placed the well-being and flourishing of human *and* non-human life at the center of decision-making. Second, there was the establishment of the 'environmental justice' movement to protect poor and minority communities that were experiencing some of the worst levels of pollution. Finally, there was an emergence of 'ecotheology,' which combined religion and conservation and argued that nature has a spiritual value and therefore humankind is "*obligated to protect and preserve the environment*" (ibid, p. 20).

[363] See Brulle (2000) for an informative and comprehensive analysis of the major strands of the U.S. environmental movement. Brulle's thesis is that the structure of the environmental social movement, which is based upon prevailing cultural and social systems, is unlikely to help transition the U.S. towards a society that is both democratic and ecologically sustainable. "*If an ecologically sustainable society is to be created, social learning must be rapidly expanded, resistance must be overcome, and intentionally directed social change must be accelerated. This is a difficult theoretical and practical task, but it must be undertaken if we are to avoid the extraordinary suffering and misery that will be inflicted on all of the Earth's living beings if the projected level of ecological disruption occurs* [ibid, p. 7.]. ... *The environmental social movement in the United States is a key component in fostering such change*" (ibid, p. 12). By analyzing the core objectives, internal structures, funding, and political practices of a wide range of environmental organizations, Brulle (2000) is able to make recommendations on how the environmental movement can reform its organizational practices to transition society towards democracy and ecological sustainability.

Box 3.9: The Emergence of Sustainable Development - 1980 to 2004

Year	Events	Publications	U.S. Legislation
1980		*World Conservation Strategy* - Published by IUCN (The World Conservation Union), UNEP, and WWF. *North-South: A Program for Survival* - Report by the Independent Commission on International Development Issues. *The Global 2000 Report to the President* - Report by the U.S. Council on Environmental Quality and the Department of State.	The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - also known as Superfund.
1981		*Global Strategy for Health for All by the Year 2000* - Prepared by the World Health Organization.	
1982	International debt crisis erupts and threatens the world financial system. World Resource Institute (WRI) is established.	*The Environment in 1982: Retrospect and Prospect* - UNEP. *The World Environment: 1972-1982* - UNEP. *World Charter for Nature* - Adopted by the UN General Assembly.	
1983	World Commission on Environment and Development (WCED) is formed.	*Environmental Research and Management Priorities for the 1980s* - Report prepared by an international group of scientists on behalf of the Royal Swedish Academy of Sciences.	
1984	Drought in Ethiopia - between 250,000 and 1 million people die from starvation. Bhopal incident - a leak of deadly methyl isocyanate at a Union Carbide pesticide plant in Bhopal, India kills thousands of people. OECD International Conference on Environment and Economics is held in Paris, France.		
1985	British scientists discover an ozone hole over the Antarctic. World Meteorological Society, UNEP, and International Council of Scientific Unions meet in Villach, Austria to report on the build-up of CO_2 and other greenhouse gases in the atmosphere.		

Box 3.9: The Emergence of Sustainable Development - 1980 to 2004

Year	Events	Publications	U.S. Legislation
1986	A nuclear reactor meltdown at Chernobyl power station releases radioactive material throughout the Northern Hemisphere.		The Superfund Amendments and Reauthorization Act (SARA), which amended CERCLA.
	IUCN (The World Conservation Union) Conference on Environment and Development is held in Ottawa, Canada.		The Emergency Planning & Community Right to Know Act (EPCRA).
	The Uruguay Round of GATT (General Agreement on Tariffs and Trade) lays the foundation for the establishment of the World Trade Organization (WTO) in 1995.		
1987	*World population - 5 billion.*	*Our Common Future* - WCED.	
	The IMF (International Monetary Fund) establishes the Enhanced Structural Adjustment Facility (ESAF).		
1988	Intergovernmental Panel on Climate Change (IPCC) is established.		
1989	Exxon Valdez oil tanker runs aground spilling 11 million gallons of oil into Alaska's Prince William sound.	*Valdez Principles* (later renamed the *CERES Principles*) - CERES.	
1990	The International Institute for Sustainable Development (IISD) is established in Canada.		The Oil Pollution Act (OPA).
			The Pollution Prevention Act (PPA).
1991	The Global Environmental Facility (GEF) is established.	*Caring for the Earth: A Strategy for Sustainable Living* - Published by IUCN, UNEP, and WWF.	The Intermodal Surface Transportation Efficiency Act (ISTEA).
	The European Bank for Reconstruction and Development (EBRD) is established.	*Ecological Economics: The Science and Management of Sustainability* - Costanza, R.	
1992	UN Conference on Environment and Development (UNCED) is held in Rio de Janeiro, Brazil.	*Agenda 21* - UN Department of Economic and Social Affairs (DESA).	
	The Earth Council is established in Costa Rica.	*Changing Course* - Schmidheiny, S.	

Box 3.9: The Emergence of Sustainable Development - 1980 to 2004

Year	Events	Publications	U.S. Legislation
1993	UN World Conference on Human Rights is held in Vienna, Austria. First meeting of the UN Commission on Sustainable Development that was created at the UNCED. North American Free Trade Agreement (NAFTA) is signed by Canada, Mexico, and the U.S. U.S. President Bill Clinton announces the creation of the President's Council for Sustainable Development (PCSD).	*Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future* - Meadows, D.H., Meadows, D.L., and Randers, J.	
1994	UN International Conference on Population and Development is held in Cairo, Egypt.		
1995	UN World Summit for Social Development is held in Copenhagen, Denmark. UN Fourth World Conference for Women is held in Beijing, China. The World Trade Organization (WTO) is established. The World Business Council for Sustainable Development (WBCSD) is established in Geneva, Switzerland.		
1996	The Summit of the Americas on Sustainable Development is held in Santa Cruz, Bolivia. ISO 14001 is formally adopted as the voluntary international standard for corporate environmental management systems. The Second United Nations Conference on Human Settlements (Habitat II) is held in Istanbul, Turkey.	*Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future* - Report by the President's Council for Sustainable Development. *Beyond Growth* - Daly, H.E. *How Much is Enough?* - Durning, A.T. *Our Stolen Future: Are We Threatening Our Fertility, Intelligence, and Survival? A Scientific Detective Story* - Colburn, T, Dumanoski, D. and Myers, J.P.	The Food Quality Protection Act (FQPA).
1997	The IMF establishes the Supplemental Reserve Facility (SRF). Special Session of the UN General Assembly to Review and Appraise the Implementation of Agenda 21.	*Do We Consume Too Much?* - Sagoff, M. *No Middle Way on the Environment* - Ehrlich, P.R., Daily, G.C., Daily, S.C., and Salzman, J.	

Box 3.9: The Emergence of Sustainable Development - 1980 to 2004

Year	Events	Publications	U.S. Legislation
1998	*World population - 6 billion.* IMF activates General Arrangements to Borrow for first time in 20 years.	*Cradle To Cradle: Remaking the Way We Make Things* - McDonough, W. and Braungart, M.	The Transportation Equity Act for the 21st Century (TEA-21).
1999	Launch of the first Dow Jones global sustainability index.	*Our Common Journey* - National Research Council *Natural Capitalism: Creating the Next Industrial Revolution* - Hawken, P., Lovins, A., and Lovins, L.H.	The Chemical Safety Information, Site Security and Fuels Act.
2000	UN Millennium Summit is held in New York, U.S.		
2001	The IMF announces it will establish the International Capital Markets Department to enhance its surveillance, crisis prevention, and crisis management activities.		
2002	UN World Summit on Sustainable Development (WSSD) is held in Johannesburg, South Africa.		
2004		*Limits to Growth: The 30-Year Update* - Meadows, D.H., Randers, J., and Meadows, D.L.	

During the 1980s and 1990s, national environmental legislation was also influenced by several international treaties and conventions (Box 3.10). However, many of the nation states that signed these international agreements were unable to ratify them in their home nations, reducing the agreements to weaker statements of intent.

It is possible to group many of the treaties and conventions shown in Box 3.10 under the four environmental drivers of sustainable development. First, the concern for ecosystem integrity and biological diversity (the first environmental driver of sustainable development established during the 1960s) is reflected, respectively, by the 1991 protocol to protect the Antarctic region, the 1992 Convention on Biological Diversity, and more recently by the 2001 Stockholm Convention on Persistent Organic Pollutants. Second, the concern that the world's resources are finite and need to be conserved (the second environmental driver of sustainable development) is reflected by the 1980 Convention on the Conservation of Antarctic Marine Living Resources, the 1988 Convention on the Regulation of Antarctic Mineral Resource Activities, and the 1992 Statement of Principles for the conservation of forests. Third, the concern that toxic chemicals can directly affect human health and the health of other species (the third environmental driver of sustainable development) is reflected by the 1989 Basel Convention, the 1998 Rotterdam Convention, and the 2001 Stockholm Convention. Finally, the concern that human activity is affecting the global climate (the fourth environmental driver of sustainable development) is reflected by the 1985 Vienna Convention, the 1987 Montreal Protocol, the 1992 Framework Convention on Climate Change, and the 1997 Kyoto Protocol.

Box 3.10: Major Treaties and Conventions - 1980 to 2001

Year	Treaty/Convention/Protocol
1980	The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)
1982	The Convention on the Law of the Sea
1985	The Convention for the Protection of the Ozone Layer (Vienna Convention)
1987	The Montreal Protocol on Substances that Deplete the Ozone Layer
1988	The Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA)
1989	The Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention)
1991	The Protocol on Environmental Protection to the Antarctic Treaty (of 1959)
	The Convention on Environmental Impact Assessment in a Transboundary Context
1992	Agenda 21
	The Convention on Biological Diversity
	The Framework Convention on Climate Change
	The Rio Declaration
	Statement of Principles for a Global Consensus on the Management, Conservation, and Sustainable Development of all Types of Forests
1993	North American Free Trade Agreement (NAFTA)
1994	The Convention to Combat Desertification
	The Draft Declaration of Principles on Human Rights and the Environment

Box 3.10: Major Treaties and Conventions - 1980 to 2001

1996	The WIPO (World Intellectual Property Organization) Copyright and Performances and Phonograms Treaty
	The Debt Initiative for 'Heavily Indebted Poor Countries' (HIPC)
1997	The Kyoto Protocol
	The Multilateral Agreement on Investment (MAI)
1998	The Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters
	The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
2001	The Stockholm Convention on Persistent Organic Pollutants

3.4.2 The 1980 World Conservation Strategy

This section takes a closer look at the notion of sustainable development as defined by the International Union for Conservation of Nature and Natural Resources (IUCN) et al.'s 1980 *World Conservation Strategy* (WCS).

The roots of the WCS can be traced back as early as 1966 when Max Nicholson called for the creation of a world conservation program for the protection of wildlife (McCormick 1995).[364] Nicholson specifically identified the IUCN (now known as the World Conservation Union) as the body that should be in charge of such a task (ibid). In 1970, IUCN began to develop a strategic approach to conservation, moving away from its traditional approach of establishing independent projects towards the creation of projects that are coherently linked. The idea was that a program of interlinked initiatives would have a greater impact on the worldwide conservation of nature and natural resources. This process was advanced in 1975 when (the newly formed) UNEP asked IUCN to prepare an integrated wildlife conservation strategy to identify what actions were needed to protect and save wild species (ibid).

The IUCN 1975-76 annual report provides some insight into its new vision of conservation that was to be treated "*as an integral part of the plans for social and economic development*" (IUCN 1976, p. 3). In addition, planning was to involve local people in conservation projects, ensuring their needs, culture, and knowledge were taken into account. As O'Riordan (1993) and McCormick (1995) note, IUCN's new strategy for conservation aligned well with the concept of 'eco-development' - the predominant development paradigm of the mid-1970s. In 1977, IUCN announced its intent to prepare a 'World Conservation Strategy' that would be the first attempt to combine conservation and development in a coherent manner. In 1980, the WCS was simultaneously released in more than 40 nations.

[364] For a valuable discussion of how the IUCN et al.'s (1980) *World Conservation Strategy* was formed, see McCormick (1995, pp. 195-202).

The WCS is an eloquent synthesis of a decade of intense debate in the international community over the need to protect the environment while continuing the process of development. The strategy is free from the "*heated rhetoric*" which characterized so many of the New International Economic Order publications at that time (Caldwell and Weiland 1996, p. 343). The WCS used the term 'sustainable' to describe development that takes "*account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as short term advantages and disadvantages of alternative actions*" (IUCN et al. 1980, p. 18). Acknowledging that "[c]*onservation and development have so seldom been combined that they often appear - and are sometimes represented as being - incompatible*" (ibid, p. 18), the WCS proceeds to develop its case as to why conservation and economic and social development are mutually supportive endeavors (Box 3.11).

Box 3.11: Excerpts from the *World Conservation Strategy* (IUCN et al.1980, pp. 18-19) (emphasis added)

Introduction: living resource conservation for sustainable development

1. ... The combined destructive impacts of a poor majority struggling to stay alive and an affluent minority consuming most of the world's resources are undermining the very means by which all people can survive and flourish.

2. Humanity's relationship with the biosphere (the thin covering of the planet that contains and sustains life) will continue to deteriorate until a new international economic order is achieved, a new environmental ethic adopted, human populations stabilize, and sustainable modes of development become the rule rather than the exception. Among the prerequisites for sustainable development is the conservation of living resources.

3. **Development is defined** ... **as**: **the modification of the biosphere and the application of human, financial, living and non-living resources to satisfy human needs and improve the quality of human life**. For development to be sustainable it must take account of **social and ecological factors**, as well as **economic** ones; of the living and non-living resource base; and of the long term as well as short term advantages and disadvantages of alternative actions.

4. **Conservation is defined** ... **as**: **the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations**. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration, and enhancement of the natural environment. ... Living resources have two important properties the combination of which distinguishes them from non-living resources: they are renewable if conserved; and they are destructible if not.

...

6. **Conservation is a process - to be applied cross-sectorally - not an activity sector in its own right**. ...

7. **Living resource conservation has three specific objectives**:

> ***to maintain essential ecological processes and life-support systems*** ..., on which human survival and development depend;
>
> ***to preserve genetic diversity*** ..., on which depend the breeding programmes necessary for the protection and improvement of cultivated plants and domesticated animals, as well as much scientific advance, technical innovation, and the security of the many industries that use living resources;
>
> ***to ensure the sustainable utilization of species and ecosystems*** ..., which support millions of rural communities as well as major industries.

...

Box 3.11: Excerpts from the *World Conservation Strategy* (IUCN et al.1980, pp. 18-19) (emphasis added)

11. ... Conservation must ... be combined with measures to meet short term economic needs. **The vicious circle by which poverty causes ecological degradation which in turn leads to more poverty can be broken only by development**. But if it is not to be self-defeating, it must be sustainable - and conservation helps to make it so. The development efforts of many developing countries are being slowed or compromised by lack of conservation. ...

12. ... While it is inevitable that most of the planet will be modified by people and that much of it will be transformed, it is not at all inevitable that such alterations will achieve the social and economic objectives of development. Unless it is guided by ecological, as well as by other environmental, and by social, cultural, and ethical considerations, much development will continue to have undesired effects, to provide reduced benefits or even to fail altogether. ... Hence **the goal of the World Conservation Strategy is the integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and wellbeing of all people**.

While 'living resource conservation' is at the heart of the WCS, the authors also recognized the need for "*a strategy for peace; a strategy for a new international economic order; a strategy for human rights; a strategy for overcoming poverty; a world food supply strategy;* [and] *a population strategy*" (IUCN et al. 1980, p. 18). If we recall Dernbach's (1998) model of sustainable development,[365] we see that the WCS represents an essential *component* of the concept of sustainable development. Alternatively, the WCS can be seen as supporting Dernbach's model of sustainable development by recognizing that environmental conservation/protection is only one aspect of the much broader notion of sustainable development.

In using the word 'sustainable' to describe the development process, the WCS effectively "*rechristened*" eco-development (the term previously used to describe ecologically sound socio-economic development) as sustainable development (Caldwell and Weiland 1996, p. 243). However, this 'rechristening' was more than simply a name change.

A central aspect of eco-development was *national self-reliance*, which focused on local and regional development to meet human needs.[366] National self-reliance also implied that nation states should be able to temporarily detach themselves from the international economic system if adversely affected by, for example, fluctuations in the world

[365] Dernbach (1998) argues that the international community has viewed the notion of 'conventional' development as incorporating at least four related components: [1] peace and security; [2] economic development; [3] social development (focusing on human rights); and [4] national governance that secures peace and development. Using conventional development as a base, Dernbach states that 'sustainable' development "*modifies the purposes of conventional development by adding a wide range of environmental protection goals, by incorporating the environment into social goals, and by insisting that economic goals be compatible with environmental protection. It also modifies the purposes of development by recognizing the present generation's responsibility to future generations*" (ibid, pp. 24-25). Hence, the fifth component of Dernbach's model of sustainable development seeks to protect the environment and the natural resources upon which the development process depends.

[366] See the 1974 *Cocoyoc Declaration's* text on national self-reliance, Box 3.5.

commodity market.[367] However, the oil shocks of the 1970s led to economic recessions throughout the world, drastically reducing trade and the availability of aid for developing nations. During this period, environmental degradation in developing nations worsened, highlighting (to many) the essential role that the international economy plays in national development. Recognizing that conservation and development are closely interlinked, the WCS highlighted the importance of a 'New International Development Strategy.' The purpose of this strategy was: "*(a) to redress the inequalities in the relations between richer and poorer nations; (b) to establish a more dynamic, more stable and less vulnerable world economy, in which all countries have opportunities to participate on a fuller and more equal basis; (c) to stimulate accelerated economic growth in the poorer countries of the world; and (d) to reduce and eventually overcome the worst aspects of poverty by improving the lot of the hundreds of millions of people now living in abject poverty and despair*" (IUCN et al. 1980, p. 62). To achieve this strategy, the WCS called for the liberalization of trade and the removal of all trade barriers to goods from developing countries. In addition, it recommended that economic and social growth be accelerated in developing nations.[368] Hence, the WCS did more than simply rename eco-development as sustainable development; it connected local, regional, and national economic and social development with the conservation of living resources and the need for a stable, equitable, and more liberal international economic system in which developing countries could participate on a more equal footing.[369]

However, the WCS's diagnosis of the pending global environmental crisis and its solution to integrate conservation and development was undermined by its failure to address the social and political forces behind prevailing unsustainable practices (Redclift 1984; 1987). In short, the WCS failed to provide a discussion on the "*ways and means*" of implementing the policies it put forward (Redclift 1984, p. 50). Further, the final version of the WCS was a compromise between the vision of IUCN's own members and that of conservationists (McCormick 1995). It tried to reach a common ground between conservation and development, and was forced to generalize and simplify the problems and issues involved (ibid). While the latter points can more easily be overlooked, the

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[367] Such fluctuations might occur due to the dumping of a heavily subsidized agricultural product onto the international market. This action reduces the price of the commodity making it impossible for the farmers of nations that do not (or are unable to) subsidize the agricultural sector to make a profit.

[368] This recommendation can be traced back to the 1974 Declaration on the Establishment of a New International Economic Order which states that the purpose of the new international economic order is to "*ensure steadily accelerating economic and social development.*" Source: *Declaration on the Establishment of a New International Economic Order*, 1 May 1974, *Resolution 3201 (S-VI)*, http://www.un.org/Depts/dhl/resguide/resins.htm (accessed on 04/09/06). Note: The Declaration was released in 1974, the year the first oil crisis ended.

[369] Two years after the publication of the *World Conservation Strategy*, UNEP highlighted the reversal in the perceived impacts of economic growth on developing nations in its ten year review of the 1972 Stockholm conference Action Plan (UNEP 1982a). It cited the negative effects of the slow-down in economic growth as being *the* factor that changed the opinion of developing nations towards seeing economic growth as being an essential instrument in achieving social goals. The combination of the need for economic and social development with the need to conserve/protect the environment is a major part of what forms the modern notion of sustainable development. The remaining components of the notion of sustainable development are the need for peace and security and the need for national governance that ensures development and security.

failure to consider the decision-making processes within which decisions involving the environment are made was a major weakness of the WCS.

Comparing the WCS with the report *North-South: A Program For Survival*, also published in 1980 by the Independent Commission on International Development Issues (otherwise known as the Brandt Commission), yields some important insights. Like the WCS, the Brandt Commission recognized that the development prospects of a number of developing countries were being threatened by the "*irreversible destruction of their ecological systems*" (Brandt 1980, p. 47). It also recognized the importance of the world economy and its influence on development issues. In fact, the Brandt Commission kept the need for a new international economic order at the center of its concerns. With this in mind, it made the following comment on the state of the international economy: "*It is clear that the world economy is now functioning so badly that it damages both the immediate and the longer-run interests of all nations. ... It will not be possible for any nation or group of nations to save itself either by domination over others or by isolation from them. On the contrary, real progress will only be made nationally if it can be assured globally. And this global approach cannot be limited to economic problems: it must also take into consideration the great complexity of human society. ... Viewed in this light, the new international order itself can be seen as a continuously changing process in which forethought and negotiation operate constantly to establish an overall balance between all its elements, whether individual or collective*" (ibid, pp. 267-268). Thus, the Brandt Commission rejected the notion that nations should be able to temporarily detach themselves from the international economy in favor of a fully integrated global economic system. Finally, while the Commission does talk about the need to make the necessary political decisions for change, like the WCS it too does not provide a robust framework through which its recommendations could be implemented (Redclift 1984).

Three years later, the Brandt Commission published a second report - *Common Crisis: North-South Co-operation for World Recovery* (Brandt 1983) - which documented the worsening worldwide economic conditions and the lack of global cooperation to address them. In many ways, the second report highlighted the failure of the 1980 report to initiate change. In response to the pending collapse of the world economic system,[370] *Common Crisis* outlined a set of clear and direct proposals on finance, trade, food, energy, and the negotiating process. Drawing from an influential report by a Commonwealth Group of Experts - *The North-South: Making it Work* (Commonwealth Secretariat 1982) - *Common Crisis* presented a set of more realistic (and politically feasible) approaches to implementing the policies needed for change.

The year 1980 also saw the release of a report by the U.S. Council on Environmental Quality (CEQ) and the Department of State assessing the potential changes in, and interdependence of, the world population, resources, and environment over a twenty year period (CEQ 1980). Arriving at the start of the Reagan administration, *The Global 2000 Report to the President* came to the conclusion that "*life for most people on earth will be more precarious in 2000 than it is now*" (CEQ 1980, p. 1). "*The available evidence*

[370] Supra note 342.

leaves no doubt that the world - including ... [the U.S.] *- faces enormous, urgent, and complex problems in the decades immediately ahead. Prompt and vigorous changes in public policy around the world are needed to avoid or minimize these problems before they become unmanageable*" (ibid, p. 5). The report effectively dismissed the myth that environmental protection and development are incompatible goals.

A year later, the CEQ published *Global Future: A Time to Act* (CEQ 1981), which provided recommendations on how the U.S. should address the problems raised in *Global 2000. Global Future* presented three reasons why the U.S. should take an urgent interest in 'global' environmental and social issues. First, there was the moral dimension. The average U.S. citizen had a good quality of life, while hundreds of millions of people lived in poverty and misery. Second, there was the question of preservation. Ensuring that resources were protected for future generations was described as being a "*profound human interest*" (CEQ 1981, p. 5). Finally, there were national security concerns. U.S. political and economic security was perceived as being under threat from the growing global resource, environmental, and population problems.[371] These reasons were used to bolster recommendations for U.S. action to address the problems occurring in critical areas such as population, food and agriculture, renewable energy resources and conservation, tropical forests, biological diversity, coastal and marine resources, water resources, and global pollution. In a sense, both *Global 2000* and *Global Future* were groundbreaking in that they were prepared by a 'national government' - as opposed to the international community - to address both national and global environmental and social problems.[372]

In addition, *Global Future* came to the conclusion that 'sustainable development' would be a key concept in solving the world's problems: "*Only a concerted attack on the socioeconomic roots of extreme poverty, one that provides people with the opportunity to earn a decent livelihood in a non-destructive manner, will permit protection of the world's natural systems. Nor will development and economic reforms have lasting success unless they are suffused with concern for ecological stability and wise management of resources*" (ibid, pp. 11-12). Further, it argued that long-term economic development would only be successful if the natural resources of 'developing' nations were protected. Its focus on developing nations highlights a weakness of the report. It failed to mention the environmental impact associated with the high consumption rates of industrialized nations, thereby disregarding the issue.

The fate of the CEQ reports was sealed when the Reagan administration chose to ignore them (McCormick 1995). In addition, the reports suffered heavy criticism (Kahn 1981; Simon 1981; Simon and Kahn 1981). However, in retrospect, it has been shown that

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[371] For a valuable exposition of how worldwide environmental destruction might lead to political instability see Norman Myers (1993) *Ultimate Security: The Environmental Basis of Political Stability*, W. W. Norton Company, New York.

[372] Interestingly, the process of assessing the problems facing the world population, resources, and environment, highlighted the shear inadequacies of the U.S. government to anticipate and respond to global issues (CEQ 1981). Therefore, a critical part of the recommendations put forward in *Global Future*, were a series of changes to be made to governmental institutions.

these criticisms were often based upon flawed reasoning and the selective use of data (McCormick 1995).

The value of the WCS, *North-South: A Program For Survival*, *Global 2000*, *Global Future*, and two UNEP reports prepared in 1982 to review the progress made during the decade since Stockholm (UNEP 1982a; 1982c) was the synthesis (mainly by scientists) of the global issues facing humankind. Speth (2003) highlights ten principal concerns that are collectively presented by these reports. In keeping with the structure of this chapter, these concerns have been regrouped under three of the four environmental drivers of the concern for sustainable development (Box 3.12). Interestingly, none of the principal concerns identified fall under the second environmental driver of sustainable development - the concern that the world's economy is based upon finite resources and energy supplies. Given the *Limits to Growth* debate during the 1970s, there is a strong case to acknowledge the finality of non-renewable resources and energy supplies. Indeed, *Global 2000* makes the case that land and petroleum would be scarcer in the year 2000 if prevailing trends persisted. Further, *North-South: A Program For Survival* recognizes that the "*depletion of the world's oil resources is proceeding so rapidly that the transition to other sources will be necessary in a foreseeable future*" (Brandt 1980, p. 160). Thus, the ten global scale challenges that Speth (2003) argues were brought to the attention of governments by the reports of the early 1980s should be extended (at a minimum) to include the rapid depletion of non-renewable energy supplies (i.e., oil).

Box 3.12: Recategorizing Speth's (2003) Ten Principal Concerns of Sustainable Development [373]

Concern 1: The disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being

- Loss of crop and grazing land due to desertification, erosion, conversion of land to nonfarm uses, and other factors.
- Depletion of the world's tropical forests, leading to loss of forest resources, serious watershed damage (erosion, flooding, and siltation), and other adverse consequences.
- Mass extinction of species, principally from the global loss of wildlife habitat, and the associated loss of genetic resources.
- Rapid population growth, burgeoning Third World cities, and ecological refugees.
- Mismanagement and shortages of freshwater resources.
- Overfishing, habitat destruction, and pollution in the marine environment.

Concern 2: The rapid use of finite resources and energy supplies

- [*Suggested Addition: Rapid depletion of non-renewable resources and energy supplies.*]

Concern 3: The direct impacts of toxic pollution on human health and the health of other species

- Threats to human health from mismanagement of pesticides and persistent organic pollutants.

[373] The ten principal concerns of sustainable development (during the 1980s) were extracted from Speth (2003, pp. 5-6).

Box 3.12: Recategorizing Speth's (2003) Ten Principal Concerns of Sustainable Development [373]

Concern 4: The disruption of the global climate

- Depletion of the stratospheric ozone layer by CFCs and other gases.
- Climate change due to the increase in "greenhouse gases" in the atmosphere.
- Acid rain and, more generally, the effects of a complex mix of air pollutants on fisheries, forests, and crops.

In summary, while the *North-South: A Program for Survival, Global 2000, Global Future*, and the two UNEP reports all documented the major environmental problems faced by the world and recognized the important role that the international economy plays in development, they did not have the same lasting impact as the WCS. The WCS's notion of sustainable development - the idea that economic and social development can occur in unison with the conservation of living resources - presented a different perspective on global problems. This formulation of 'sustainable development' would later be adapted as the central theme of the World Commission of Environment and Development's report *Our Common Future* and become the integrating theme of the 1992 UN Conference on Environment and Development (Caldwell and Weiland 1996). Both of these developments are discussed in the following two sections, respectively.

3.4.3 The Brundtland Commission and Our Common Future (1983 - 1987)

In light of the evidence that environmental conditions around the world were deteriorating (Brandt 1980; CEQ 1980; IUNC et al. 1980; UNEP 1982a) and population and economic growth - two critical factors affecting the environment - were continuing to increase (Strong 2003), the Governing Council of UNEP called for the creation of a "*global strategy for sustainable development*," during its 'session of a special character' in 1982.[374] The following year, the UN General Assembly passed Resolution 38/161, approving the creation of a special, independent commission on the environment to propose "*long-term environmental strategies for achieving sustainable development to*

[374] The 1982 report of the Governing Council of UNEP on its session of a special character made the following statement on the need for sustainable development: "*There was general agreement that economic and social progress was essential to the effective implementation of environmental protection policies. Stress was, however, laid on the* ***need for a new approach to economic and social progress****, based on careful stewardship of the earth's resources and a concern for the interests of future generations. The guiding principle of such development should be the achievement of* ***sustainable economic and social progress, not only within the limits imposed by nature, but also, and above all, in the context of respect for and protection of mankind; it should have man as the focus, and operate in harmony with the environment****. Work should therefore begin as soon as possible* ***on a global strategy for sustainable development, which, while respecting human needs and the human person, should ensure a balance between man and the environment***" (emphasis added). Source: UNEP, *Report of the Governing Council on its Tenth Session, General Debate*, 49, http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=70&ArticleID=702 (accessed on 04/09/06).

the year 2000 and beyond."[375] As part of its terms of reference, the commission was required to consider the interrelationships between developed and developing nations, and between people, resources, the environment, and development. In short, the commission was required to do nothing less than rethink and articulate a new vision of development.

Under the chairmanship of then Prime Minister Gro Harlem Brundtland[376] of Norway, the World Commission on Environment and Development (WCED, also known as the Brundtland Commission) was subsequently formed and held its first meeting in Geneva, Switzerland in October 1984. The Commission consisted of 23 members: four from central European countries, seven from developed nations (including Maurice Strong, the chairman of the 1972 Stockholm conference), and 12 from developing nations (WCED 1987). During the Commission's first meeting, it adopted its mandate to:

(a) "re-examine the critical issues of environment and development, and formulate innovative, concrete, and realistic action proposals to deal with them;

(b) strengthen international co-operation on environment and development, and assess and propose new forms of co-operation that can break out of existing patterns and influence policies and events in the direction of needed change; and

(c) raise the level of understanding and commitment to action on the part of individuals, voluntary organizations, business, institutes, and governments" (WCED 1987, p. 363).

Between 1984 and 1987, the Brundtland Commission received advice and support from thousands of individuals, institutions, and organizations from all over the world (WCED 1987, p. 359). The Commission also visited each world region to obtain a firsthand view of environment and development issues and to hold deliberative meetings and open public hearings. On 11 December 1987, the Commission's report - *Environmental Perspective to the Year 2000 and Beyond* - was submitted to, and adopted by, the UN General Assembly via Resolution 42/186 as a "*broad framework to guide national action and international co-operation on policies and programmes aimed at achieving environmentally sound development.*"[377] That same year, the Commission's report was published as *Our Common Future.*[378]

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[375] Source: UN General Assembly, *Resolution 38/161, Process of preparation of the Environmental Perspective to the Year 2000 and Beyond*, 19 December 1983, Section 8 (a), http://www.un.org/documents/ga/res/38/a38r161.htm (accessed on 04/09/06).

[376] Gro Harlem Brundtland was a member of the Brandt Commission that published *North-South: A Program for Survival* (Brandt 1980) and *Common Crisis: Co-operation for World Recovery* (Brandt 1983). Brundtland saw the position as Chairman of the World Commission on Environment and Development (WCED) as being her third call for political action, one which she would answer with *Our Common Future* (WCED 1987, p. x).

[377] Source: UN General Assembly, *Resolution 42/186, Environmental Perspective to the Year 2000 and Beyond*, 11 December 1987, 2, http://www.un.org/documents/ga/res/42/a42r186.htm (accessed on 04/09/06).

[378] See the UN General Assembly, *Resolution 42/187, Report of the World Commission on Environment and Development*, for the UN response to the release of *Our Common Future*, http://www.un.org/documents/ga/res/42/a42r187.htm (accessed on 04/09/06).

Benefiting from more than a decade of debate over the notion of eco-development and then sustainable development, the Brundtland Commission sought to effectively integrate social and economic development with the need for environmental protection. By combining these elements with the important notion of intergenerational equity, the Commission created what has become the first universally accepted definition of sustainable development.

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

- *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs*" (WCED 1987, p. 43).

Like the Cocoyoc Declaration, *Small is Beautiful* (Schumacher 1999), and *What Now: Another Development* (Dag Hammarskjöld Foundation 1975), *Our Common Future* defined the major objective of development as the "*satisfaction of human needs and aspirations*" (WCED 1987, p. 43). Further, it saw sustainable development not as an end state, but rather as "***a process of change*** *in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs*" (ibid, p. 9, emphasis added). As Redclift notes (1991), focusing sustainable development on human needs - as opposed to tradeoffs between economic and biological systems - meant that many economists would find it hard to endorse the concept. Further, the Brundtland Commission adopted a highly political agenda by viewing "*sustainable development as a policy objective, rather than a methodology. It is an over-arching concept ... Such an approach is unapologetically normative, and places both the responsibility for problems, and the political will to overcome them, in the hands of human actors*" (WCED 1987, p. 37).

The Brundtland Commission made a convincing argument that environment and development are "*inexorably linked*" and cannot be treated as separate challenges (WCED 1987, p. 37). It concluded: "[d]*evelopment cannot subsist upon a deteriorating environmental resource base; the environment cannot be protected when growth leaves out of account the costs of environmental destruction*" (ibid, p. 37). This recognition that the 'costs of environmental destruction' need to be considered in the development equation provided the field of 'environmental economics' with a strong endorsement.[379]

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[379] Note: 'Environmental' economics is not to be confused with 'ecological' economics. The former treats nature as an 'input' to the economy that functions to satisfy *human* wants and needs and emphasizes a concern for scarce resources and ecological damage. Thus, it follows that environmental economics seeks to maximize human benefit while minimizing social and environmental costs. Ecological economics treats human economic systems as being embedded within ecosystems; "*the field can be defined as the study of interdependent natural and economic systems*" (Dryzek 1997, p. 30). Ecological economics sees natural ecosystems as finite and, therefore, is concerned about the scale of human activity that can be supported

Further, the Commission highlighted the role public policy could play in using "*incentives and disincentives*" to guide commercial organizations to develop environmentally sound technologies (ibid, p. 60). Redclift (1996, p. 18) argues that the endorsement of economic mechanisms as valid policy tools to protect the environment "*effectively opened the door to environmental economics which sought to fill the policy vacuum.*"

Our Common Future appeared at a time when the political climate was beginning to become more receptive to the issues raised by the report. Future prospects for economic growth in industrialized nations were beginning to look positive, while global ecosystems were beginning to show signs of distress.[380] Hence, there was an international audience eager to learn how to embrace economic growth while reducing pressure on ecosystems. The Commission's insistence that science and technology could be utilized to meet human needs and solve environmental problems was the answer many were looking for. Towards the end of the 1980s, many governments were committed to market liberalization as a means of solving their economic problems. They saw free trade as a way of stimulating ordinary (and unsustainable) economic growth. Therefore, by focusing on technological improvements that could support economic growth, conserve natural resources, and protect the environment, the Commission gained the support of both developed and developing nations. As Dryzek (1997, p. 136) notes, "*sustainable development would surely lose unless it could be demonstrated that environmental conservation ...* [was] *obviously good for business profitability and economic growth everywhere, not just that these competing values can be reconciled.*" Hence, unless science and technological innovation - two mainstays of economic growth in industrial societies - were a central theme of sustainable development, national governments would most likely have rejected the concept as another radical and politically unrealistic form of environmentalism.

By explicitly bringing science and technology into the development equation, the technologically optimistic Brundtland Commission sought to articulate a new era of economic growth where policies were designed to release human ingenuity to expand and increase the natural resource base. Hence, economic growth could continue and the environment could be protected. The Commission stipulated, however, that for this to be achieved, the protection of ecosystems "*must be guaranteed*" and all "*economic partners must be satisfied that the basis of exchange is equitable*" (WCED 1987, p. 17).

Having articulated a bold new development agenda, the Brundtland Commission highlighted a major problem with the institutional frameworks that would implement the new era of economic and social development. It argued that most governmental environment agencies, especially those in developing nations, "*tend to be independent, fragmented,* [and] *working to relatively narrow mandates with closed decision processes*"

(ibid, p. 30). Living (and producing) within ecological limits becomes a major focus. Both environmental and ecological economics are discussed in Sections 4.2.1 and 4.2.2, respectively.

[380] Source: United Nations Chronicle, on-line edition, Volume XXXIX, Number 3, 2002, essay by Lars-Göran Engfeldt, *The Road from Stockholm to Johannesburg,* http://www.un.org/Pubs/chronicle/2002/issue3/0302p14_essay.html (accessed on 04/09/06).

(WCED 1987, p. 9). It stated the same was true for many international agencies responsible for areas such as development lending, trade regulation, and agricultural development. The Commission believed the solution to these problems lay in ensuring that national and international institutions consider the ecological dimensions of policy at the same time as economic, social, trade, energy, agricultural, and other dimensions. Such integration would close 'institutional gaps' and bring environmental concerns into the center of decision-making. In parallel with this, the Commission called for the strengthening of international law and conventions and for better implementation of these mechanisms for change.

Box 3.13 presents the broad set of conclusions from *Our Common Future* which reiterates the above points and presents several additional requirements for the pursuit of sustainable development.

Box 3.13: Requirements of the Pursuit of Sustainable Development, *Our Common Future* (WCED 1987, p. 65)

In its broadest sense, the strategy for sustainable development aims to promote harmony among human beings and between humanity and nature. In the specific context of the development and environment crises of the 1980s, which current national and international political and economic institutions have not and perhaps cannot overcome, the pursuit of sustainable development requires:

- a political system that secures effective citizen participation in decision making,
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis,
- a social system that provides for solutions for the tensions arising from disharmonious development,
- a production system that respects the obligation to preserve the ecological base for development,
- a technological system that can search continuously for new solutions,
- an international system that fosters sustainable patterns of trade and finance, and
- an administrative system that is flexible and has the capacity for self-correction.

Finally, in addition to making numerous recommendations related to the areas of population, food security, the loss of species and genetic resources, energy, industry, and human settlements, the Brundtland Commission found that for sustainable development to be realized, all four components of conventional development - peace and security, economic development, social development, and national governance that ensures peace and development - require environmental protection (Dernbach 1998).

Our Common Future was the first rigorous attempt at formulating the concept of sustainable development. A major part of its success was due to the Commission's efforts to base its recommendations on institutional and political realities and on what needed to be accomplished in the short-term. The endorsement of an equitable and liberal international economy, fueled by scientific advance and technological progress that conserved resources and minimized environmental harm, resonated well with those struggling to reconcile development with the environment. Developed nations could continue along their development paths guided by economic incentives encouraging

sustainable development. Simultaneously, developing nations could look forward to rapid economic growth by joining a more equitable international economic system.

However, even before the report's publication, some remained skeptical as to whether nation states could implement the recommendations put forward. Redclift (1987, p. 14) argues that both developed and developing countries could not make the necessary changes "*without involving themselves in a very radical structural reform, not only of methodologies for costing forest losses or soil erosion, but of the international economic system itself.*" Almost two decades later it seems that Redclift's insights were valid. Many governments have failed to implement the recommendations put forward in *Our Common Future* and the international community is still attempting to develop a more equitable international economic system.[381, 382]

3.4.4 The UN Conference on Environment and Development - The Earth Summit (1992)

In response mainly to the Brundtland Commission's call for an international conference to "*review progress made, and to promote follow-up arrangements* ...[to Our Common Future] *to set benchmarks and to maintain human progress within the guidelines of human needs and natural laws*" (WCED 1987, p. 343), the UN General Assembly decided to "*convene the United Nations Conference on Environment and Development*"[383] (UNCED) in Brazil in 1992.[384] The decision to hold the conference in a developing nation - especially one that had made significant progress on environmental issues since the 1972 Stockholm conference - had enormous political relevance and

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[381] An early critique of *Our Common Future* is provided by Duchin and Lange (1994).

[382] A meeting of the World Trade Organization (WTO) in Geneva, July/August 2004, where developed nations agreed to cut farm subsidies in return for the opening of markets for manufactured goods in developing countries, is a testament to this fact.

[383] Source: UN General Assembly, *Resolution 44/228, United Nations Conference on Environment and Development*, 22 December 1989, 1, http://www.un.org/documents/ga/res/44/a44r228.htm (accessed on 04/09/06).

[384] While the 1980s had witnessed a rise in the use of the term 'sustainable development,' it was not used in the title of the conference since influential developing countries feared that doing so would reduce their freedom of action. Their position was that the title 'environment and development' provided a level of ambiguity that strengthened their case that the environmental destruction witnessed during the latter part of the twentieth century was caused primarily by developed countries. Hence, developed nations should take the lead in rectifying the environmental destruction experienced around the world. [Source: United Nations Chronicle, on-line edition, Volume XXXIX, Number 3, 2002, essay by Lars-Göran Engfeldt, *The Road from Stockholm to Johannesburg*, http://www.un.org/Pubs/chronicle/2002/issue3/0302p14_essay.html (accessed on 04/09/06).] In a similar context, Sachs (2001) argues that the inclusion of the word 'development' in the title of the conference was a code word used by developing countries to express their desire for "*recognition and justice*" (ibid, p. 5). Following the aborted negotiations for a 'New International Economic Order' in the 1970s and the international debt crisis of the 1980s, developing nations had a strong case for placing their 'right to development' at the forefront of discussion (ibid, p. 5). Principle 3 of the Rio Declaration - "[t]*he right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations*" - speaks directly to these concerns. Notwithstanding the politics behind the official title of the Earth Summit, Dernbach (1998) argues that the international community's efforts to "*synthesize and integrate environment and development issues*" (ibid, p. 21) provided a strong endorsement to the notion of sustainable development.

symbolism (McCormick 1995). In addition, the importance of the UNCED was reinforced when it was decided that the conference should be held at the 'summit level' - meaning that the heads of state should be present. This decision effectively renamed the UNCED in the media as the 'Earth Summit' (Strong 2003).

The UNCED was subsequently held in Rio de Janerio from 3-14 June 1992, and attracted some 178 nation states, including 110 heads of state who attended the final two-day meeting (UN 1993b; 1993c; 1993d). The Earth Summit (also known as the Rio Summit) was much larger than the Stockholm conference and was the first time in history that so many influential people had gathered in one place.

The main objectives of the UNCED were to review the progress that had been made since the Stockholm conference and to identify strategies, programs, legal mechanisms, financial resources, and regional/national/global institutional frameworks that could protect and enhance the environment in the socio-economic development process of all nation states.[385] Its purpose was nothing less than to develop ways to protect the planet and ensure the welfare and future of humankind. Further, the UNCED planned to bridge the major conflicts between developed and developing nations in order to increase the likelihood that its outcomes would be implemented (Linner and Selin 2003). For this objective to be achieved, the impact that both poverty *and* affluence, individually and together, have on the environment needed to be addressed in the search for sustainable forms of economic development (South Centre 2002a).

While the high profile nature of the UNCED attracted a surge of media interest and put the topic of environment and development on government agendas worldwide, it is not seen as a seminal event. Caldwell and Weiland (1996) argue that the Earth Summit and its agreements were only made possible because of the 1972 Stockholm conference, which "*legitimized and initiated* ***environment*** *as a focus of international policy*" (ibid, p. 104). Further, the preparation for UNCED followed the model developed for Stockholm; that of extensive plenary meetings and negotiations in the run up to the Summit. However, the strong non-governmental organization (NGO) and media presence at the UNCED meant that "*expectations ... for openness and public participation in defining agendas and negotiating compromises*" were high (ibid, p. 105). Thus, NGOs were able to play a much greater role in agenda setting than they did in the pre-Stockholm deliberations.

The 'Global Forum' was held at the same time as the Earth Summit and was attended by over 500 NGOs to discuss issues related to environment and development (Reid 1995). As Maurice Strong, the Secretary-General of the UNCED,[386] recounts: "*The whole spirit of the ...* [UNCED] *was very much helped and lifted by the ...* [NGO] *presence ... We*

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[385] Source: UN General Assembly, *Resolution 44/228, United Nations Conference on Environment and Development*, 22 December 1989, Sections 15 (a) to (w), http://www.un.org/documents/ga/res/44/a44r228.htm (accessed on 04/09/06).

[386] Maurice Strong was also the Secretary-General of the 1972 UN Conference on the Human Environment. The UN asked Strong to be the Secretary-General of the UN Conference on Environment and Development to ensure continuity between the two conferences (Wirth 1995).

made a point of getting the NGOs from the developing world, including those who were not accredited to the UN. ... We made relevance the key criteria for UNCED accreditation and we got unprecedented numbers. It was extremely important to setting the spirit that infected the official conference. I am quite sure that the ... [UNCED] *would not have had even the results that it did without the presence of that dynamic and motley group of...* [NGO] *representatives*" (Strong 2003, pp. 106-107). Strong's comments provide some insight into the often intense debates that occurred during the plenary meetings and the Summit itself. Without the constant pressure from NGOs and media scrutiny, the outcomes from the Summit might have been quite different.

In addition to the views of NGOs, a major undertaking in the pre-UNCED deliberations was the solicitation of the official positions of both developed and developing nations. To facilitate this process, the UN asked each nation state to submit a report on its policies and expectations for the UNCED. By the end of 1992, almost every government had prepared a report (McCormick 1995). Further, several conferences were held on the topic of sustainable development (involving UN agencies, national governments, and NGOs), which provided valuable conclusions that helped inform the UNCED (ibid, p. 255).

By taking a closer look at the positions of developing nations prior to the UNCED, it is possible to gain some insight into the core arguments of the early 1990s. In lieu of a document comparable to the 1971 Founex Report, a review of a report by the South Commission[387] (an advocacy group for developing nations) is beneficial.

We recall that a main conclusion from the Founex Report was that developing nations should not have to relinquish their hopes of industrial development as a result of environmental controls imposed by developed nations. However, this position weakened during the two decades between Stockholm and Rio. The combination of the rise of environmental movements in developing nations with a worsening of environmental problems fueled by the growing debt crisis meant that politicians from these nations could no longer argue that the environment was only a concern for developed nations.

The South Commission's 1991 report, *Environment and Development - Towards a Common Strategy of the South in the UNCED Negotiations and Beyond* (South Centre 2002a),[388] documents this shift in position by highlighting the importance of adopting environmentally-sound and sustainable patterns of development. Further it argues that for "*a new equitable world order to emerge and for sustainable development to become a*

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[387] The South Commission was an advocacy group for developing nations. The Commission, formed in 1987, functioned as an independent body and its members (from developing nations) served in their own personal capacities. In recognition of the need to enhance co-operation between developing nations, the 'South Centre' was officially formed on 31 July 1995 when the Intergovernmental Agreement to establish the Centre came into force. Today, the South Centre has 46 members from developing nations and exists to help formulate the positions of developing nations on major policy issues, including global economic, political, and strategic issues related to the evolving concepts of development, sovereignty, and security. Source: South Centre, http://www.southcentre.org/index.htm (accessed on 04/09/06).

[388] The South Centre Report, *The South and Sustainable Development Conundrum: From Stockholm 1972 To Rio 1992 To Johannesburg 2002*, which contains the South Commission's 1991 report, can accessed at: http://www.southcentre.org/publications/conundrum/toc.htm (accessed on 04/09/06).

reality, it is critical that the developing countries, representing four-fifths of all humanity have a major role and say in charting the new directions" (ibid, p. 133).

Prior to UNCED, the South Commission believed both developed and developing nations had strong positions from which they could negotiate a compact (South Centre 2002a, p. 108). It argued that developing nations should only concede on environmental issues pursued by developed nations in return for firm commitments that the international economic system would be restructured to make the terms of trade more equitable for developing nations. Yet despite the optimism that progress on development and environmental issues could be made, there was pessimism related to the actions of principal developed nations in the pre-UNCED deliberations. The South Commission (2002a) argued that developed nations had attempted to shift the focus of the Summit to what they deemed to be important at the expense of the agendas of developing nations. Specifically, that developed nations promoted a narrowly defined and sectoral environmental agenda which included separate negotiations for the climate change and biodiversity conventions and encouraged incremental case-by-case negotiations. Further, the South Commission (2002a) argued that developed nations sought to shift the responsibility for environmental issues towards developing nations. By focusing on issues such as deforestation and population growth the fundamental causes of these problems could be ignored. "[T]*he North has been reluctant to make concessions in respect of areas where the burden of adjustment falls on the North (e.g., climate change, dumping toxic wastes, technology, finance). It has also avoided the issue of its own consumption levels and lifestyles which make heavy demand on the global environment and are wasteful of natural resources*" (ibid, p. 120). The poor coordination between developing nations combined with a lack of adequate human resources meant that little resistance was mounted to counter the agenda setting tactics of developed nations, whether legitimate or not.

The South Commission put forward two fundamental strategic objectives to help determine the negotiating positions of developing nations at the UNCED:

(a) "*to ensure that the South has adequate 'environmental space' for its future development, and*
(b) *to modify global economic relations in such a way that the South obtains the required resources, technology, and access to markets which would enable it to pursue a development process that is both environmentally-sound and rapid enough to meet the needs and aspirations of its growing population*" (South Centre 2002a, p. 109).

A strong message of the South Commission's report was that the needs of developed nations should not be met at the expense of present and future needs of developing nations (South Centre 2002a, pp. 110-111). Embedded within this statement is the concern that the production and consumption patterns of developed nations were reducing the environmental space available for developing nations. This 'environmental space' refers to both the national and global environment and commons. The South Commission's position was similar to that taken by the 1971 Founex Report, which sought to entice industry to developing nations through more favorable operating

environments.[389] The notion of environmental space correlates to a right to pollute within the carrying capacity of the environment. Hence, the position taken by the South Commission twenty years after Founex was that adequate (*global*) environmental space should be allocated for developing nations to allow for their industrialization and the inevitable pollution of the environment.[390] Further, the Commission cited poverty, population growth, and unemployment as factors that feed upon each other to the detriment of the environment (ibid, p. 122). Therefore, any global action program that sought to protect the environment must simultaneously tackle global poverty. The equitable access to markets was seen as an effective way of achieving these objectives.

While the pre-Summit negotiations were underway, the UN Development Programme (UNDP), UN Environment Programme (UNEP), and World Bank established the Global Environment Facility (GEF) in 1991. The purpose of the GEF was to help developing nations fund projects and programs that aligned with the objectives of the UNCED to protect the global environment.[391] GEF grants were to be provided to support projects related to areas such as biodiversity, the ozone layer, climate change, and land degradation.

On the first day of the Earth Summit, Maurice Strong delivered an opening statement in which he spoke to the concerns of both developed and developing nations.

> "*Sustainable Development - development that does not destroy or undermine the ecological, economic or social basis on which continued development depends - is the only viable pathway to a more secure and hopeful future for rich and poor alike. This Conference must establish the foundations for affecting the transition to sustainable development. This can only be done through fundamental changes in our economic life and in international economic relations, particularly as between industrialized and developed countries. Environment must be integrated into every aspect of our economic policy and decision-making, as well as the culture and value systems which motivate economic behaviour*" (Strong 1993, p. 46).

The UNCED produced three official agreements: [1] the Rio Declaration on Environment and Development; [2] Agenda 21; and [3] a Statement on Forest Principles.[392] In keeping with the Stockholm format, the Rio Declaration provided a statement of principles that was supported by an action plan (Agenda 21) for its implementation. In addition, two conventions were opened for signature - the Convention on Biological Diversity and the Framework Convention on Climate Change. These conventions were a response to events of the late 1980s which raised concerns about the continuing extinction of species and

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[389] Supra note 238.

[390] The notion that environmental pollution is an unavoidable aspect of industrialization is being challenged by the 'next industrialization' (McDonough and Braungart 1998) and 'industrial ecology' movements (see the *Journal of Industrial Ecology*). Both movements are attempting to establish industrial processes that eliminate or greatly reduce environmental pollution from industrial activity.

[391] Source: The Global Environment Facility (GEF), http://www.gefweb.org/index.html (accessed on 04/09/06).

[392] For an informative discussion of the UNCED agreements see Grubb et al. (1993).

depletion of biodiversity (the first environmental driver of sustainable development) and about ozone depletion and global climate change[393] (the fourth environmental driver of sustainable development). Both the Rio Declaration and Agenda 21 are discussed in the following two sections.

The UNCED agreements highlight a transition in the international community's conceptualization of development. The notion that prevailing economic policies were deepening economic divisions between developed and developing nations was widely understood by the Summit delegates (UN 1993a). Therefore, the UNCED agreements sought to manage and protect ecosystems so as to establish a *prosperous* future for humankind. Further, it was widely accepted that no nation state could achieve the objective of sustainable development on its own. As Caldwell and Weiland (1996) note, the recognition that global international action would be required to address issues such as climate change meant that 'Only One Earth' - the title of the Stockholm conference - "*became an operational reality at Rio*" (ibid, p 107).

In addition to the five direct outcomes of the UNCED, the Summit led to a number of important international agreements and conferences and to the formation of several bodies that are often referred to as the "*Rio Cluster*" of UN proceedings (Box 3.14).[394]

Box 3.14: The Rio Cluster of UN Proceedings

Year	
1992	The UN Commission on Sustainable Development (CSD)[395] is formed by the UN General Assembly via Resolution 47/191
1993	The UN World Conference on Human Rights is held in Vienna, Austria, 14-25 June [396]
	The Economic and Social Council (ECOSOC) reviews arrangements for NGO consultation [397]
1994	The Convention on Small Island Developing States is held in Bridgetown, Barbados, 25 April - 6 May (culminating in the Declaration of Barbados) [398]
	The UN Convention to Combat Desertification is adopted in Paris on 17 June and opened for signature between 14-15 October [399]
	The International Conference on Population and Development is held in Cairo, Egypt, 5-13 September [400]

[393] The decision to develop a Convention on Climate Change was made at the first meeting of the Intergovernmental Panel on Climate Change (IPCC), established by WMO and UNEP, in 1988.
[394] Source: Habitat (a clearinghouse for information related to the 1992 UNCED), http://habitat.igc.org/un-proc/#unced (accessed on 04/09/06).
[395] See the UN Commission on Sustainable Development (CSD), http://www.un.org/esa/sustdev/csd/csd13/csd13.htm (accessed on 04/09/06).
[396] See the UN World Conference on Human Rights, http://www.unhchr.ch/html/menu5/wchr.htm (accessed on 04/09/06).
[397] See the Global Policy Forum, *ECOSOC Review, E/1993/80,* http://www.globalpolicy.org/ngos/docs/e1993-80.htm (accessed on 04/09/06).
[398] See the Declaration of Barbados, http://islands.unep.ch/dbardecl.htm (accessed on 04/09/06).
[399] See the UN Convention to Combat Desertification (UNCCD), http://www.unccd.int/main.php (accessed on 04/09/06).
[400] See the International Conference on Population and Development, http://www.un.org/popin/icpd2.htm (accessed on 04/09/06).

Box 3.14: The Rio Cluster of UN Proceedings

1995	The World Summit for Social Development is held in Copenhagen, Denmark, 5-12 March [401]
	The UN Fourth World Conference on Women is held in Beijing, China, 4-15 September [402]
	The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks is adopted by the UN [403]
1996	The United Nations Conference on Human Settlements (Habitat II) is held in Istanbul, Turkey, 3-14 June [404]
	The World Food Summit is held in Rome, Italy, 13-17 November [405]
	The CSD Intergovernmental Panel on Forests (IPF) is established (the panel completes its work in 1997) [406]
1997	The CSD Intergovernmental Forum on Forests (IFF) is established (the forum completes its work in 2000) [406]
	The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) is adopted by the Conference of the Parties to the UNFCCC on 11 December

While several of the items in Box 3.14 are only loosely connected to the UNCED, it can be argued that they would not have occurred had it not been for the international momentum behind sustainable development post-Rio. The international environmental movement of the 1990s had moved beyond the despair of the 'limits to growth' movement of the 1970s into a "*more mature and measured phase*" (McCormick 1995, p. 261). Both developed and developing nations began to understand that global environmental problems were caused by local actions, giving rise to the phrase "think globally, act locally."

3.4.4.1 The Rio Declaration on Environment and Development

The roots of the Rio Declaration on Environment and Development (commonly known as the Rio Declaration) can be traced back to *Our Common Future*, which called for a "*new charter to guide state behaviour in the transition to sustainable development*" (WCED 1987, p. 332). In 1992, the Secretary General of the UN, Boutros Boutros-Ghali, addressed this call by encouraging the development of such a charter for the UNCED. In response, Maurice Strong proposed that an 'Earth Charter' be prepared as a forward to

[401] See the World Summit for Social Development, http://www.un.org/esa/socdev/wssd/ (accessed on 04/09/06).
[402] See the UN Fourth World Conference on Women, http://www.un.org/womenwatch/daw/beijing/ (accessed on 04/09/06).
[403] See the UN Conference on Straddling and Highly Migratory Fish Stocks, http://www.un.org/Depts/los/fish_stocks_conference/fish_stocks_conference.htm (accessed on 04/09/06).
[404] See the United Nations Conference on Human Settlements, http://www.un.org/Conferences/habitat/ (accessed on 04/09/06).
[405] See the World Food Summit, http://www.fao.org/wfs/index_en.htm (accessed on 04/09/06). Also see the World Food Summit *five years later*, 10-13 June 2002, http://www.fao.org/worldfoodsummit/english/index.html (accessed on 04/09/06).
[406] See the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF), http://www.un.org/esa/forests/ipf_iff.html (accessed on 04/09/06).

Agenda 21 (Strong 2003). The intention was to build upon the Stockholm declaration and outline the basic moral and ethical principles that would guide the development process towards sustainability. However, the creation of an Earth Charter that could be supported by all nation states proved to be unattainable (Strong 2003; Wirth 1995). Therefore, the title 'Earth Charter' was subsequently abandoned in favor of the 'Declaration on Environment and Development.'[407]

Interestingly, only fourteen nation states (seven from both developed and developing nations) had an active role in drafting the Rio Declaration in coordination with the chairman of the UNCED Preparatory Committee, Tommy Koh (Wirth 1995). Time constraints had prevented the solicitation of views from other nations. The draft declaration was subsequently adopted by the Preparatory Committee and later by the UNCED without alteration (ibid, p. 606).

The 27 principles of the Rio Declaration[408] reaffirmed and built upon the 1972 Stockholm Declaration.[409] While some of the principles included in these two declarations cover the same subject matter (Wirth 1995) - compare the principles in Table 3.3 [Stockholm Declaration] and Table 3.4 [Rio Declaration]) - the Rio Declaration effectively broadened the notion of 'conventional' or 'eco-' development to 'sustainable' development by integrating environmental protection into the development process. Yet a critical look at the Rio Declaration's principles reveals weaknesses in the compromises that were made to make it politically palatable (Grubb et al. 1993). "*Far from a timeless ethic, it was ... a snapshot of history*" (ibid, p. 85). A significant turning point in the negotiations of the Declaration was the success of developing nations in placing their 'right to development' at the forefront of considerations (Sachs 2001). The recognition that less developed nations needed to 'develop' meant that the Rio Declaration effectively turned into a "*declaration on development, rather than on environment*" (ibid, p. 5). Further, since 'development' can be defined in multiple ways it can be argued that the Rio Declaration supports a business as usual approach to development where the environment is more of an afterthought. However, while the Rio Declaration has its shortcomings, and is far from an 'Earth Charter,' it has proven to be a useful framework from which the concept of sustainable development has evolved.

As discussed in Section 3.1.1, it is possible to describe the notion of sustainable development - as viewed by the international community - using five critical components:

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[407] In 1994, two years after the UNCED, an initiative to develop a new Earth Charter was led by Maurice Strong and Mikhail Gorbachev with support from the Dutch government. In 1997, an Earth Charter Commission was established to manage the initiative and an Earth Charter Secretariat was created at the Earth Council in Costa Rica. In 2000, the official Earth Charter was launched at the 'Peace Palace' in The Hague. Today, the ongoing mission of the initiative is to "*promote the dissemination, endorsement, and implementation of the Earth Charter by civil society, business, and government*[; to] ... *encourage and support the educational use of the Earth Charter*[; and to] ... *seek endorsement of the Earth Charter by the UN.*" Source: The Earth Charter Initiative, http://www.earthcharter.org/ (accessed on 04/09/06). The Earth Charter can be viewed at: http://www.earthcharter.org/files/charter/charter.pdf (accessed on 04/09/06).

[408] See the *Rio Declaration on Environment and Development*, http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm (accessed on 04/09/06).

[409] See the *Stockholm Declaration on the Human Environment*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1503 (accessed on 04/09/06).

peace and security; economic development; social development; national governance that ensures peace and development; and environmental protection (Dernbach 1998; 2004). The first four of these components were established via the formation of international institutions and/or major multilateral treaties over the past half-century. The four components form what Dernbach (1998) calls 'conventional' development. The addition of environmental protection measures in the Rio Declaration signaled a transition from 'conventional' development to 'sustainable' development. In effect, the Rio Declaration states that for development to be sustainable it must protect the resources upon which the development process depends and integrate environmental protection goals with development objectives (see Rio Principles 3 and 4). Table 3.4 shows how the Rio Declaration principles correspond with the five components of sustainable development.

In keeping with the Stockholm Declaration (specifically Principle 21), Principle 2 of the Rio Declaration reaffirms the sovereign right for nation states "*to exploit their own resources pursuant to their own environmental and developmental policies.*" Since national sovereignty is a central aspect to international relations and law, establishing sovereign rights to resources ensured the participation of nation states at the UNCED.

Like Principles 9, 10, 11, and 12 of the Stockholm Declaration, Principles 6 and 9 of the Rio Declaration address the special needs of developing nations. Principle 6 states that the needs of the "*least developed and those most environmentally vulnerable, shall be given special priority.*" Principle 9 compliments this recommendation by calling for the strengthening of "*endogenous capacity-building for sustainable development,*" to be achieved "*through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.*" If these two principles are considered along with Principle 7 (Table 3.4), it is clear that developed nations were seen to have a "*responsibility*" for the international pursuit of sustainable development. Interestingly, the Rio Declaration does not call for the direct transfer of financial aid to developing nations - a call made in the Stockholm Declaration. Instead, the Declaration relies on an equitable international economy as a means to alleviate poverty. However, international aid is addressed in Agenda 21, which asked developed nations to donate 0.7 percent of their GNP (Gross National Product) per year to overseas development assistance (ODA),[410] and by the newly established GEF.

One of the major thrusts behind the (ultimately unsuccessful) development of the Earth Charter was the need to codify international legal norms surrounding environmental decision-making (Wirth, 1995). This objective clearly influenced the formation of the Rio Declaration. Three important instruments included in the Declaration which directly relate to environmental decision-making are: [1] the precautionary principle (Principle 15); [2] the importance of internalizing environmental costs - i.e., the polluter-pays

[410] The commitment to donate 0.7 percent of developed nations' GNP to ODA represented more than a doubling of the amount of aid provided to developing nations at that time. Since the UNCED, the U.S. and other developed nations have not been able to provide this level of financial assistance. In fact, even at the time of the UNCED, the U.S. stated that it would not guarantee that it would provide this level of aid and would instead provide aid on a case-by-case basis (UN 1993d).

principle (Principle 16);[411] and [3] the environmental impact assessment (Principle 17). Moreover, the Rio Declaration called upon the international community to cooperate and develop further international law in the field of sustainable development (Principle 27).

One of the more controversial Principles of the Rio Declaration proved to be Principle 3 - "*The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.*"[412] This principle was designed to protect developing nations from international actions that might slow or compromise their plans for development (McCormick 1995; Sachs 2001). The U.S. refused to endorse the principle on the grounds that "[d]*evelopment is not a right. On the contrary, development is a goal we all hold, which depends for its realization in large part on the promotion and protection of human rights set out in the Universal Declaration on Human Rights. ... The United States understands and accepts the thrust of principle 3 to be that economic development goals and objectives must be pursued in such a way that the development and environmental needs of present and future generations are taken into account. The United States cannot agree to, and would disassociate itself from, any interpretation of principle 3 that accepts a "right to development", or otherwise goes beyond that understanding*" (UN 1993d, p. 17).

Finally, if the 1972 Stockholm and 1992 Rio Declarations are considered alongside the 1944 Declaration of Philadelphia[413] and Agenda 21, the positive tensions generated between these documents begin to provide a more robust and comprehensive formulation of the notion of sustainable development.

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[411] The polluter-pays principle was first introduced by the OECD (Organization for Economic Cooperation and Development) to "*restrain public subsidization of the pollution control costs of private firms in line with traditional liberal economics calling for the internalization of environmental externalities*" (Gaines 2002, p. 10332).

[412] Principle 3 of the Rio Declaration provides a somewhat ambiguous description of the right to development. Just as human needs can be difficult to define, so are developmental and environmental needs - especially when considered in an intergenerational context. Interestingly, the 1986 UN Declaration on the Right to Development does not include any text on environmental considerations. Instead, it states that the "*right to development is an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized*" (UN Declaration on the Right to Development, 1986, Article 1, 1). Further, it reaffirms that nation states have sovereignty over their natural wealth and resources, but does not provide any guidance on how these should be used other than in accordance with relevant provisions in both International Covenants on Human Rights. Therefore, "*fulfilling*" the right to development to meet developmental *and* environmental needs encompasses a much broader notion of the 'right to development.'

[413] See Section 3.3.3.1 for a discussion on the Stockholm Declaration and Declaration of Philadelphia.

Table 3.4: Dernbach's Model of 'Sustainable Development' and the Rio Principles [414]

Component of *Sustainable* Development	Rio Principles
Peace and Security	**Principle 24** - Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further development, as necessary. **Principle 25** - Peace, development and environmental protection are interdependent and indivisible. **Principle 26** - States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.
Economic Development	**Principle 5** - All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world. **Principle 12** - States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. ... **Principle 25** - above.
Social Development	**Principle 1** - Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. **Principle 8** - To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies. **Principle 20** - Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development. **Principle 21** - The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all. **Principle 25** - above.

[414] Principles 2, 6, 9, and 27 of the Rio Declaration are not included in the table since they do not fit within any of the categories listed - see supporting text for a discussion of these principles.

Component of *Sustainable* Development	**Rio Principles**
National Governance that Secures Peace and Development (or more generally, National Governance that Secures Sustainable Development)	**Principle 3** - The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations. **Principle 10** - Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided. **Principle 11** - States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries. **Principle 13** - States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction. **Principle 22** - Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.

Component of *Sustainable* Development	Rio Principles
'Strong' Environmental Protection Measures (Note: These Rio Principles explicitly link the development process with the environment, which is why they have been called 'strong' environmental protection measures.)	**Principle 4** - In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it. **Principle 7** - States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command. **Principles 8, 11, and 13** - above. **Principle 14** - States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health. **Principle 15** - In order to protect the environment, the **precautionary approach** shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. **Principle 16** - National authorities should endeavour to promote the **internalization of environmental costs** and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment. **Principle 17** - **Environmental impact assessment**, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. **Principle 18** - States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted. **Principle 19** - States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith. **Principle 23** - The environment and natural resources of people under oppression, domination and occupation shall be protected. **Principles 25 and 26** - above.

3.4.4.2 Agenda 21 and the UN Commission on Sustainable Development

> "*Agenda 21 stands as a comprehensive blueprint for action to be taken globally - from now into the twenty-first century - by Governments, United Nations organizations, development agencies, non-government organizations and independent-sector groups, in every area in which human activity impacts on the environment*" (UN 1993a, p. 3).[415]

Agenda 21 is the action plan for the Rio Declaration. The preamble to Agenda 21 states that national strategies, plans, policies, and processes are crucial in achieving its successful implementation and that the responsibility for sustainable development lies principally with national governments. Since the retention of national sovereignty is an essential part of international relations, it is fitting that Agenda 21 places this responsibility with national governments. However, transitioning society towards sustainable development is not the sole responsibility of governments. The private sector and other groups in civil society also need to take a proactive role - an aspect that is understood and reinforced in Agenda 21. In this regard, Agenda 21 reinforces the need for "*community-based action*" (Reid 1995, p. 232) that was first called for in the Cocoyoc Declaration, *Small is Beautiful*, and *What Now: Another Development.*

Agenda 21 is structured using four overarching sections: [1] Social and Economic Dimensions; [2] Conservation and Management of Resources for Development; [3] Strengthening the Role of Major Groups; and [4] Means of Implementation. Within each of these sections are numerous program areas (covering a wide range of topics) that articulate their purpose by defining the basis for action; the objectives of the action; the potential activity areas; and, the means of implementing the objectives/activities. Since Agenda 21 is an action plan, the fine details of how its objectives are to be achieved are left to the decision-making institutions and/or NGO groups.

The forty chapters of Agenda 21 provide a comprehensive framework against which governments can assess their activities. The detailed nature of the objectives and proposed action items also means that the notion of sustainable development is made more tangible. By providing examples of what sustainable development means to economic sectors, natural resources, and important problem areas, Agenda 21 offers an implementation (or operational) context for sustainable development (Dernbach 1998). In this regard, Agenda 21 is more complete and actionable than the 1972 Stockholm Action Plan.

An important recommendation made in Agenda 21 is the call for the creation of a UN Commission on Sustainable Development (UNCSD) to monitor progress in the implementation of the action plan.[416] In December 1992, the UN General Assembly

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[415] Source: UN Department of Economic and Social Affairs, Division for Sustainable Development, *Agenda 21*, http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm (accessed on 04/09/06).

[416] "*In order to ensure the effective follow-up of the Conference, as well as to enhance international cooperation and rationalize the intergovernmental decision-making capacity for the integration of*

requested that the Economic and Social Council (ECOSOC) establish the UNCSD at its organizational session in 1993.[417] The UNCSD was subsequently formed with representatives from 53 states.[418]

Since its formation, the UNCSD has played an important supporting role in the 1997 Earth Summit II and the 2002 Johannesburg Summit. During this time the mandate of the UNCSD has gradually evolved. While the Commission still meets annually to review progress on the implementation of Agenda 21 - as well as the Barbados Programme of Action for Sustainable Development of Small Island Developing States[419] and the Johannesburg Plan of Implementation[420] - its work plan has been streamlined into a multi-year program of work.[421] This program is structured around seven thematic clusters of issues (such as water, sanitation, and human settlements), each of which will be focused on for two years. The final cluster will be completed in 2016/2017. By grouping issues into thematic clusters, the UNCSD will be able to assess them in an integrated manner, taking into account economic, social, and environmental dimensions of sustainable development. Further, as a functional commission of the ECOSOC, the UNCSD will continue to play a key role in providing the UN system with expertise on sustainable development.

Since the 1992 UNCED some 6,400 municipalities in 113 countries have become involved in local Agenda 21 initiatives, 87 of which are located in the U.S. (UNDESA 2002).

3.4.4.3 Rio's Unasked Questions

The Earth Summit is seen as a seminal event, when the international community gathered to recognize and articulate the concept of sustainable development. Indeed, the Summit was unprecedented in its scale and scope. Its mission was to revolutionize the way we think and live so as to protect the planet and ensure the welfare and future of humankind. A major part of this vision was to bridge the conflicts between developed and developing nations that had preoccupied so many of the 'development' discussions of the previous

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environmental and development issues and to examine the progress in the implementation of Agenda 21 at the national, regional and international levels, a high-level Commission on Sustainable Development should be established in accordance with Article 68 of the Charter of the United Nations" (UN 1993c, p. 275).

[417] Source: UN General Assembly, *Resolution 47/191*, 22 December 1992, http://www.un.org/documents/ga/res/47/a47r191.htm (accessed on 04/09/06).

[418] See the UN Commission on Sustainable Development, http://www.un.org/esa/sustdev/ (accessed on 04/09/06).

[419] See the 1994 *Declaration of Barbados* and the *Programme of Action for Sustainable Development of Small Island Developing States*, http://www.sidsnet.org/docshare/other/BPOA.pdf (accessed on 04/09/06).

[420] See the 2002 *Johannesburg Plan of Implementation*, http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm (accessed on 04/09/06).

[421] In 2003, the CSD announced its multi-year program of work until 2017. The program is structured into seven two-year cycles, with each cycle focusing on a selected thematic clusters of issues. The multi-year program can be viewed at: http://www.un.org/esa/sustdev/csd/csd11/CSD_mulityear_prog_work.htm (accessed on 04/09/06).

twenty years. However, while the Earth Summit was perceived by many to have successfully addressed these issues (given the challenge of achieving consensus among so many nation states), there were those who argued that the Summit had sidestepped vitally important, and politically volatile, questions.

On the eve of the UNCED, David Korten (founder and president of the People-Centered Development Forum) published a column which highlighted three questions that he argued had not been asked in the pre-Summit discussions:

1. "*Is sustained economic growth possible within a finite ecosystem?*"
2. "*Is the removal of barriers to the free international flow of trade and capital consistent with the essential need for community and environmental stewardship?*"
3. "*Is official international assistance part of the solution or part of the problem?*"[422]

The first two questions addressed the conviction that economic growth would be sufficient to alleviate the world's problems of poverty and environmental degradation. Korten argued that even a smarter (more environmentally sound) approach to sustained economic growth ignores data which indicates that the earth cannot support the scale of economic (i.e., industrial) expansion envisioned by its proponents. Second, a reliance on free trade is likely to enable goods and capital to move freely across national borders, weakening the ability of governments to regulate their own economies and protect their citizens against fluctuations in the international economy. "*Where corporate globalists tell of the spread of democracy and vibrant market economies, civil society tells of the power to govern shifting away from people and communities to financial speculators and global corporations dedicated to the blind pursuit of short-term profit in disregard of human and natural concerns.*"[423, 424] Korten saw the UNCED process as being dominated by nation states whose political power and social systems were grounded in market capitalism. Hence, there was no incentive for them to consider alternative forms of development that moved away from economic growth through industrialization. Those nations, groups, or individuals who questioned the economic belief that a 'rising tide will raise all boats' faced ridicule for being insensitive to the needs of the poor.

Korten's third question was based upon the fact that while the amount of aid given to developing nations had increased over the previous four decades, environmental conditions in these nations had consistently worsened. Therefore, it only seemed logical

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[422] Source: Korten, D. (1991) People-Centered Development Forum, Column No. 12, 15 April 1991, *The UN Conference on Environment and Development: Unasked Questions*, http://www.pcdf.org/1991/12KORTEN.htm (accessed on 04/09/06).

[423] Source: Korten, D. (2003) *Global Economics, Environmental Integrity, and Justice: Reflections of an "Economic Missionary,"* National Council of Churches, Enough for All: Sustainable Living in a Global World, Seattle University, June 20-23 2003, http://www.pcdf.org/2003/NCC.htm (accessed on 04/09/06).

[424] In a speech to the World Business Council on Sustainable Development (WBCSD) on 4 November 1999, Gro Harlem Brundtland admitted that markets are not always right. To provide an example, she quoted a former prime minister of India who "*saw no multinational companies willing to invest in educating the children of India, or immunising them and helping them to grow up*" (Saha 2002, p. 23).

to ask the question of whether there were alternative international mechanisms through which developing nations could be assisted.

In response to Korten's column, Herman Daly (Daly 1991) suggested that the first question was growing impossible to ignore based upon an increasing volume of data on the declining vitality of the earth's ecosystems. He also suggested that the latter two of Korten's questions were vitally important and would be the most challenging to address. Rather than attempt to tackle them at Rio, he recommended that they be resolved through further research after the Summit and that the UNCED focus its attention on the first question. A look at both the Rio Declaration and Agenda 21 provides some evidence that the UNCED did attempt to address the first question directly. For example, Rio Principle 8 calls for nation states to try and "*reduce and eliminate unsustainable patterns of production and consumption.*" In support of this principle, Agenda 21 dedicates an entire section to promoting "*patterns of consumption and production that reduce environmental stress*" (UN 1993a, p. 31).

One year after the UNCED, *The Ecologist* magazine published *Whose Common Future?*, which addressed similar questions to those raised by Korten. However, its critique of the UNCED process was rather more scathing.

> "*The Summit ... went according to plan: indeed the outcome was inevitable from the start. Unwilling to question the desirability of economic growth, the market economy or the development process itself, UNCED never had a chance of addressing the real problems of "environment and development". Its secretariat provided delegates with materials for convention on biodiversity but not free trade; on forests but not on logging; on climate but not on automobiles. Agenda 21 - the Summit's "action plan" - featured clauses on "enabling the poor to achieve sustainable livelihoods" but none on enabling the rich to do so; a section on women but none on men. By such deliberate evasion of the central issues which economic expansion poses for human societies, UNCED condemned itself to irrelevance even before the first preparatory meeting got under way*" (The Ecologist 1993, pp. 1-2).

A main conclusion of *Whose Common Future?* is that communities should be reinstated as sources of social and political authority and the idea that the modern CEO faces the same common future as the peasant in Bihar should be rejected. A critical question raised by the book is *who* will manage the environment for *whose* interest? It argues that *how* the environment should be managed is known through past experience and indigenous/local knowledge - both of which were becoming lost in the international economy. It is interesting that both Korten and *The Ecologist's* arguments lean towards the notion of national self-reliance. This concept was a core element of the 1970s 'eco-development' movement, which sought ecological and economically sound regional and local development. Further, their arguments highlight the importance of balancing the role of national/local government with the role of the market - both of which must be held accountable to the people's interests by the legal/institutional frameworks of civil society.

Michael Redclift (1996) also provides a valuable retrospective on the UNCED. His main criticism of the Summit is that its spectators might have been convinced that the principal environmental problems facing the world were "*climate change, a loss of forests and, with them, biodiversity*" (ibid, p. 19). Redclift argues that the UNCED neglected to address important questions relating to population, trade, poverty, the debt crisis (faced by many oil importing developing nations),[425] and distributional inequality more generally. In addition, he raises an important question about whether the 'development' of industrialized nations is what the developing world should be aspiring to achieve.

> "*With hindsight we may come to see UNCED as marking an important shift away from the development discourse of the 1970s and 1980s, towards a new concern with science and uncertainty, a concern that paralysed Northern governments by laying bare the contradictions of their development. The 'success' of development, including improved material standard of living, has not necessarily brought improvements in the quality of life, as measured by personal security, freedom from pollution and traffic congestion, and risks from nuclear and toxic waste streams.*" (Redclift 1996, p. 20).

The above critiques of the UNCED indicate that it is far easier to identify the problems faced by humanity than it is to develop international consensus on any suitable way to address them. While science helps unravel the complexity of global environmental problems, it is human behavior that will ultimately direct the societies of the world towards potential solutions. As McCormick (1995, p. 264) notes, "[w]*hether or not solutions are effectively applied will continue to depend upon politics and policy, upon the attitudes of leaders, parties, industry and the public, and upon a complex cross-referencing and cooperative system involving international agencies, national environmental agencies, NGOs, and a series of often non-binding international conventions and agreements.*" Hence, we return to the arguments made by the critics of *Limits to Growth*, who emphasized that the course of events can be changed dramatically (by altering the prevailing social arrangements) if environmental and social constraints become intolerable (Jahoda 1973; Rowland 1973). However, at the end of the 1980s, as the extent of global environmental problems was beginning to be appreciated, some remained skeptical that any effective political action could be achieved.[426]

The idea that social activism could alter what is politically feasible was cast in doubt around the time of the UNCED. A UNEP report revealed somewhat of a paradox between the public's growing awareness of environmental problems and the lack of any tangible political 'action' to address these problems (UNEP 1992). One possible reason for this paradox was a "*corrupt political process awash in corporate money and beholden*

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[425] Supra note 342.

[426] "*It becomes increasingly difficult to say what are practical suggestions, when one's research tends to show that what is politically feasible is usually too minor to make any difference, while changes significant enough to be worthwhile are often unthinkable in practical political terms. In any case, genuine practicality in making policy suggestions requires detailed knowledge of a particular country or area; its history, culture, vegetation, existing situation, and much more besides. Lists of general 'policy conclusions' make it all too easy for the rigid-minded to apply them as general recipes, without thought, criticism or adjustment for circumstances*" (Raikes 1988, p. v).

to corporate interests rewriting our laws to provide corporations with massive public subsidies while eliminating the regulations and borders that hold corporations accountable to some larger public interest."[427] The same corporations that fund the political process also control/influence the media, raising the question of whether a clear picture of global environmental problems is actually reaching society. A counterargument might simply be that the predicted environmental and social problems have yet to reach a point where prevailing paradigms can be challenged. Indeed, the problems may never reach this point. A critical question that remains, however, is whether the model of political action based upon social discontent is capable of addressing the complex problem of ecosystem overshoot and collapse. With so many interests and positions to consider, so much dynamic uncertainty, and so much at stake, the challenge of *operationalizing* 'sustainable' development is likely to be the most important and most daunting task of the twenty-first century.

3.4.5 Earth Summit II (1997)

In 1997, five years after the Earth Summit in Rio, the UN held a General Assembly Special Session (otherwise known as the Earth Summit II or Earth Summit +5) to review and appraise the implementation of Agenda 21. The 19th Special Session took place in New York from 23-27 June.

While the Earth Summit II was the 'official' review of progress made towards the implementation of Agenda 21, there were several important events prior to the Summit that had a direct or indirect effect on its outcome (Box 3.15).[428]

Box 3.15: Important Events Held Prior to the Earth Summit II

Date	Event
22 Dec 1992	UN General Assembly, via Resolution 47/190,[429] calls for a Special Session to review progress made on the implementation of Agenda 21 to be held no later than 1997.
16 Dec 1996	UN General Assembly, via Resolution 51/181,[430] decides to convene the Special Session envisioned in Resolution 47/190 from 23-27 June 1997, in New York. The 19th Special Session is to be attended by heads of state.

[427] Supra note 423.
[428] A comprehensive set of materials relating to the Earth Summit II can be accessed from the Habitat web site (Habitat is a clearinghouse for information related to the 1992 UN Conference on Environment and Development), http://habitat.igc.org/csd-97/prop-out.html (accessed on 04/09/06).
[429] See the UN General Assembly, *Resolution 47/190, Report of the United Nations Conference on Environment and Development*, 22 December 1992, http://www.un.org/documents/ga/res/47/a47r190.htm (accessed on 04/09/06).
[430] See the UN General Assembly, *Resolution 51/181, Special session for the purpose of an overall review and appraisal of the implementation of Agenda 21*, 16 December 1996, http://www.un.org/documents/ga/res/51/a51r181.htm (accessed on 04/09/06).

Box 3.15: Important Events Held Prior to the Earth Summit II

Date	Event
24 Feb - 7 Mar 1997	The **UN Commission on Sustainable Development (UNCSD)** holds an **Ad Hoc Open-ended Inter-Sessional Working Group** to prepare for the 19th Special Session.
13 - 19 Mar 1997	"**Rio +5**" is held in Rio de Janeiro, Brazil. This forum was organized by the Earth Council (an NGO created by Maurice Strong) and was attended by over four hundred participants from all sectors and geographic regions of the world.[431] The heads of UNESCO, UNDP, UNEP, and the World Bank were present, along with many representatives from national and international NGOs. Rio +5 was an 'unofficial' part of the preparations for the 19th Special Session of the UN General Assembly.
7 - 26 Apr 1997	The **UNCSD holds its fifth session** as a negotiation and preparation meeting for the 19th Special Session to review and appraise the implementation of Agenda 21.[432]
16 - 21 June 1997	The **UNCSD holds a second week of negotiations and preparations** to pull together the material for the 19th Special Session.
20 June 1997	A special meeting of the UN General Assembly adopts the ***Agenda for Development***[433] - an all-encompassing framework for international cooperation on development. The *Agenda for Development* is not part of the preparations for the 19th Special Session of the UN General Assembly; however, its content is of direct relevance to sustainable development.
23 - 27 June 1997	The **19th UN General Assembly Special Session (Earth Summit II)** is held in New York. The UN General Assembly adopts the **Programme for the Further Implementation of Agenda 21**.[434]

The core objective of the Earth Summit II was to assess how well nation states, international organizations, and civil society had responded to the challenges laid out at the 1992 Earth Summit.[435] The UN sought to identify where progress towards the implementation of Agenda 21 had been both positive and negative and, based on its evaluation, establish a work plan for the further implementation of the Rio action plan. A second objective was to reestablish and increase world-wide political commitment to

[431] See the Earth Council, *The Rio +5 Consultation*, March 13-19, 1997, http://www.ecouncil.ac.cr/rio/ (accessed on 04/09/06).
[432] The official documents from the UNCSD fifth session and the Ad Open-ended Hoc Inter-sessional Working Group can be accessed from the following web site, http://www.un.org/esa/sustdev/csd/CSD5.htm (accessed on 04/09/06).
[433] See the UN Agenda for Development, http://www.un.org/Docs/SG/ag_index.htm (accessed on 04/09/06).
[434] See the UN General Assembly, *Programme for the Further Implementation of Agenda 21*, http://www.un.org/documents/ga/res/spec/aress19-2.htm (accessed on 04/09/06).
[435] Source: The United Nations, Earth Summit +5, *Special Session of the General Assembly to Review and Appraise the Implementation of Agenda 21*, http://www.un.org/ecosocdev/geninfo/sustdev/es&5sust.htm (accessed on 04/09/06).

Agenda 21. The UN General Assembly also made a clear statement, via Resolution 51/181, that the Rio Declaration, Agenda 21, and the non-legally binding Forest Principles would not be open for renegotiation at the 1997 Summit.

The first significant review of progress towards Agenda 21 took place during the UN Commission on Sustainable Development's (UNCSD's) Ad Hoc Open-ended Inter-Sessional Working Group (hereafter referred to as the 'Ad Hoc Working Group') from 24 February to 7 March 1997. This Ad Hoc Working Group was attended by representatives from all of its 53 member states. In addition, observers from other nation states within the UN system were present, along with representatives from many intergovernmental and non-governmental organizations (UNCSD 1997b).

The tone of the Ad Hoc Working Group was set by its co-chairs, who asked the attendees for "*maximum creativity and receptivity*" (Osborn and Bigg 1998, p. 5). The idea was to use the first week of discussions to outline a set of creative proposals which the Working Group could debate during the second week. As a result of these two weeks of discussions - which covered the full range of issues in Agenda 21 - the Working Group was able to agree on six main areas that required special attention (ibid, pp. 5-6). These were the need to:

- address poverty and the growing levels of economic inequality around the world;
- halt the decline in overseas development assistance (ODA);[436]
- address the growing problem of diminishing water resources and the pollution of these resource in many parts of the world, and identify means to bring fresh water and sanitation services to the hundreds of millions of people with no or limited access to them;
- develop a global strategy to tackle climate change;
- promote the sustainable management of forests throughout the world; and
- establish effective international cooperation and political support to halt the decline of fish stocks in many parts of the world and to protect the marine environment from pollution.

It is interesting to note that important issues such as population growth, human health, and air quality were not identified as requiring special attention.

The conclusions of the Ad Hoc Working Group indicate that five years after the UNCED, the condition of the global environment had continued to deteriorate and looked set to worsen (UNCSD 1997b). While some nations had been able to reduce pollution levels and the degradation of resources through institutional change and capacity-building efforts (involving both public participation and private sector actions), these actions were not sufficient to counteract the sheer scale of human activity that fed negative environment and development trends (ibid, p. 5).

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[436] At the 1992 Earth Summit, nation states committed to a level of ODA that was equivalent to 0.7 percent of GNP for developed nations and 0.15 percent of GNP for developing nations. However, between 1992 and 1995, ODA, as a percentage of GNP in developed nations, declined from 0.34 percent to 0.27 percent (UNCSD 1997b).

Between the Ad Hoc Working Group meeting and the next meeting of the UNCSD at its fifth session, the Earth Council (an NGO based in Costa Rica) held the 'Rio +5' forum in Rio de Janeiro, Brazil. The theme of Rio +5, an unofficial part of the preparations for the Earth Summit II, was "*Moving From Agenda to Action.*"[437] This theme was indicative of the perceived lack of action in moving towards the objectives of sustainable development since the UNCED. Rio +5 attracted over four hundred participants from all over the world from governments, international organizations, and NGOs. The pre-forum activities included a series of national and international multi-stakeholder consultations which produced more than 70 special focus reports and 80 consultation reports. The conclusions of the Rio +5 forum were the same as the Ad Hoc Working Group. "*Despite progress made on many fronts as evidenced at Rio+5, the world community has still not made the fundamental transition to a development pathway that will provide the human community with a sustainable and secure future. Environmental deterioration continues and the forces which drive it persist.*"[438]

While Rio +5 was a significant event, a number of organizations involved with the preparations for the Earth Summit II were critical of the forum, questioning its overall value and the amount of resources it required (Osborn and Bigg 1998). The proponents of Rio +5 argue that it was intended to revitalize the sustainable development movement and provide additional material for the Earth Summit II. Its critics claim that the opposite occurred. "[I]*t is clear that Rio +5 did not have the major impact on* ... [the Earth Summit II] *that its organizers hoped for. Attempts were made during the forum to agree* [on] *a set of recommendations from delegates, and to get backing for the preparation of an Earth Charter. Both of these proved controversial and in the event no strong endorsement for either could be claimed. The texts made available in New York* [at the Earth Summit II] *did not have a strong impact on the intergovernmental process*" (ibid, p. 7). Further, Osborn and Bigg (1998) argue that since many influential people took part in the forum, the lack of progress in Rio indicated that no substantial progress could be made at the Earth Summit II. Thus, these people were not as active or constructive as they might have been during the official Summit three months later.

Almost three weeks after the Rio +5 forum, the UNCSD met for its fifth session in New York with the objective of preparing for, and negotiating the likely conclusions from, the Earth Summit II (Osborn and Bigg 1998). During the two weeks of the UNCSD's fifth session, some progress was made on key issues identified during the Ad Hoc Working Group meeting.[439] However, no progress was made on the implementation of the forest principles and the framework convention on climate change. Not surprisingly, the conclusions from the UNCSD fifth session were largely the same as those from the Ad Hoc Working Group and the Rio +5 forum.

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[437] Source: Statement by Maurice F. Strong, *Earth Council Chairman's Report to the UN Commission on Sustainable Development*, April 8, 1997, http://www.ecouncil.ac.cr/rio5/forum/english/annex1.htm (accessed on 04/09/06).

[438] Supra note 437.

[439] For example, a new international initiative on fresh water was approved, potential ways to strengthen work on sustainable consumption and production were launched, and some new opportunities for addressing problems associated with energy use and transportation were identified (Osborn and Bigg 1998, p. 9).

> *"Currently, some trends appear positive: the growth in world population is slowing, food production is still rising, the majority of people are living longer and healthier lives, environmental quality in some regions is improving. But it is impossible to ignore the other trends which have the potential to undermine these gains or even bring about catastrophic collapse of local economies. They include the growing scarcity of fresh water, loss of productive agricultural land and the downward spiral of impoverishment affecting a significant minority of the world's population. These threats are real and near-term; they already affect millions of people. ... Global catastrophe does not appear to be imminent. But projections ... clearly indicate that pursuit of business-as-usual development patterns is most unlikely to result in sustainable development in the near future"* (UNCSD 1997a, p. 5).

In addition to the events discussed above, the output of the Earth Summit II was also influenced by the adoption of the *Agenda for Development* by the UN General Assembly a few days before the Summit. Initiated by the first Earth Summit in 1992,[440] the *Agenda for Development* outlines an *"all-encompassing framework for international cooperation on development."*[441] By building upon and integrating the output from major UN conferences and agreements, *Agenda for Development* provides a comprehensive *"blueprint for optimizing the efforts and the impact of the multilateral system as a whole."*[442] Since the *Agenda for Development* was crafted over a four year period, outside of any pre-conference deliberations that tend to be subject-biased, it articulates a comprehensive and well balanced framework for development. If this framework is considered along with the *Agenda for Development's* action-oriented synthesis of social and economic development, it indicates that the prevailing conceptualization of 'sustainable' development has not been fully realized (Dernbach 1998).

Despite the groundbreaking scope of the *Agenda for Development*, many developing nations were dissatisfied with the final document (Osborn and Bigg 1998). In particular, they cited the lack of any decisive commitment by developed nations to transfer financial and technological support to developing nations to assist with their development. Osborn and Bigg (1998) argue that this dissatisfaction influenced the positions of many developing nation delegates at the Earth Summit II, which affected the negotiations of the key sections of the Summit's resolution.

The above discussion indicates that by the time the Earth Summit II was underway its conclusions were already largely known. There had been little tangible progress on achieving the objectives of the Rio Declaration, Agenda 21, and the Forest Principles,

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[440] See UN General Assembly, *Resolution 47/181, An Agenda for Development*, 22 December 1992, http://www.un.org/documents/ga/res/47/a47r181.htm (accessed on 04/09/06). Also see Resolution 48/166, *An Agenda for Development*, 21 December 1993, http://www.un.org/documents/ga/res/48/a48r166.htm (accessed on 04/09/06), and *Resolution 49/126, An Agenda for Development*, 19 December 1994, http://www.un.org/documents/ga/res/49/a49r126.htm (accessed on 04/09/06).

[441] Source: UN, *Agenda for Development*, Foreword, http://www.un.org/Docs/SG/forward.htm (accessed on 04/09/06).

[442] Supra note 441.

and important environment and development trends looked set to deteriorate. Given the relatively ineffective pre-Summit negotiations, there was also little hope that an effective plan of action could be developed to correct the perceived problems.[443] Further, many were critical of the Earth Summit II, arguing that its focus was the world's economy and how economic growth can be sustained rather than environmental protection (Sandbrook 1993).

The resulting UN General Assembly resolution on the *Programme for the Further Implementation of Agenda 21*[444] combined with the pre-Summit reports provide a rather discouraging appraisal of the limited success of the first decade of sustainable development (NRC 2002). It was clear to many that the political commitments made mainly by developed nations at the UNCED had not been kept and that the Earth Summit II had failed to address this problem.[445] The long list of broken promises seriously undermined any trust that had been established between developed and developing nations and provided little incentive for developing nations to make the difficult transitional steps towards sustainable development (Osborn and Bigg 1998). Further, it was apparent that political, media, and public interest in environmental concerns had waned since the post-Brundtland peak (NRC 2002; Osborn and Bigg 1998). Without such public attention and media scrutiny, politicians had little incentive to commit to new promises. Indeed, this was the case at the Earth Summit II when three Ministerial Working Groups failed to achieve any substantive progress on the issues of forestry management, climate change, and financial aid.

Thus, the overriding message from the Earth Summit II was that if progress is to be made towards sustainable development, there needs to be a "*renewed effort around the world to focus attention on the issues and to build political consciousness and determination to achieve real results*" (Osborn and Bigg 1998, p. 3).

Possibly one of the most depressing realizations regarding the Earth Summit II is the fact that even if all of the objectives of Agenda 21 had been fully implemented, "*the environment, and every living creature that depends on the environment, including you and me, would still be in trouble.*"[446] Given that the international community was unable to commit to the provisions within Agenda 21, the future for sustainable development looked somewhat bleak.

Three years after the Earth Summit II at the turn of the millennium, UNEP published the *Global Environmental Outlook 2000.* The report stated that two overriding trends (similar to those identified at the time of the Earth Summit II) would characterize the start of the 21st century:

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[443] Source: Meadows, D. H. (1997) *Rio Plus Five and Going Backward*, June 19, 1997, http://www.pcdf.org/meadows/rioplus5.htm (accessed on 04/09/06).
[444] Supra note 434.
[445] An example of the worldwide perception of the Earth Summit II is encapsulated by the headline of *The Guardian* newspaper, London, 28th June 1997, which read "*Earth Summit ends in failure.*"
[446] Supra note 443.

- "*First, the global human ecosystem is threatened by grave imbalances in productivity and in the distribution of goods and services.*"
- Second, "*the world is undergoing accelerating change, with internationally-coordinated environmental stewardship lagging behind economic and social development.*"[447]

UNEP argued that the first trend is likely to result in the accentuation of extremes in wealth and poverty. Hence, those that have will have more and those that do not will slip further into impoverishment. The second trend, however, is likely to result in the environmental gains from technological progress being overshadowed by the sheer scale of population growth and economic development. Both trends undermine the political and environmental stability of the world and suggest that the importance of sustainable development is likely to increase the longer these trends are ignored.

Finally, two other notable millennium documents are the *Earth Charter* (prepared by the Earth Council) and the *Millennium Declaration* adopted by the UN General Assembly via Resolution 55/2. Interestingly, the structure of both the *Earth Charter* (Box 3.16) and the *Millennium Declaration*[448] align closely with the five components of sustainable development - peace and security; economic development; social development; national governance that ensures peace and development; and environmental protection. Since the two publications are produced by different sources (the UN and an NGO), it provides additional support to the notion that 'sustainable' development can be broadly defined using these five critical elements.

Box 3.16: Principles of the Earth Charter

I. RESPECT AND CARE FOR THE COMMUNITY OF LIFE

1. Respect Earth and life in all its diversity.
2. Care for the community of life with understanding, compassion, and love.
3. Build democratic societies that are just, participatory, sustainable, and peaceful.
4. Secure Earth's bounty and beauty for present and future generations.

In order to fulfill these four broad commitments, it is necessary to:

II. ECOLOGICAL INTEGRITY

5. Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and the natural processes that sustain life.

[447] Source: United Nations Environment Programme, *Global Environmental Outlook 2000*, Synthesis, http://www.unep.org/geo2000/english/0011.htm (accessed on 04/09/06).

[448] Major headings of the United Nations Millennium Declaration: [1] Values and principles (specifically: freedom; equality; solidarity; tolerance; respect for nature; and shared responsibility); [2] Peace, security and disarmament; [3] Development and poverty eradication; [4] Protecting our common environment; [5] Human rights, democracy and good governance; [6] Protecting the vulnerable; [7] Meeting the special needs of Africa; and [8] Strengthening the United Nations. Source: UN, *United Nations Millennium Declaration*, http://www.un.org/millennium/declaration/ares552e.htm (accessed on 04/09/06).

Box 3.16: Principles of the Earth Charter

6. Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach.
7. Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being.
8. Advance the study of ecological sustainability and promote the open exchange and wide application of the knowledge acquired.

III. SOCIAL AND ECONOMIC JUSTICE

9. Eradicate poverty as an ethical, social, and environmental imperative.
10. Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner.
11. Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity.
12. Uphold the right of all, without discrimination, to a natural and social environment supportive of human dignity, bodily health, and spiritual well-being, with special attention to the rights of indigenous peoples and minorities.

IV. DEMOCRACY, NONVIOLENCE, AND PEACE

13. Strengthen democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision making, and access to justice.
14. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life.
15. Treat all living beings with respect and consideration.
16. Promote a culture of tolerance, nonviolence, and peace.

3.4.6 The World Summit on Sustainable Development - Earth Summit III (2002)

> "*Johannesburg Summit 2002 is an opportunity to rejuvenate the quest to build a more sustainable future. The Summit must bring the world together, and forge more cohesive global partnerships for the implementation of Agenda 21. It must send out a message that sustainable development is not only a necessity, but also an exceptional opportunity to place our economies and societies on more durable footing.*" (Kofi Annan, Secretary-General of the UN, 2001).

Kofi Annan's comments speak directly to the failures of the Earth Summit II in 1997. His call to rejuvenate the quest for sustainable development indicates the lack of international momentum and commitment to the concept. However, there was little in the deliberations before the World Summit on Sustainable Development to suggest that this situation would be altered.

The decision to hold the 'World Summit on Sustainable Development' (also known as the Johannesburg Summit or the Earth Summit III) in Johannesburg in 2002 was made by the UN General Assembly via Resolution 55/199, adopted 5 February 2001.[449] The purpose of the Johannesburg Summit was almost identical to that of the Earth Summit II - to review "*progress achieved in the implementation of the outcome of the United Nations Conference on Environment and Development* [and] ... *reinvigorate the global commitment to sustainable development.*"[450] The General Assembly placed a specific emphasis on the identification of new challenges and opportunities within "*the principle of common but differentiated responsibilities.*"[451] Further, it decided that the Johannesburg Summit and its preparatory process (to be administered by the UN Commission on Sustainable Development - UNCSD) "*should ensure a balance between economic development, social development and environmental protection, as these are interdependent and mutually reinforcing components of sustainable development.*"[452] The Summit was also seen as a good opportunity to replenish the GEF Trust Fund.

While there was a clear high-level commitment to make progress at the third global summit on sustainable development, the intractable problems identified during the 1997 Earth Summit II continued to be a problem during the Johannesburg plenary sessions. The final meeting of the Preparatory Committee for the Johannesburg Summit, held in Bali, Indonesia from 27 May - 7 June 2002,[453] failed to break the deadlock between developed and developing nations on how to reconcile the conflicting goals of economic development, poverty reduction, and environmental protection (New Scientist 2002a; 2002c). The South Centre (2002b) argues, however, that the Bali confrontation was useful in that it brought to the surface the pervasive divisions between affluent and poor nations. Further, it awoke the international community to the need to lower its expectations for the Johannesburg Summit and prepared delegates for what was set to be "*another difficult North-South encounter*" (ibid, p. vii). A worrying conclusion from the Bali meeting was that some of the earlier policy achievements for sustainable development now seemed to be in jeopardy.

During the ten years since the UNCED, the world experienced a new phase of economic growth that was largely based upon patterns of development, consumption, and lifestyles that had the effect of widening the gap between affluent and poor nations (South Centre 2002c).[454] While many developed nations had experienced enhancements in their overall quality of life, the direct or indirect effects of globalization led to the gradual degradation of the social, economic, political, and natural environment in many developing nations (ibid, pp. 6-7). Further, the international economic system was still far from being equitable. Differing levels of development and bargaining power throughout the world

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[449] See the UN General Assembly, *Resolution 55/199, Ten-year review of progress in the implementation of the outcome of the United Nations Conference on Environment and Development*, 5 February 2001, http://www.un.org/Depts/dhl/resguide/r55.htm (accessed on 04/09/06).
[450] Ibid, (1).
[451] Ibid, (3).
[452] Ibid, (4).
[453] See the Fourth Summit Preparatory Committee (PREPCOM 4) reports, http://www.johannesburgsummit.org/html/documents/prepcom4.html (accessed on 04/09/06).
[454] Supra note 447.

meant that the international economy tended to be dominated by those with excessive economic and political power.

This new era of economic globalization has had the effect of changing the perception of what mechanisms/solutions would be suitable to transition the world towards sustainable development. The South Centre (2002c, p. 9) argues that developed nations have fundamentally changed their view in this regard and summarizes their new positions as follows:

- "*It is best to leave the issues to the market mechanisms and processes to resolve, with some corrective actions at the margin (end of the pipe approach) and by relying on technological advances.*
- *Developing countries should improve their governance and should pull their act together domestically, including through technical assistance from the North for "capacity building", and in this process should rely increasingly on the private sector, and particular the transnational corporations from the North who have, or will develop, knowledge and solutions needed to deal with diverse challenges of sustainable development and so should be brought into partnerships with the public authorities to provide their services and know-how.*"

On 2 August 2002, a consortium of NGOs, organizations, and academics in the U.S. sent a letter to President George W. Bush to support his decision not to attend the Johannesburg Summit. In this letter, they reinforce the South Centre's characterization of the position of developed nations (e.g., the U.S.) entering the Summit.

> "*We support your insistence ... that one of the key conditions for sustainable development is good national governance. The sad fact is that many of the poorest "developing" nations are not developing at all. Their people are mired in poverty and environmental degradation largely because of oppressive and incompetent government. The World Summit may be considered successful if it follows your lead and proposes ways to encourage building government institutions based on the rule of law and that respect people's civil rights, including the right to property. ... ... World Bank studies have concluded that there is a direct correlation between national prosperity and environmental quality and that environmental conditions improve rapidly as poor nations become wealthier. What will therefore create the conditions necessary for sustainable development is implementing policies that lead to economic growth*" (Letter to President Bush on the Johannesburg Summit, 2 August 2002).

The letter clearly supports economic growth as a vital component of achieving sustainable development; however, there is no discussion of the need to stimulate rapid technological improvements to offset the environmental impact of this (unsustainable) growth.

The World Trade Organization (WTO) Ministerial Declaration, adopted at the 2001 meeting in Doha, 9-14 November, provides further insight into the rise of market mechanisms and capacity-building as core instruments in addressing sustainable

development. The Declaration's preamble states that international trade is an essential part of economic development and the alleviation of poverty, and that "*enhanced market access, balanced rules, and well targeted, sustainably financed technical assistance and capacity-building programmes have important roles to play.*"[455] The Ministerial Declaration's section on 'Trade and Environment' specifically reinforces "*the importance of technical assistance and capacity-building in the field of trade and the environment to developing countries, in particular the least-developed among them.*"[456]

On the eve of the Johannesburg Summit, the International Herald Tribune published a short list of sobering statistics (Box 3.17) prepared by Vangelis Vitalis, the chief advisor to the Round Table on Sustainable Development (an independent organization hosted by the Organisation of Economic Co-operation and Development). These statistics were even more ominous if considered alongside research which indicated that, using current technology, the global society would require the resources of *four* more planet Earths if each person in the world were to reach the consumption level of the average American (Wilson 2002). There was clearly a moral dimension to the continued unsustainable consumption of resources by developed nations which needed to be addressed at the Johannesburg Summit.

Box 3.17: Some Sobering Statistics by Vangelis Vitalis (James 2002a, p. 8)

- The cost to rich countries of fulfilling the Kyoto targets on the reduction of climate warming gases by 2010 will be $56 billion. Subsidies on fossil fuels by rich countries over the same period will total $57 billion.
- The amount of fresh water available to each person in 1950 was 17,000 cubic meters. In 1995, this had declined to 7,000 cubic meters, and it is now going down so fast that up to 5 billion people will experience "high water stress" by 2020, and water could replace oil as the world's leading source of conflict.
- Nearly 50 percent of fish stocks are fully exploited. Over 20 percent are over-exploited or depleted. Fishing fleets in rich countries collect subsidies equivalent to about 20 percent of the value of the landed catch to build bigger boats to pursue diminishing shoals.
- The area covered by tropical forests is disappearing at the rate of four Switzerlands every year. The global forestry industry picks up $35 billion in subsidies every year.
- Annual development assistance by rich countries to poor countries is $53.7 billion. Farmers in rich countries collect $335 billion in subsidies.

In addition to the four preparatory meetings led by the UNCSD, the direction of the Johannesburg Summit was influenced by several important events that preceded it (ECOSOC 2002): [1] the international endorsement of the *Millennium Development Goals*;[457] [2] the understanding that the next round of trade negotiations would build

[455] Source: The WTO (Doha) *Ministerial Declaration*, Adopted on 14 November 2001, paragraph 2, http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.pdf (accessed on 04/09/06).
[456] Ibid, paragraph 33.
[457] See the *UN Millennium Development Goals*, http://www.un.org/millenniumgoals/ (accessed on 04/09/06).

upon the WTO Doha agreements and focus specifically on *development* concerns; and [3] the *International Conference on Financing for Development* held in Monterrey, Mexico, 18-22 March 2002, which placed financing for development at the forefront of the global agenda.[458]

The Johannesburg Summit was held from 26 August to 4 September 2002.[459] The Summit attracted 22,000 participants, including 100 heads of State and Government, 10,000 delegates representing 193 countries and intergovernmental organizations, 8,000 representatives from major groups (i.e., NGOs, industry, and civil society groups), and 4,000 members of the press.[460] In addition to the official Summit, there were a number of parallel events led by NGOs and other groups independent from the UN.[461]

As an implementation-focused Summit, Johannesburg did not lead to the adoption of any new international treaties. However, the Summit did lead to the following four outcomes (ECOSOC 2002):

1. The Johannesburg Declaration on Sustainable Development;[462]
2. The Plan of Implementation of the World Summit on Sustainable Development (i.e., the *Johannesburg Plan of Implementation*);[463]
3. The WEHAB Initiative (a group of five priority areas for action covering water and sanitation; energy; health and environment; agriculture; and biodiversity and ecosystem management); and
4. The Partnerships for Sustainable Development initiative.[464]

The Johannesburg Declaration provides a poignant summary of the challenges that face the international community, many of which were debated in detail during the Summit's plenary sessions (Box 3.18).[465] In addition to reaffirming a commitment to sustainable development, the Johannesburg Declaration specifically urges developed nations to provide the internationally agreed upon levels of official development assistance (ODA)

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[458] See the '*Report of the Conference*' (A/Conf.198/11), accessible from the International Conference on Financing for Development, http://www.un.org/esa/ffd/ (accessed on 04/09/06) and the UN General Assembly, *Outcome of the International Conference on Financing for Development, Report of the Secretary-General*, accessible from http://www.un.org/esa/ffd/ffdconf/ (accessed on 04/09/06).

[459] For a wealth of information on the Johannesburg Summit see the web sites of the following organizations: United Nations, http://www.johannesburgsummit.org/ and http://www.un.org/esa/sustdev/index.html (accessed on 04/09/06); Heinrich Boell Foundation, http://www.worldsummit2002.org/index.htm (accessed on 04/09/06); and Stakeholder Forum for Our Common Future, http://www.earthsummit2002.org/ (accessed on 04/09/06).

[460] Source: United Nations Department of Economic and Social Affairs, *The Road from Johannesburg, What was Achieved and the Way Forward*, http://www.un.org/esa/sustdev/media/Brochure.PDF (accessed on 04/09/06).

[461] See the United Nations Johannesburg Summit 2002, *Parallel Events*, http://www.johannesburgsummit.org/html/basic_info/parallel_events.html (accessed on 04/09/06).

[462] See the *Johannesburg Declaration on Sustainable Development*, http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POI_PD.htm (accessed on 04/09/06).

[463] See the *Johannesburg Plan of Implementation*, http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm (accessed on 04/09/06).

[464] See the *Johannesburg Partnerships for Sustainable Development* program, http://www.un.org/esa/sustdev/partnerships/partnerships.htm (accessed on 04/09/06).

[465] Supra note 462.

to developing nations. Further, and for the first time in such a Declaration, the private sector is called upon to recognize its role in achieving sustainable development. Finally, the Declaration states that the goals of sustainable development will be achieved through "*effective, democratic and accountable international and multilateral institutions,*" [466] putting multilateralism at the center of sustainable development efforts.

Box 3.18: Excerpts from the Johannesburg Declaration - Challenges

The challenges we face

11. We recognize that poverty eradication, changing consumption and production patterns and protecting and managing the natural resource base for economic and social development are overarching objectives of and essential requirements for sustainable development.
12. The deep fault line that divides human society between the rich and the poor and the ever-increasing gap between the developed and developing worlds pose a major threat to global prosperity, security and stability.
13. The global environment continues to suffer. Loss of biodiversity continues, fish stocks continue to be depleted, desertification claims more and more fertile land, the adverse effects of climate change are already evident, natural disasters are more frequent and more devastating, and developing countries more vulnerable, and air, water and marine pollution continue to rob millions of a decent life.
14. Globalization has added a new dimension to these challenges. The rapid integration of markets, mobility of capital and significant increases in investment flows around the world have opened new challenges and opportunities for the pursuit of sustainable development. But the benefits and costs of globalization are unevenly distributed, with developing countries facing special difficulties in meeting this challenge.
15. We risk the entrenchment of these global disparities and unless we act in a manner that fundamentally changes their lives the poor of the world may lose confidence in their representatives and the democratic systems to which we remain committed, seeing their representatives as nothing more than sounding brass or tinkling cymbals.

Unlike the action plan from Rio, the *Johannesburg Plan of Implementation* takes a more focused approach to the execution of Agenda 21 (ECOSOC 2002). Some 60 pages in length, it places more emphasis on socio-economic elements of sustainable development and introduces time-bound targets along with innovative approaches to integrate the management of issues such as poverty, consumption and production, natural resources, and health (ibid, p. 6). The implementation plan also outlines the roles and responsibilities of key bodies such as the UN General Assembly, the ECOSOC (UN Economic and Social Council), the UNCSD, and international institutions in general. Further, the plan advocates the need to strengthen national and regional frameworks for planning for sustainable development, and the need to include major groups in this process. As with the action plan from Rio, the UNCSD is responsible for monitoring its implementation.

[466] Supra note 462, (paragraph 31).

The WEHAB initiative, introduced by Kofi Annan in the lead up to the Summit, was designed to be a complimentary element to the *Johannesburg Plan of Implementation.* The initiative responded to Resolution 55/199 of the UN General Assembly, which stated that the preparatory process should "*focus on ... areas where further efforts are needed to implement Agenda 21*" and that "*action-oriented decisions in those areas, should address ... new challenges and opportunities.*"[467] Hence, the purpose of the WEHAB initiative was to provide focus and momentum for action in five thematic areas that captured the core objectives of Agenda 21. The WEHAB initiative helped focused the Johannesburg Summit on real world issues and enhanced the integration of the five thematic areas within the UN system (ECOSOC 2002). In addition, the five 'framework papers'[468] produced during the plenary sessions provided the Summit with a valuable review of activities in these areas. These papers should also be useful as a framework against which future progress can be monitored in follow-up activities to the Summit.

Finally, the 'Partnerships for Sustainable Development' initiative is described as being "*one of the key innovations of the Summit*" (ECOSOC 2002, p. 7). This initiative focused on establishing voluntary, multi-stakeholder initiatives that were aimed at implementing sustainable development. The intention was that these partnerships should complement inter-governmental partnerships, and in no way substitute for actions and commitments by governments. At the time of the Johannesburg Summit, over 220 partnerships had been identified with many new partnerships being announced during and after the Summit.

Two days after the Johannesburg Summit, the *International Herald Tribune (IHT)* ran an article with the title "*Johannesburg summit: a triumph or a disaster?*" (James 2002b). The article concluded that the Summit had been too complex and that its efforts to include something for everyone resulted in a sprawling document with few specific promises. This view was echoed by an editorial in the *New Scientist*, which argued that what "*emerged from Joburg is a few non-binding targets and lots of good intentions, sprinkled with confused messages about the compatibility of development and conservation*" (New Scientist 2002b, p. 3). A search of the web archives of Greenpeace and Friends of the Earth reveals similar stories of discontent with the Johannesburg summit. In fact, both organizations depict the Earth as being 'sold' to private interests. Indeed, it is hard to find a positive report of the Summit unless it is from an official UN document or a quote from a UN staff member.

A significant outcome from the Johannesburg process was the international community's commitment to market-mechanisms and capacity-building (now reconceived as *capacity development*)[469] as critical measures to achieving sustainable development. Developing

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[467] Source: UN General Assembly, *Resolution 55/199, Ten-year review of progress in the implementation of the outcome of the United Nations Conference on Environment and Development*, 5 February 2001, http://www.un.org/Depts/dhl/resguide/r55.htm (accessed on 04/09/06).

[468] See the WEHAB framework papers, http://www.johannesburgsummit.org/html/documents/wehab_papers.html (accessed on 04/09/06).

[469] During the 1990s, the concept of capacity building and capacity development grew in importance as the international community began to realize that sustainable development could not be addressed through technological and financial solutions alone. While the terms *capacity building* and *capacity development*

nations, however, were concerned about the nature of this transition as it reduced the pressure on (and responsibility of) developed nations to provide their agreed upon share of overseas development assistance since 'the market' would make up for any shortfall.[470] While the creation of a fair (or equitable) trade regime is essential for development in less developed regions, the assistance that industrialized nations provide to less developed nations is likely to remain an important aspect to their early progress. Further, the transition towards a reliance on the market reflects a continuing ideological shift away from the role of the government as a policy driver. In effect, the trend to greater trade liberalization allows industry to escape or minimize the social costs of production by locating its operations in places where national laws of environmental protection are weak and good health and the environment are less valued.

Given that developed nations currently hold the majority of economic and political power, and that this power is based upon the expansion of the international economy, it is not surprising that developing nations are concerned. In the words of the South Centre (2002c, p. 10), "*the overall political and power context, together with the now dominant neo-liberal globalization paradigm favoured by the North and projected worldwide, are not in harmony with some of the basic policy premises contained in the Stockholm-Rio declarations and plans for action. Nor are they responsive to the expectations of the developing countries concerning what role the North - whom they see as being chiefly responsible for global environmental predicament - and the international community should play in supporting, directly and indirectly, their actions and sustainable development objectives in the South. This has led to a widening policy divide on sustainable development between the North and the South.*"

The recent decisions by the U.S. to withdrawal from many multilateral agreements and, instead, focus on voluntary partnerships, is a signal to many environmental organizations that the U.S. is attempting to redefine sustainable development away from environment

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are often used interchangeably, there is a difference between them. *Capacity development*, a more recent term, emphasizes an 'on-going process' of enhancing 'existing' capacities as opposed to 'building' new ones. Hence, it is understood to be an 'endogenous process' whereby 'society' develops its social arrangements (i.e., its regulations, institutions, and standards of behavior), increases its social capital, and enhances its ability to adapt to new circumstances. Source: www.capacity.org (accessed on 04/09/06). For more information on the concept of capacity development, see the UNDP, *Capacity Development Resource Book*, http://magnet.undp.org/cdrb/Default.htm (accessed on 04/09/06).

[470] Given the fact that virtually no developed nation has been able to meet its commitment to provide 0.7 percent of its GNP for overseas development assistance (Martens 2001; UNCSD 1997b), developing nations have had no real option but to compete for 'private capital' to assist with their development. This transition to a reliance on transnational corporations for capital has undermined the notion of the 'social contract' between developed and developing nations (Sachs 2001). There is also a parallel concern that in order to secure private capital, recipient businesses, organizations, and institutions within nation states might be forced to accept unfavorable terms of agreement. Alternatively, governments might be coerced into adjusting regulations to lower the financial risk of investing in their nation when compared to other nation states. If such regulatory adjustments have the effect of lowering environmental and worker health and safety standards, then this outcome would clearly be a shift away from the objectives of sustainable development. The need to look to the international economy for development assistance further reinforces the international economy as *the* mechanism through which nation states should follow their 'right to development.' In this regard, Sachs (2001) suggests that a more accurate name for the 1992 Earth Summit would have been "*Environment, Development, and the Global Economy*" (ibid, p. 11).

and development issues towards trade liberalization (or free trade) (James 2002a). The fact that delegates were able to reject a sentence from the Summit's final resolution, which would have given the WTO a judicial role in trade and environment disputes, indicates that the lines are drawn for a future battle on economic globalization (New Scientist 2002b).

While the outcomes of the Johannesburg Summit did not meet the expectations of almost anyone, the Summit did mark a departure from previous UN conferences both in terms of the preparatory process and its outcomes.[471] The Summit's Secretary-General, Nitin Desai, supported what was achieved at Johannesburg but suggested that too many expectations were placed upon the Summit. He commented that "*we have to be careful not to expect conferences like this to produce miracles. But we do expect conferences like this to generate political commitment, momentum and energy for the attainment of the goals.*"[472]

Governments were not the only group to make commitments at Johannesburg; NGOs, intergovernmental organizations, and the private sector also promised action through the numerous partnerships that were launched at the Summit. While some questioned the validity of these partnerships (New Scientist 2002b), they remain a starting point from which new ventures can evolve in the years to come.

It only seems fitting for the final word on the Johannesburg Summit to go to Kofi Annan, the UN Secretary-General. "*We invited the leaders of the world to come here and commit themselves to sustainable development, to protecting our planet, to maintaining the essential balance and to go back home and take action. It is on the ground that we will have to test how really successful we are. But we have started off well. Johannesburg is a beginning. I am not saying Johannesburg is the end of it. It is a beginning.*"[473]

3.5 Sustainable Development and Economic Globalization

> "*Globalization has helped hundreds of millions of people attain higher standards of living, beyond what they, or most economists, thought imaginable but a short while ago. ... But for millions of people globalization has not worked. Many have actually been made worse off, as they have seen their jobs destroyed and their lives become more insecure. They have felt increasingly powerless against forces beyond their control. They have seen their democracies undermined, their cultures eroded*" (Stiglitz 2002, p. 248).
>
> "*Although I have made a fortune in the financial markets, I now fear that the untrammeled intensification of laissez-faire capitalism and the spread of market*

[471] Source: Department of Economic and Social Affairs, Division for Sustainable Development, *The Johannesburg Summit Test: What Will Change?*, http://www.johannesburgsummit.org/html/whats_new/feature_story41.html (accessed on 04/09/06).
[472] Supra note 471.
[473] Supra note 471.

values into all areas of life is endangering our open and democratic society. The main enemy of the open society, I believe, is no longer the communist but the capitalist threat" (Soros 1997, p. 45).

When Nobel Prize economist Joseph Stiglitz (2002) and the legendary investor Gorge Soros (1997; 2002) express such concerns about economic globalization it sends a strong message that the current trajectory of economic development is flawed.

In contrast to the early international debates around environment and development - which focused mainly on national issues - today's discourse places sustainable development within the much broader concept of globalization. Indeed, globalization is described as adding a 'new dimension' to sustainable development in the Johannesburg Declaration. This new dimension takes the already multidimensional and complex idea of 'sustainable development' and adds a level of additional complexity that makes it even more difficult to comprehend.

This section attempts to provide a high-level review of globalization and address the question of whether it presents an opportunity for, or is an impediment to, a global transition towards 'sustainable' forms of development. While globalization can be considered from a wide range of perspectives, the predominant focus will be on the process of international economic integration.

3.5.1 What is Globalization?

There is no universally agreed upon definition for globalization and the concept is still being formulated (Held and McGrew 2002; Saha 2002).[474] Thus, the discourse on globalization can be described as representing an area for discussion rather than an established mode of thought. Three main theories are often used to frame the process of globalization: [1] the World-System Theory (the spread of the capitalist system across the globe); [2] the World Polity Theory (the theory that "*a rationalized world institutional and cultural order has crystallized that consists of universally applicable models that shape states, organizations, and individual identities*"); and [3] the World Culture Theory (the formation of a 'world consciousness' that gives meaning to living in the world as a single place).[475]

An important element of the globalization discourse is its links to discussions on the "*nature and existence of the nation state, economically, politically and culturally*" (Voisey and O'Riordan 2001, p. 34). Since the 'nation state' has a *responsibility* to move towards the objectives of sustainable development (see the Stockholm, Rio, and Johannesburg[476] Declarations and Agenda 21), any forces that might influence the

[474] For a useful list of definitions of globalization, see Streenten (2001, pp. 167-173).
[475] Source: Emory University, The Globalization Website, *Globalization Theories*, http://www.emory.edu/SOC/globalization/theories.html (accessed on 04/09/06).
[476] We recall that the Johannesburg Declaration called upon the private sector to recognize its role in achieving sustainable development. This evolution in strategy broadened the *responsibility* for action to effectively incorporate all stakeholders working to achieve sustainable development. However,

effectiveness of government in this task will have important implications for the design of national and/or international strategies to address sustainable development. Hence, it is important to understand how globalization could enhance, undermine, or provide new opportunities for government action.

While an agreed upon definition of globalization remains elusive, there appears to be some consensus on its core drivers (Held and McGrew 2002; Saha 2002; Stiglitz 2002). These drivers are:

- the rapid reduction in the costs of transportation and communication;
- the gradual removal of barriers to trade and to the movement of capital, services, knowledge, and (to a lesser extent) people between nations; and
- the creation of new institutions to supplement existing ones to formulate and oversee normative rules of engagement (especially for trade) at the international level.

These drivers have the effect of bringing nations, people, societies, cultures, economies, and markets closer together, affecting them "*in different ways through space and time*" (Voisey and O'Riordan 2001, p. 34). A concise description of the wide range of elements that form the process of globalization is put forward by Held and McGrew (2002, p. 3, emphasis added):

> "*Globalization has been variously conceived as* ***action at a distance*** *(whereby the actions of social agents in one locale can come to have significant consequences for 'distant others'); **time-space compression** (referring to the way in which instantaneous electronic communication erodes the constraints of distance and time on social organization and interaction); **accelerating interdependence** (understood as the intensification of enmeshment among national economies and societies such that events in one country impact directly on others); **a shrinking world** (the erosion of borders and geographical barriers to socio-economic activity); and, among other concepts, **global integration**, the **reordering of interregional power relations**, **consciousness of the global condition** and the **intensification of inter-regional interconnectedness**.*"

Like the sustainable development discourse, the globalization debate is somewhat polarized by those who are skeptical that such a phenomenon exists and those who believe it is an integral and unavoidable aspect of our lives. Held and McGrew (2002) provide a useful summary (Table 3.5) of the perceptions of those who believe in the existence of the globalization process and those who are skeptical. It is important to recognize that the perceptions presented do not necessarily represent the views of all

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governments - which have retained the sovereign right to use national resources as they see fit within certain international constraints - remain central to any transition towards sustainable development since they define the economic and regulatory environment within which the private sector operates. The major debate with the current process of globalization is that it holds the potential to undermine the ability of governments to establish this environment by transferring political and economic power to corporate interests. This problem is discussed throughout this section.

skeptics and globalists. By the very nature of the subject, it is highly likely that views on certain issues may begin to diverge *within* the skeptic and globalist camps.

Table 3.5: The Great Globalization Debate

	Skeptics	Globalists
Concepts	Internationalization not globalization Regionalization	One world, shaped by highly extensive, intensive and rapid flows, movements and networks across regions and continents
Power	The nation-state rules Intergovernmentalism	Erosion of state sovereignty, autonomy and legitimacy Decline of nation-state Rise of multilateralism
Culture	Resurgence of nationalism and national identity	Emergence of global popular culture Erosion of fixed political identities Hybridization
Economy	Development of regional blocs Triadization New imperialism	Global informational capitalism The transnational economy A new global division of labour
Inequality	Growing North-South divide Irreconcilable conflicts of interest	Growing inequality within and across societies Erosion of old hierarchies
Order	International society of states Political conflict between states inevitably persists International governance and geopolitics Communitarianism	Multilayered global governance Global civil society Global polity Cosmopolitanism

Source: Held and McGrew (2002, p. 37).

A relatively skeptical view of economic globalization is presented by Hirst and Thompson (2002, pp. 2-3), who provide a convincing set of evidence to show that:

1. "*The present highly internationalized economy is not unprecedented. ... In some respects, the current international economy is less open and integrated than the regime that prevailed from 1870 to 1914.*
2. *Genuinely transnational companies appear to be relatively rare. ...*[477]
3. *Capital mobility is not producing a massive shift of investment and employment from the advanced to the developing countries. ...*
4. *As some of the extreme advocates of globalization recognize, the world economy is far from being genuinely 'global'. Rather trade, investment and financial flows are concentrated in the Triad of Europe, Japan and North America and this dominance seems set to continue.*

[477] A transnational company, or corporation, is "*an economic entity operating in more than one country or a cluster of economic entities operating in two or more countries - whatever their legal form, whether in their home country or country of activity, and whether taken individually or collectively*" (ECOSOC 2003, p. 7).

5. *These major economic powers, the G3, thus have the capacity, especially if they coordinate policy, to exert powerful governance pressures over financial markets and other economic tendencies. Global markets are thus by no means beyond regulation and control, even though the current scope and objectives of economic governance are limited by the divergent interests of the great powers and the economic doctrines prevalent among their elites."*

Held and McGrew (2002, p. 20) support the notion of the "*triadization of the world economy,*" but argue that economic integration has occurred between the broader group of Europe, Asia-Pacific, and the Americas. This broader grouping incorporates the formation of the APEC, NAFTA, MERCOSUR, and ASEAN multilateral agreements and the recent economic integration of the EU. It also suggests that reducing globalization to a purely economic or technological discourse is misleading since it does not take into account other important forces shaping modern societies.

During the deliberations prior to the Johannesburg Summit, the U.S. Under Secretary of State and Global Affairs, Paula Dobriansky, gave the following statement in support of economic globalization: "*the globalized economy is a powerful engine for development, and each country must take on the responsibility to harness it by practicing good government, adhering to the rule of law, investing in its people and encouraging political and economic freedom*" (Dobriansky 2002, p. 55). The Under Secretary continues: "[w]*e must recognize that, despite the increasingly globalized nature of our world and its economy, sustainable development must begin at home. Poverty alleviation, improved health and environmental stewardship all require good domestic governance, democratic societies, free markets and accountable public and private sectors*" (ibid, p. 55).

The U.S. decision to emphasize economic globalization and capacity development[478] as central themes of sustainable development was criticized by sustainable development advocates. The major concern was that a transition to a free market economy might be used to negate the need for developed nations to supply financial and technological assistance to less developed nations - as agreed at the Rio Summit. "*Many U.S. policymakers have seen the globalization (market) paradigm as supplanting the need for the sustainable development (partnership) paradigm. 'Trade, not aid' has become a Washington mantra.*" (Speth 2003, p. 12). In addition, the fact that 'poverty alleviation' is highlighted and 'over consumption' is not could be interpreted as a direct ploy by the U.S. to move the burden of sustainable development to developing nations.

Jeffery Sachs, a vocal critic of the U.S. position on sustainable development, argues that the current U.S. agenda is creating a situation where the economic inequalities between nations are likely to persist, undermining the future security of the nation and the world. "*Global society is caught between competing visions of the future: one of fear and one of hope. Both acknowledge a world under stress but draw wholly different conclusions. The vision of fear holds that globalization, rising populations, resource depletion, and environmental stress auger an intensified struggle over scarce resources and across clashing cultures, a world increasingly divided between "us" and "them." The United*

[478] Supra note 469.

States, alas, seems to be betting that way, allocating an astounding $450 billion per year to the military, which is half of the world's total military spending" (Sachs 2004, p. 649).

While the position of the U.S. can be criticized, key advisors to the U.S. government have acknowledged that a reliance on the market is not sufficient to address all of the problems facing society. During his tenure as Chairman of President Clinton's Council of Economic Advisors, Joseph Stiglitz fought to develop an economic policy "*that viewed the relationship between governments and markets as complementary, both working in partnership, and recognized that while markets were at the center of the economy, there was an important, if limited, role for government*" (Stiglitz 2002, p. xiii). This role for government was to address inequality, unemployment, and pollution, all of which cannot be adequately addressed by markets alone. In his later work, Stiglitz's views moved further to the left (Friedman 2002). In *Globalization and its Discontents*, Stiglitz argues that "[g]*overnment can, and has, played an essential role not only in mitigating ... market failures, but also in ensuring social justice*" (Stiglitz 2002, p. 218). His position is that governments can improve the market and the well-being of society by making well-chosen interventions (Friedman 2002). These interventions include expansionary monetary and fiscal policies to stimulate demand for goods and services, tax policies that encourage investment in more productive industries, trade policies that protect new industries until they are ready to compete in the international economy, and policies/programs that protect workers in times of hardship.

Given that the roles of government and the market need to be balanced, an important question is how to reconcile political and economic interests within the dynamic and complex process of globalization.

3.5.2 The Role of Government and International Organizations in a Global Economy

It is apparent that economic globalization has benefited those nations that have sought to expand their export markets while encouraging foreign investment (Stiglitz 2002). Further, within this group of nations, those that have benefited the most recognized that government had an important role to play in addressing the social and environmental costs of economic development. As Soros (2002, p. 14) notes, "[i]*nternational trade and global financial markets are very good at generating wealth, but they cannot take care of other social needs, such as the preservation of peace, alleviation of poverty, protection of the environment, labor conditions, or human rights - what are generally called "public goods." Economic development, that is, the production of private goods, has taken precedence over social development, that is, the provision of public goods.*"

A major challenge faced by governments is how to support a competitive market while providing an appropriate level of social welfare. As capital mobility increases, important segments of a nation's tax base are able to invest their capital in locations where they can avoid or minimize tax payments and obtain a higher return on their investment. This has the effect of increasing the "*tax rates disproportionately on labor income*" (Rodrik, 1997, p. 6), and can lead to a number of "*lowest-common-denominator socioeconomic and*

policy tendencies" (Paehkle 2003, p. 2). Swank (2002) provides a useful explanation of how this process of increasing capital mobility can negatively affect social policies.

> "*In brief, the economic logic argues that international capital mobility constrains social policies of democratically elected governments through the operation of markets: in a world of high or near perfect capital mobility, mobile asset holders pursue the most profitable rate of return on investment and governments compete to retain and attract that investment. ... Politically, international capital mobility may constrain the social welfare policies of democratically elected governments through the routines of conventional politics; the credible threat of exit may enhance the conventional political resources of mobile asset holders and their interest associations*" (Swank 2002, p. 4).

Yet, contrary to this economic logic, Rodrik (1996; 1997) shows that as national economies have become more open, their social spending has increased. For example, in small and open economies such as the Netherlands and Belgium, government spending has increased to insulate society against external risks (e.g., the 1970s oil shocks). Rodrik argues, therefore, that the welfare state is the other side of the coin to economic globalization. However, as discussed above, the increasing demands placed upon governments to provide social programs is continually undermined by the process of economic globalization. "[A]*s globalization proceeds, the social consensus required to maintain domestic markets open to international trade is endangered. With domestic political support for trade eroding, a return to old-style protectionism becomes a serious possibility*" (Rodrik 1997, p. 53). In this regard, Rodrik (1997) identifies two dangers that arise from complacency towards the social consequences of globalization. First, as indicated above, there is the risk of a political backlash against trade. For example, it is easier for a politician to defend protectionist policies if this action is likely to secure employment for his/her constituents and subdue anxiety about globalization. Second, and potentially more important, globalization that is achieved at the cost of social disintegration would pay a very high price for development.

To prevent the erosion of social and environmental objectives from economic globalization, governments may need to focus more of their efforts on collective action at the international level (OECD 1997). The establishment of mechanisms for global governance, if designed to ensure the well-being of society and the protection of the environment, are likely to reduce the risks of globalization and trade liberalization. However, the establishment of global governance through 'enforceable' international law is likely to be politically difficult and time consuming. A major challenge will be to overcome resistance from government and corporate representatives charged with the defense of national and corporate interests (Paehkle 2003). In addition, the scale of global governance is problematic due to its inaccessibility to citizens.

These difficulties are compounded by the two legal frameworks that govern the transnational world - [1] the *economic regime*, led by the WTO (World Trade Organization) and supported by the IMF (International Monetary Fund) and World Bank; and [2] the *environmental regimes*, created through conventions and treaties covering

topics such as environmental protection, climate change, wildlife, and biodiversity - which "*are inconsistent and sometimes even in open contradiction with each other*" (Sachs 2001, p. 12). Further, Khor (2001, p. 209) argues that "*the strong support and aggressive advocacy of the powerful countries*" for the market paradigm has strengthened this model of development in relation to the sustainable development paradigm. The result has been the ascendancy of the WTO and the Bretton Woods institutions and the decline of the UN system in its capacity to influence national agendas. Khor argues that this development has placed national economic competitiveness ahead of environmental and other standards, which are weakened by powerful private commercial interests.

However, placing the WTO at the forefront of development efforts raises several issues in relation to 'sustainable' development. In particular, four charges against the WTO have been made (Singer 2002, p. 55):

1. "*The WTO places economic considerations ahead of concerns for the environment, animal welfare, and even human rights.*
2. *The WTO erodes national sovereignty.*
3. *The WTO is undemocratic.*
4. *The WTO increases inequality; or (a stronger charge) it makes* the *rich richer and leaves the world's poorest people even worse off than they would otherwise have been.*"

While there are signs that the WTO is attempting to address these charges through plans to integrate environment and development concerns into its core activities, a major problem remains. The core competencies of WTO's staff lie in trade and economics and not in human health, ecosystem integrity, or human rights. The latter areas of expertise would be essential if the WTO were to become an arbitrator for environmental and human health disputes. However, instead of trying to integrate sustainable development objectives into the WTO's mandate, many argue that while the WTO needs to be made more open and accountable, a more useful outcome would be to establish an equally effective institution to serve environmental and social goals (Soros 2002; Speth 2003). Indeed, the idea of creating a World Environmental Organizational (WEO) or Global Environmental Organization (GEO) was raised by France and Germany at the Johannesburg Summit but was heavily opposed by other G8 members. Interestingly, the G77 (including China and India) were also reluctant to support the formation of a WEO/GEO and favored a strengthened UNEP.

Whether the WTO succeeds in securing control over environmental disputes, or existing international agencies, programs, and multilateral environmental agreements are centralized into a WEO/GEO, the lines seem to be drawn for an intense and protracted debate. On the one side there are those who believe in free trade and would like the authority for decisions related to sustainable development to lie with the institutions that oversee the international economy. On the other side there are those who believe that giving such authority to trade/economic bodies is fundamentally flawed, and argue for the creation of institutions that have a stronger voice for the environment. At present, it seems that the final outcome will rest upon the position of developed nations who

currently have the economic and political power to imprint their views on the international community.

3.5.3 Conclusion

During the last decade, sustainable development and globalization have emerged as important discourses for social and environmental concerns. Sustainable development has firmly established the importance of transforming societies to more environmentally sound, equitable, and fulfilling lifestyles in which current and future citizens have the opportunity to meet their needs. On the other hand, the globalization discourse has attempted to understand and articulate the dynamic social and physical milieu of the modern world. In this regard, 'globalization' has become a phrase that can be used to describe both positive and negative aspects of human endeavor. For sustainable development advocates, the process of globalization is often used to describe unsustainable pathways of development. However, it is apparent that sustainable development and globalization are not the polar opposites they are often seen to be. Instead, both discourses see development and efficiency as critical mechanisms for achieving sustainability (Byrne and Glover 2002).

Advances in transportation and communication technologies are creating a world in which the process of globalization is effectively irreversible. Nothing short of radical protectionist policies that restrict the flow of information, people, and goods across national borders can prevent it. Yet, protectionism is not seen to be a solution to the environmental and social costs associated with globalization (Rodrik 1997). The political challenge raised by globalization and sustainable development is the need to balance the interests of citizens (or constituents) with the welfare of people throughout the world.[479] Singer (2002, p. 13) argues that our ability to transition to the global era "*will depend on how we respond ethically to the idea that we live in one world. For the rich nations not to take a global ethical viewpoint has long been seriously morally wrong.*"

The decision by developed nations to adopt *trade* - as opposed to *aid* - to fuel growth and development in less developed nations has made the private sector a critical player in international development for good or for bad. Since the early conceptualization of sustainable development, numerous attempts have been made to articulate the concept in a way that can be *operationalized* in a business setting. The most prominent interpretation of sustainable development adopted by industry is the *triple bottom line*. Under this paradigm, business activities should not adversely affect the environment, society, or the economy (i.e., profitability). However, as discussed throughout this chapter there are two additional elements to development that must be considered - peace and security and national governance that ensures development and peace. These two elements are outside the bounds of what can be legitimately provided by the economy and lie solely with government. It seems difficult to imagine any situation in which we would want to leave

[479] Ashford (2001) argues that 'balance' is the wrong goal because it involves tradeoffs and losses as well as gains. A competing concept is 'co-optimization,' whereby multiple gains are possible by enlisting innovative solutions in the technological, social, institutional, and organizational realms.

the provision of national security to the economy. Yet, we must recognize that governments would be unable to provide a safe and secure living environment if it were not for the products and services developed by industry.

While industry must continue to make progress on the triple bottom line, government - to use similar terminology - must consider the much broader *quintuple bottom line*. Within the context of the nation state, government is clearly able, and has a responsibility, to address all five of the critical components of sustainable development. However, as discussed above, the process of globalization (in its various forms) holds the potential to weaken national governance. A weakness in one component implies a strengthening of others, meaning that those able to influence the market economy can accumulate immense power. Therefore, there is a need to balance the power of the market with the role of government. One potential way of achieving this is through international trade and environmental institutions designed to ensure that the process of trade liberalization does not weaken a government's ability to achieve its social and environmental goals. In short, what is needed at the national level are "*policies for sustainable, equitable, and democratic growth*" (Stiglitz 2002, p. 251) that are enhanced - and not undermined - by the international economy and the wide range of multilateral agreements, treaties, and conventions in existence.

As we move into the twenty-first century, the pathway towards sustainable development seems to be relatively clear. With the advent of the global media, societies throughout the world are beginning to see and to emulate the lifestyles of developed nations. Hence, it is developed nations that need to be at the forefront of the "*search for technologies and lifestyles that are both sustainable and replicable throughout the world - subject only to local adjustments and adaptations*" (Corea 2002, p. 2). Further, if we accept that developed nations have largely filled the available global ecological space, it seems unfair to place environmental limits on the progress of developing nations without first dramatically reducing the environmental burden of modern lifestyles. Without such a transformation, the establishment of free trade and/or the provision of international aid to help developing nations develop will simply perpetuate these unsustainable forms of living. What is not clear, however, is whether the political drive in developed *and* developing nations will be sufficient to put us onto a more sustainable pathway.

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4 Concepts and Organizing Frameworks

The objective of this chapter is to provide an overview of the concept of sustainable development and present a series of organizing frameworks through which policy intervention and instruments for achieving sustainable development can potentially be designed and integrated.

4.1 Sustainable Development

The historical evolution of the concept of sustainable development from the early 1960s until 2002 is discussed in detail in Chapter 3. Therefore, the purpose of this section is to highlight the central ideas that together form the concept of sustainable development.

Early debates/critiques on the concept of sustainable development revealed a wide range of interpretations/discourses and a lack of a sufficiently robust theoretical and analytic framework against which decisions aimed at achieving a more sustainable form of development could be assessed (Dixon and Fallon 1989; Holdren et al. 1995; Holmberg and Sandbrook 1992; Lele 1991; Norgaard 1988; Redclift 1991; Shiva 1992; Toman 1992). These reviews indicate that sustainability should be seen as a broad field of inquiry encompassing issues of cultural integrity, justice, and governance as well as questions of ecological limits to economic activity, the individual right to a safe and secure livelihood, and the national right to economic development.

The dominant view of sustainable development is that economic and social development and environmental conservation/protection are mutually compatible objectives. Neither one constrains the other. Therefore, **sustainable development** can be crudely defined as:

Conventional Development[480] + Environmental Protection/Conservation

This formulation implies that to achieve sustainable development we need to add (or integrate) environmental considerations to prevailing decision-making processes. The problem, however, is that environmental considerations still remain more of an after-thought in mainstream economic and political realms. Efforts to develop economies and protect the environment have frequently been in opposition to one another.

A major challenge facing proponents of sustainable development is that the concept means different things to different people and interpretations may evolve with changing circumstances. The type of questions raised during debates on sustainability reflect these differences and normally take the form of what is to be sustained, for how long, and who

[480] During the past half-century, the international community has viewed the notion of development as incorporating at least four related concepts: [1] peace and security; [2] economic development; [3] social development; and [4] national governance that secures peace and development (Dernbach, 1998). These four concepts form what is known as *conventional development.*

bears the costs and benefits? As Richard Norgaard (1988, p. 607)[481] aptly pointed out, "[e]*nvironmentalists want environmental systems sustained. Consumers want consumption sustained. Workers want jobs sustained.*" It should be clear that no single disciplinary lens can answer all of these questions adequately. Therefore, for answers to be acceptable to a wide audience they must be considered through each of the major disciplinary lenses. At a minimum, these lenses include ethical/moral reasoning, ecology, economics, law, politics, trade, finance, and technological capability.

4.1.1 Metaphors and Discourses of Sustainable Development

In an effort to pull together the fragmented and multidisciplinary literature of sustainable development, Jabreen (2004) developed a series of seven metaphors through which he describes a comprehensive - albeit preliminary - map of sustainable development.[482] A summary of Jabreen's (2004) metaphors is presented below, along with some supplemental references where appropriate. Following these metaphors are Dryzek's (1997) nine discourses of sustainable development, which offer an alternative, but closely related, way to think about the multidimensional nature of sustainable development.

The Ethical Paradox Metaphor (Jabreen 2004, pp. 626-628) represents the *ethical domain* of the knowledge map of sustainable development and is located at the heart of the map. The metaphor reveals the ethical paradox of the term sustainable development. The term 'sustainability' originates from ecology literature and implies a process or state that continues forever. The term 'development' implies the continued use of natural resources and the modification of the environment. As Jabreen notes, "[m]*ost national government and international financing agencies still define development as maximum economic growth and a concerted drive towards industrialization and mass consumption*" (ibid, p. 626). Therefore, when combined, the term 'sustainable development' reveals a paradox in the meaning of the two words. This paradox has largely been overlooked in the definitions of sustainable development, which tend to

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[481] Norgaard's (1988) description of sustainable development as a co-evolutionary and emerging view is still as relevant today as it was in the 1980s. In Norgaard's (1988, p. 614) opinion, "*the call for sustainable development resonates with the rise of new understandings of environmental systems, technology, social organization, knowledge, values and their interplay.*" Thus, as our knowledge of how these variables interact increases, so too will our understanding of sustainable development. Norgaard (1988, p. 615) continues, "*knowledge is intertwined with values, social organization, technology and resource systems. It is contextual, arising in the context of social organization, technologies and values of particular people, times and places. Knowledge, in this view, is part of the 'patchwork quilt' of the cultures around the globe. Furthermore, each patch is complex. No one way of understanding it is sufficient and, even with multiple ways, we will periodically be surprised.*"

[482] An earlier formulation of the sustainable development discourse was provided by Meadows (1994). In a classic article, Meadows (1994) describes the characteristics of four generalized groups/sides engaged in the debate: [1] *the blues* - free marketers and technological optimists; [2] *the reds* - socialists interested in equality and the welfare of all humans; [3] *the greens* - environmentalists concerned with resource depletion and pollution; and [4] *the whites* - synthesizers who do not entirely disagree with the other views and support local self-reliance/eco-development. It follows that the views of many individuals will consist of two or more of these generalized lenses. Rather than searching for which view or combination of views is right, Meadows (1994, p. 24) argues that the true value lies in "*understanding the intransigent nature of the discussion.*"

ignore the ecological meaning of 'sustainability' and instead focus on 'protecting' the environment while meeting human needs through development.

Defining sustainable development in this way meant that the stark differences between ecological interests and capitalism could be brought closer together. This optimistic formulation - which ignores the underlying contradictions in the environmental policy process - gained the support of the world's economic and political elite who could continue their operations and practices with minimal changes. The idea was that negative environmental impacts of consumer products and industrial processes could be adjusted to ecological thresholds. "*The 'limits to growth' became negotiable and manageable*" (ibid, p. 627).

In parallel with this formulation of sustainable development is the call for a new global ethic that would ensure that development and environmental protection go hand-in-hand. Herein lies the ethical paradox: the model of sustainable development described above is still ecologically destructive and is not grounded in concepts of rights and responsibilities. It is instead grounded in meeting the present and future needs of humans. The inherent ethical paradox in the relationship between 'sustainability' and 'development' can be seen through the 'light' and 'deep' ecology doctrines. At the extremes, the former uses the 'domination of nature' metaphor when articulating a position whereas the latter argues for the 'intrinsic right of nature,' placing the environment above or alongside anthropocentric considerations.

The Natural Capital Stock Metaphor (Jabreen 2004, pp. 628-629) represents the *material domain* of the knowledge map of sustainable development. This metaphor represents the natural capital stock that supports human development.[483]

Natural capital stock is defined as the stock of all environmental and natural resource assets and has three main categories. First are non-renewable resources such as fossil fuels and minerals. Second is the finite capacity of the natural system to produce renewable resources such as wood, food crops, and water. Third is the capacity of natural systems to absorb emissions and pollutants from human activity without side effects that

[483] In recent years there has been a growing interest in identifying ways of valuing the various forms of capital that support human development. Goodwin (2003) provides a useful description of the five kinds of capital that are frequently discussed in relation to sustainable development: [1] *natural capital* - the stock of environmentally-provided assets, i.e., renewable (e.g., living species and ecosystems), replenishable (e.g., groundwater and ozone), and non-renewable (e.g., fossil fuels and minerals) resources (see Costanza and Daly 1992); [2] *human capital* - the stock of human skills and capabilities that can provide a flow of services; [3] *produced (human-made) capital* - the stock of physical assets produced by transforming natural and/or manufactured capital using human productive capacities; [4] *social capital* - the stock of trust, mutual understanding, and shared values that support the social coordination of economic activity; and [5] *financial capital* - the stock of money that can be invested to enhance human or social capital, produce a product, or simply make more money. The first three kinds of capital mirror those deemed necessary by the early classical economists for the production of goods and services - i.e., natural resources, labor, and man-made capital. Of the five kinds of capital, social capital is the most controversial. It is used as a proxy to describe how variations in social capital can result in different levels of economic development (Goodwin 2003). Finally, financial capital is markedly different from the other forms of capital in that it has no intrinsic value; its value is expressed through the other kinds of capital.

can be passed onto future generations. Natural capital cannot be created by humans, is generally non-substitutable, and its maintenance is essential for further development.[484] While the measurement of natural capital has proved to be difficult, the field of ecological economics has adopted natural capital as a powerful metaphor.[485] Sustainability is often referred to as 'weak' if a declining level of natural capital is deemed acceptable. In theory, as natural capital declines, human-made capital is introduced to make up for any losses. Weak sustainability is often referred to as the 'substitutability paradigm,' or 'Solow-Hartwick sustainability,' since its formulation is based upon the work of Nobel Prize winning economist Robert Solow and economist John Hartwick (Neumayer 2003).[486] Conversely, 'strong' sustainability refers to conditions that support a constant level of natural capital. It represents a 'non-substitutability paradigm,' a 'steady-state economy,' where renewable resources are harvested at their maximum sustainable yield, the sink capacity of the environment does not deteriorate over time, and non-renewable resource usage is kept to a minimum (Daly 1991b; Neumayer 2003).[487]

The Fairness Metaphor (Jabreen 2004, pp. 629-630) represents the *social domain* of the knowledge map of sustainable development. More specifically it represents the domains of social, environmental, and economic justice. The central themes associated with this metaphor are social equity, the right to development, democracy, stakeholder participation, and empowerment.

The main use of the metaphor is to call for equity in the distribution of resources within and between groups and nations. The three main types of fairness are international, intra-generational, and intergenerational equity, all of which are addressed to varying degrees in the Brundtland report on sustainable development (WCED, 1987).

The economist Robert Solow (1993, p. 181) interprets sustainable development as "*an obligation to conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are.*" Hence, we have a moral obligation to not overindulge at the

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[484] A concept closely related to natural capital is 'ecological footprint,' which refers to the load imposed upon nature by a given population and standard of living. The maximum load (or population) that the earth can sustain is referred to as the earth's *carrying capacity*. The environmental economist William E. Rees defines ecological footprint as "*the corresponding area of productive land and aquatic ecosystems required to produce the **resources** used, and to assimilate the **wastes** produced, by a defined population at a specified material standard of living, **wherever on Earth that land may be located.***" Source: Sustainable City, *Ecological Footprint*, http://www.global-vision.org/city/footprint.html (accessed on 04/09/06).

[485] This statement is reasonable when considered in a U.S. context since it aligns with the predominant capitalist way of thinking. However, one might question whether the use of the phrase natural 'capital' is sensible, since it gives the *impression* that a price can be placed on the environment - i.e., the word 'capital' is too closely associated with monetary reasoning.

[486] The fields of *environmental and resources economics* view natural capital through the lens of 'weak' sustainability (Section 4.2.1). See Dasgupta and Heal's (1979) book, *Economic Theory and Exhaustible Resources*, for the neo-classical economic treatment of non-renewable resources. Their main conclusion is that development which relies upon non-renewable resources is sustainable since the *substitution* of natural capital with man-made capital (through technological progress) will enable the economy to expand even if non-renewable resources are being depleted.

[487] The field of *ecological economics* views natural capital through the lens of 'strong' sustainability (see Section 4.2.2).

expense of our successors. If we do, then we must provide them with the capability to live as well as we did. Defining whether these conditions hold for a given path of development is likely to be extremely difficult. In *The Theory of Justice*, John Rawls (1971) presents a different schema whereby fairness is determined using impartiality. The idea is that principles and strategies for a just society are developed from initial conditions that are inherently fair. Justice, therefore, proceeds out of fairness. While equity is essential for sustainable development, it is widely understood that social considerations must be balanced with economic and environmental objectives.

The Eco-form Metaphor (Jabreen 2004, pp. 630-632) represents the *spatial domain* of the knowledge map of sustainable development. The eco-form metaphor is used to describe ecologically desirable forms of urban space and other human habitats.

Research in the spatial domain tends to focus on the sustainability of the built environment at different levels (e.g., a city, neighborhood, or building). Ecological design introduces new technology or construction forms that either improve the energy efficiency of urban spaces/habitats or change the energy source to rely on renewable sources. Thus, the purpose of ecological design is to introduce eco-forms that are energy efficient and designed to have a minimal ecological footprint and a long lifetime. Jabreen (2004, p. 632) argues that in the urban context, "*the metaphor of eco-form suggests compactness, high density of the built environment, intensification of its activities, efficient land planning, diverse and mixed land-uses, and efficient transportation systems.*"

The Integrative Management Metaphor (Jabreen 2004, pp. 632-633) represents the *management domain* of the knowledge map of sustainable development. This metaphor represents the 'integrative' view of sustainable development, which attempts to combine aspects of social and economic development and environmental protection. The basic premise is that in order to achieve ecological integrity - i.e., preserve natural capital stock - there must be a holistic and overarching policy, planning, and management approach capable of pulling together the three main pillars of sustainable development. This integrative view of development is clearly espoused in *Our Common Future* (WCED, 1987), the 1992 Rio Declaration on Environment and Development, and Agenda 21 (Chapter 8 in particular).

The creation of intellectual frameworks which bridge disciplinary boundaries has been a major undertaking over the past ten years. For example, for those who believe in the 'hard' nature of ecological limits to the human economy, neither the traditional confines of neo-classical economics or of ecology permit the study and analysis needed to understand the requirements of, and inform policy-making for, an environmentally sustainable future. Thus, the emerging field of *ecological economics*, which combines both the economy and technology with ecology, provides the foundation for an integrative framework for considering sustainable development (Costanza 1991).[488] It studies the relationships between ecosystems and economic systems, encompassing both biological and cultural change. The human economy is seen as being part of a larger

[488] See Section 4.2.2 for a discussion of ecological economics.

whole. Its domain is the entire web of interactions between economic and ecological sectors. Ecological economics defines sustainability in terms of natural capital, which plays such a vital role in sustaining life that its true value should be made explicit in commodity production (Ayres 1996; Daly 1994b). Thus, consumption should not deplete natural capital at a faster rate than it can be replaced by human capital. Daly's notion of the steady-state economy views natural ecosystems as finite and, therefore, focuses on the scale of human activity (i.e., the economy) that can be supported. Living (and producing) within ecological limits is the major focus of ecological economics.

Those who use the integrative management metaphor tend to call for fundamental changes to the prevailing decision-making processes that place environment and development at the center of economic and political decision-making.

The Global Discourse Metaphor (Jabreen 2004, pp. 633-635) represents the *political domain* of the knowledge map of sustainable development. This metaphor has been developed by the global environmental discourse associated with the concept of sustainable development. This discourse extends the 'national' vision of sustainable development - grounded upon ideas such as eco-development and self-reliance - to include international issues such as peace and security, trade, international governance, hunger, shelter, and water. In essence, the global environmental discourse has *globalized* the concern for the environment and human development, transcending national boundaries. The global discourse is captured by phrases such as 'only one earth,' or the 'Earth Summit.' It engenders a commitment to addressing global environmental and development problems, and to providing developing nations with the resources necessary to participate on a more equal footing in the international economy.

The Utopian Metaphor (Jabreen 2004, pp. 635-636) represents the *visionary domain* of the knowledge map of sustainable development. The metaphor signifies those approaches to sustainable development that imagine utopian visions of a perfect society where justice prevails for all, people are content and their basic needs are satisfied, and societies live and flourish in harmony with nature. The utopian visions are critical of the prevailing development trends and show a particular concern for the health of ecosystems, which are being demised as a result of entrenched vested economic and political interests. Green reformers and classical utopians use the metaphor to present a radically different picture of the post-industrial, post-consumer society which is based upon deep ecology and new ethics for considering nature.

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The simplicity of Jabreen's (2004) seven metaphors provide a useful map that can be used to navigate and order the seemingly nebulous literature on sustainable development. While each metaphor represents a subjective interpretation of sustainable development, it is possible to locate many of the arguments/discussions put forward in Chapters 2 and 3 in one or more of the metaphors. However, one area of the sustainable development literature which is not explicitly addressed by Jabreen is technological change. Therefore,

it is proposed that an eighth metaphor which captures the technological fix paradigm would be a useful addition.

The Proposed Technological Metaphor represents the *technological domain* of the knowledge map of sustainable development. This metaphor signifies the belief that science and technological innovation will enable human activity to stay within ecological limits (see Section 2.4.1). While ecological limits are fixed, human ingenuity is not. The technological metaphor is different from the utopian metaphor in that it seeks to continue the development trajectory of industrialized nations, albeit in a more ecologically-sound manner. It does not question whether consumption patterns are sustainable or whether its products/services are satisfying basic human needs. Instead, it seeks to sustain the capitalist market economy by ensuring that consumption patterns and services continue and become more accessible to those who do not have access to them.

Solow's (1993) approach to sustainable development is grounded in the idea that *technology* can create high degrees of substitutability between one resource and another, and that natural and man-made capital are in some sense fungible.[489] Other sustainable development research that can be connected to the technological metaphor is the notion of ecological modernization and the 'factor X' debate (Mol 1995; Reijnders 1998) - see Section 2.4.1. Both seek to improve the environmental performance of technology by reducing resource consumption and increasing efficiency.

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An alternative way to organize the sustainable development literature is to adopt a 'discourse' approach. Dryzek (1997) has identified nine discourses through which the major issues related to sustainable development are articulated (Table 4.1). While there are overlaps between the metaphors and discourses, the discourse approach provides a more focused view of the critical issues. Table 4.1 provides a brief description of each discourse and presents the basic entities from which it is formed along with assumptions of how humans relate to themselves and to nature within the specific discourse.

[489] It is interesting how Solow's (1993) ideas on sustainable development form part of the fairness metaphor and run counter to the natural capital metaphor, which argues that natural capital is generally non-substitutable with human capital.

Table 4.1: **John Dryzek's Environmental Discourses** (Dryzek 1997, pp. 21-193)

DISCOURSE	BASIC ENTITIES RECOGNIZED OR CONSTRUCTED	ASSUMPTIONS ABOUT [SOCIAL AND] NATURAL RELATIONSHIPS
Global Limits and Their Denial		
1. ***Looming Tragedy: Survivalism*** *Human demands on the carrying capacity of ecosystems threaten to explode out of control and drastic action is needed to curb the demands.*	Finite stocks of resources Carrying capacity of ecosystems Population Elites	Hierarchy and control
2. ***Growth Forever: The Promethean Response*** *Natural resources, ecosystems, and nature do not exist. Nature is nothing more than a store of energy and matter. Pollution is simply matter in the wrong place in the wrong form and can be corrected with the skilled application of energy.*	Nature as only brute matter Markets Prices Energy Technology People	Hierarchy of humans over everything else Competition
Solving Environmental Problems		
3. ***Leave it to the Experts: Administrative Rationalism*** *Organization of scientific and technical expertise into bureaucratic hierarchy in the service of the state.*	Liberal capitalism Administrative State Experts Managers	Nature subordinate to human problem solving People subordinate to state Experts and managers control state
4. ***Leave it to the People: Democratic Pragmatism*** *Government is carried out by liberal democracy, not by the administrative state. The discourse has little to say about ecosystems and the natural world.*	Liberal capitalism Liberal democracy Citizenry	Equality among citizens Interactive political relationships, mixing competition and cooperation
5. ***Leave it to the Market: Economic Rationalism*** *Privatize everything. Specification and enforcement of property rights is the main role of government. Where this is not possible, revert to government-managed markets or quasi-market incentives.*	Homo economicus Markets Prices Property Governments (not citizens)	Competition Hierarchy based on expertise Subordination of nature

DISCOURSE	BASIC ENTITIES RECOGNIZED OR CONSTRUCTED	ASSUMPTIONS ABOUT [SOCIAL AND] NATURAL RELATIONSHIPS
The Quest for Sustainability		
6. ***Environmentally Benign Growth: Sustainable Development*** *Economic growth is environmentally benign and socially just. Justice refers to distribution within and between generations.*	Nested social and ecological systems Capitalist economy	Subordination of nature Economic growth, environmental protection, distributive justice, and long-term sustainability go together
7. ***Industrial Society and Beyond: Ecological Modernization*** *Capitalist political economy needs conscious reconfiguring and far-sighted action so that economic development and environmental protection can proceed hand-in-hand and reinforce one another.*	Complex systems Nature as waste treatment plants Capitalist economy The state	Partnership encompassing government, business, environmentalists, scientists Subordination of nature Environmental protection and economic prosperity go together
Green Radicalism		
8. ***Save the World through New Consciousness: Green Romanticism*** *Industrial society involves and introduces a warped conception of persons and their place in the world. New kinds of human sensibilities, ones that are less destructive to nature, are required.*	Global limits Inner nature Nature Unnatural practices Ideas	Natural relationships between humans and nature have been violated Equality across people and nature
9. ***Save the World through New Politics: Green Rationalism*** *The prevailing multi-faceted and ecological crises can only be resolved through radical political action and structural change. Actions must consider complex social relations and how these bear upon the problems that need to be addressed.*	Global limits Nature as complex ecosystems Rational humans Social, economic, and political structures	Equality among people Complex interconnections between humans and nature

4.1.2 Definitions and Challenges

As a result of both national and international debates on sustainable development and research across the wide range of disciplines mentioned above, the literature relating to sustainability has produced an extensive list of definitions, principles, and conceptual frameworks to describe the concept (Murcott 1997). Box 4.1 provides a selection of some of the more well known definitions that have arisen over the past two decades. It is interesting to consider which of the eight metaphors are specifically covered by each definition since this provides some indication of which discourse(s) the definitions are focused towards.

Box 4.1: Some Definitions of Sustainable Development

"*Development is defined ... as: the modification of the biosphere and the application of human, financial, living and non-living resources to satisfy human needs and improve the quality of human life. For development to be sustainable it must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as short term advantages and disadvantages of alternative actions*" (IUCN et al., 1980, p. 1).

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

- *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs*" (Brundtland definition) (WCED, 1987, p. 43).

"[I]*mproving the quality of human life while living within the carrying capacity of supporting ecosystems*" (IUCN et al., 1991, p. 10).

"*Economic growth that provides fairness and opportunity for all the world's people, not just the privileged few, without further destroying the world's finite natural resources and carrying capacity*" (Pronk and ul Haq 1992).

1. "*The main principle* [of sustainable development] *is to limit the human scale (throughput) to a level which, if not optimal, is at least within carrying capacity and therefore sustainable. ...*
2. *Technological progress for sustainable development should be efficiency-increasing rather than throughput-increasing. ...*
3. *Renewable resources, in both their source and sink functions, should be exploited on a profit-maximizing sustained yield basis and in general not driven to extinction (regardless of the dictates of present value maximization), since they will become ever more important as nonrenewables run out ... Specifically this means that: (a) harvesting rates should not exceed regeneration rates; and (b) waste emissions should not exceed the renewable assimilative capacity of the environment.*
4. *Nonrenewable resources should be exploited, but at a rate equal to the creation of renewable substitutes"* (Daly 1991a, pp. 44-45).

Sustainable development "*is an obligation to conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are*" (Solow 1993, p. 181).

Box 4.1: Some Definitions of Sustainable Development

"*Sustainability is a strategy for improving the quality of life while preserving the environmental potential for the future, of living off interest rather than consuming natural capital. Sustainable development mandates that the present generation must not narrow the choices of future generations but must strive to expand them by passing on an environment and an accumulation of resources that will allow its children to live at least as well as, and preferably better than, people today. Sustainable development is premised on living within Earth's means*" (National Commission on the Environment 1993, p. 2).

Necessary Conditions for Global Sustainability:
"*Ecological stability requires that:*

- *— consumption by the economy of the products and services of nature be compatible with rates of production by the ecosphere.*
- *— the production of wastes by the economy remain within the assimilative capacity of the ecosphere.*
- *— economic activity protect the essential life-support functions of the ecosphere and preserve the biodiversity and resilience of Earth's ecological systems.*

Geopolitical security requires that:

- *— society satisfy basic standards of material equity and social justice.*
- *— governance mechanisms be in place to enable an informed citizenry to have an effective participatory role in decision-making.*
- *— people share a positive sense of community cohesion (local and global) and a sense of collective responsibility for the future*" (Rees 1995a, p. 356).

"*An expanded set of principles for sustainable development*

Sustainability	*Development*
S_a - preserving natural resources for future generations	*D_a - improving quality of life for individuals*
S_b - preserving the option value of human and man-made capital for future generations	*D_b - ensuring a fair distribution of life-quality*" (Gudmundsson and Hojer 1995, p. 273)

"*The **possibility** that human and other forms of life will **flourish** on the Earth **forever***" (Ehrenfeld 2004, p. 8).

Sustainable development is the "*process of meeting the needs of current and future generations without undermining the resilience of life-supporting properties or the integrity & cohesion of social systems.*

Extending this definition further, we differentiate among four dimensions of sustainability:

1. *Ecological configuration*
2. *Economic production & consumption*
3. *Governance & politics*
4. *Institutions & performance*

To become sustainable, a system must meet four conditions:

- *(a) Ecological systems exhibit balance and resilience,*
- *(b) Economic production & consumption do not threaten ecological systems,*
- *(c) Governance modes reflect participation and responsiveness,*
- *(d) Institutions demonstrate adaptation and feedback.*

If, and only if, these conditions hold will a system dispose toward sustainability" (GSSD, 2004).[490]

The most widely quoted definition of sustainable development - the Brundtland definition (Box 4.1) - centers on the concept of meeting human needs. Chapter 2 began with an

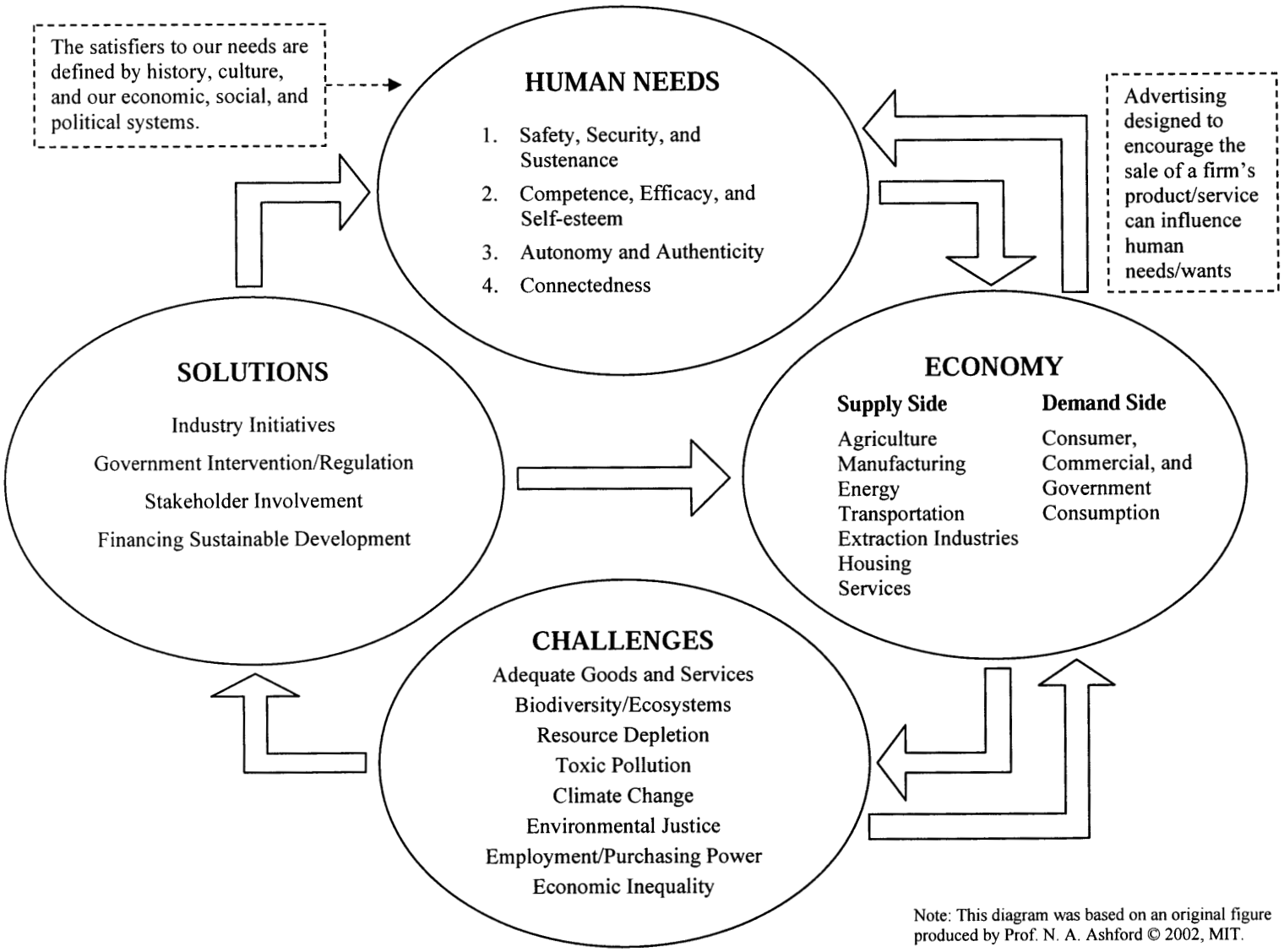
[490] Source: Global System for Sustainable Development (GSSD), http://gssd.mit.edu (accessed on 04/09/06).

anthropocentric look at sustainable development in an attempt to understand what meeting human needs entails. Today, the most widely accepted notion of human development - though not ideal - is put forward by the UN's Human Development Index (HDI, see analysis in Section 2.1.3). The HDI measures human development by looking at health, education, and income. However, if we are to begin to address the problems that confront sustainable development, understanding human needs and how these motivate behavior is essential.

In 1992, the National Research Council (NRC) undertook an assessment of research focused on ecological degradation and concluded that "[t]*he quality of environmental analyses is limited by the quality of the behavioral analysis that it includes*" (Stern et al. 1992, p. 21). The NRC report also suggested that there is a "*need to build stronger links between the natural sciences and the social sciences in efforts to understand global environmental changes and to devise public policies to respond to them in an effective manner*" (Stern et al. 1992, p. 21). With this in mind, Figure 4.1 attempts to present a holistic view of the drivers, challenges, and solutions to globalization within a context of human needs.

An argument made in Section 2.1.4 is that a growing concern in Western culture is that our view of the good life has been affected (or put out of balance) by the forces of the market economy (i.e., advertising, as well as social competition for conspicuous consumption). As a result, Western society is increasingly becoming a throughput society in which the consumption of products and services (to satisfy needs and wants) supports the growth of the economy. Putting aside the question of whether the current forms of consumption are satisfying fundamental physiological and psychological needs, it is possible to identify the social and environmental 'challenges' that are often associated with the unsustainable industrial state (see Figure 4.1).

The first challenge is the need to provide society with adequate and high quality goods and services - e.g., food, health care, transportation, security, etc. The second four challenges relate to four environmentally different concerns: [1] ecosystem integrity and the loss of biodiversity; [2] resource depletion; [3] toxic pollution; and [4] climate change. The historical formulation of these environmental concerns is a central theme throughout Chapter 3. The burden of these environmental problems is felt unequally within nations, between nations, and between generations, leading to concerns for intra-national, international, and intergenerational equity. These concerns for equity are often expressed under the heading of 'environmental justice.' The final two challenges relate to economic and social concerns associated with employment, wages, and economic inequality.



Note: This diagram was based on an original figure produced by Prof. N. A. Ashford © 2002, MIT.

Figure 4.1: Drivers, Challenges, and Solutions to Globalization within a Context of Human Needs

As implied by Figure 4.1, the environmental problems occur from activities within the supply side of the economy that are driven by consumer, commercial, and governmental demands (or needs).[491] In addition to these problems, there are social problems that result from industrial activities - in particular, from rapid technological change and globalization (see Section 2.5). For example, the creation of global communication networks and the spread of industrial capacity are changing the international division of labor, affecting the amount, security, and skill of employment and also the conditions of work and purchasing power. In addition, economic inequality that arises through inadequate and unequal purchasing power within and between nations remains an important problem of our time.

The solutions to these environmental and social problems are likely to be found in industry initiatives, government intervention/regulation, stakeholder involvement, and financing for sustainable development, and through changes in the (culturally defined) satisfiers to our basic needs. However, if solutions within these categories are to be successful they must address a number of fundamental problems within the industrial state (Ashford 2004b). These problems are presented in Table 4.2 along with recommended solutions.

[491] In economics, the term 'demand' refers to *effective demand*, or the *ability to pay*, and not to human needs, however urgent and acute (Gilpin, 2000). Thus, the 2.8 billion people on earth with virtually no purchasing power (less than $2 per day PPP - World Bank, 2002) are not represented by the 'economy' depicted in Figure 4.1. Since these people have no real role in the 'economy,' it follows that they cannot have played a direct role in causing the environmental impacts that result from economic activity. However, with the possible exception of toxic pollution, it is understood that poverty (like economic activity) can also affect biodiversity/ecosystem health and resource availability, and contribute towards climate change (all of which are listed on Figure 4.1), although the mechanisms through which the impacts occur are likely to be considerably different. Therefore, it is important to recognize the difference between the environmental impacts caused by *economic activity* and those caused by *poverty*. It can be argued that the former occurs as a result of the aggregate choices made by consumers, whereas the latter occurs through the actions taken by individuals struggling to survive (i.e., to satisfy their most fundamental human needs).

Table 4.2: Fundamental Problems with the Industrial State and Their Solutions

Problem with Industrial State	Solution
The fragmentation [and inadequacy] of the knowledge base leads to a myopic understanding of problems and the creation of insufficient single-purpose or narrowly-focused solutions	Adopt an integrative (or transdisciplinary) approach to the creation of solutions to environmental and social problems [and apply the precautionary principle when the negative impacts of a human activity are uncertain]
Inequality of access to economic and political power	Establish mechanisms for democratic, participatory governance
There is a tendency to govern industrial systems using old ideas	Stimulate technological, institutional, organizational, and social innovation[492]
Markets fail to correctly price the adverse consequences of industrial activity	Internalize as far as possible the external environmental and social costs
Markets fail to deal sensibly with social and environmental problems that span long time horizons, which pricing and markets are inherently incapable of solving	Transcend markets and implement far-sighted and integrated government policies

Source: Adapted from Ashford (2004b).

4.1.3 Conceptualizing Sustainable Development

An implicit argument made throughout Sections 2.3, 2.4, and 2.5 is that the environment in which policy decisions for sustainability must be made is one of *rapid technological change* and *globalization.* Technology plays an important role in connecting the environment, society, and the economy. For example, technology is the medium through which:

- an economy (the production of goods and services that satisfy needs and wants) interacts with the environment;
- labor and capital are combined in production (technology is thus an important determinant of the nature of work);
- people are able to enhance their quality of life (e.g., by using technology for mobility purposes, etc.); and

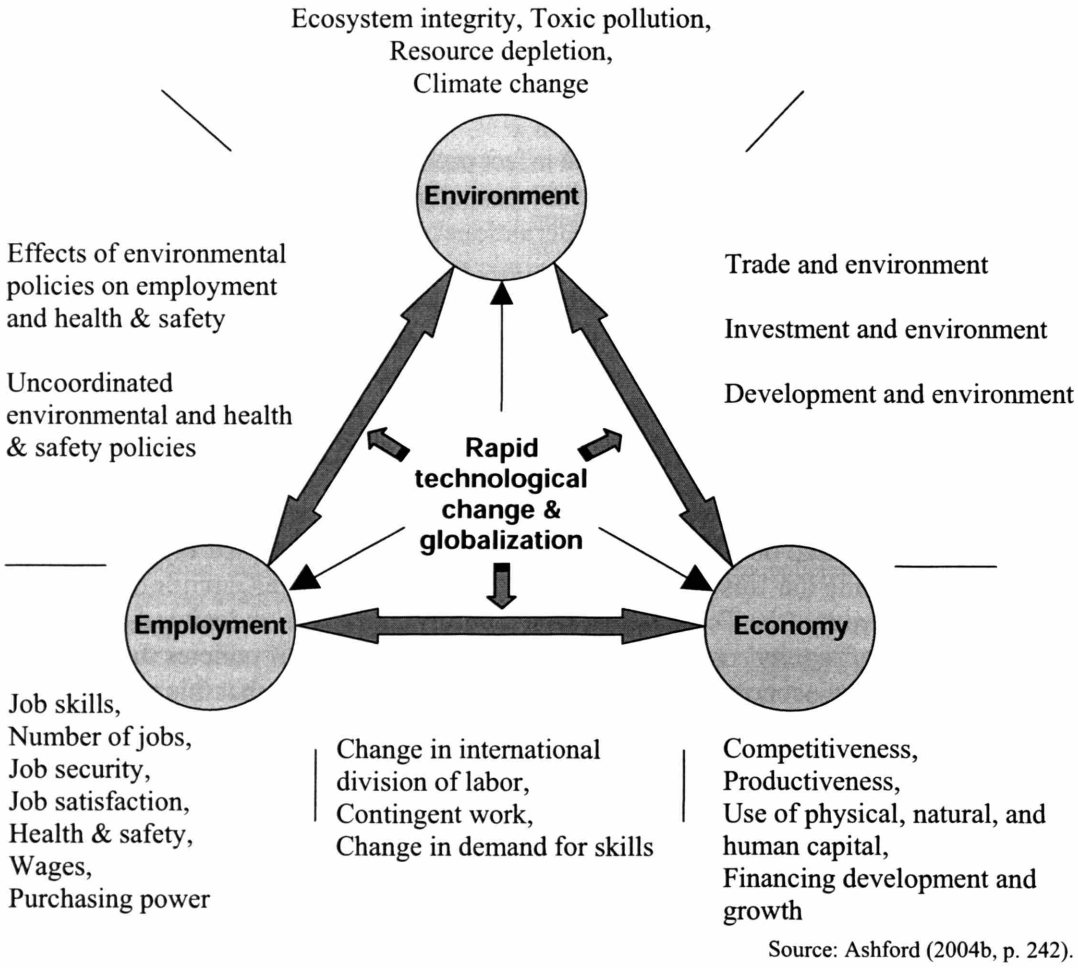
[492] These four types of innovation can be defined in the following manner (Ashford 2001). *Technological Innovation* is defined as the first commercially successful application of a new technical idea (or an invention). *Social Innovation* is defined as changes in the *preferences* of consumers, citizens, and workers for the types of products, services, environmental quality, leisure activities, and work they require, and changes in the *processes* by which the new preferences are selected. Social innovations can alter both the *supply* and *demand* for products/services. O*rganizational Innovation* is defined as changes in and among various organizational aspects of a firm's *functions* such as R&D/product development, marketing, environmental and governmental affairs, industrial relations, worker health and safety, and customer and community relations. *Institutional Innovation* is defined as changes in and among various institutions/departments within a government with regard to their *functions* and *goals* and the working relationships and shared visions among them.

- competitiveness can be achieved (technology plays an important role within an economy in helping industries and firms produce an adequate level of high quality goods and services).

Similarly, the forces of globalization can affect policy decisions for sustainability. Both developed and developing countries are increasingly subject to influences and constraints derived from their participation in the international economy. This has relevance for two reasons: [1] policy-making in a highly dynamic and interconnected environment is significantly more difficult than in a stable, isolated one; and [2] globalization may act to exacerbate unsustainable, or improve sustainable, trajectories in the areas of environment, economy, and society. However, evidence suggests that on the social dimension, globalization may be the only way to create a more equitable society with regards to income distribution (Firebaugh 2003).

Figure 4.2 is included to help visualize how technological change and globalization can affect the inter-related dimensions of environment, economy, and society (or employment in this case). While the 'sustainability triangle' is often defined as environment, economy, and equity (the Three E's of sustainability), here it is understood that considerations of 'equity' occur in *each* corner of the triangle. If policies that affect the environment or the economy lead to inequality, it can be argued that this will not move a society towards sustainable development as broadly conceived. Thus, equity is replaced with employment since technological change and globalization have direct implications on employment in both developed and developing nations. In addition, if we are to meet the basic human needs for food, clothing, shelter, etc., the only practical way to do this is to satisfy the basic need for a livelihood - that is employment. The thin black arrows in Figure 4.2 point to those concerns that are specific to each dimension of sustainability, whereas the small grey arrows point to those concerns that occur at the *interface* between each of the three dimensions.

Given the multidimensional nature of sustainable development, an agenda for change is by definition, one of system change. Ashford et al. (2002) provide a valuable discussion of the difference between the current environmental policy agenda and a sustainable development planning agenda (Table 4.3). It is argued that the current environmental policy agenda focuses on those policies that: [1] improve profit and market share by improving performance of current technologies or by cutting costs; [2] control pollution/make simple substitutions and changes and conserve energy and resources; and [3] ensure an adequate supply of appropriately skilled labor, a reliable dialogue with workers, and safe and healthy workplaces. These strategies are described as *reactive* in regards to technological change rather than *proactive*. Further, government policies aimed at affecting each dimension of sustainable development are coordinated, but not integrated, which can lead to the inadequate single-purpose or narrowly-focused solutions mentioned in Table 4.2.



Source: Ashford (2004b, p. 242).

Figure 4.2: The Dimensions of Sustainability

In contrast, a sustainable development policy agenda focuses on processes within the supply side of the economy shown in Figure 4.1. Hence, the policies are designed to affect extraction, manufacturing, transportation, agriculture, energy systems, etc., and may extend to more cross-cutting technological and social systems changes. Therefore, a sustainable development agenda should encompass policies that seek technological changes to the way goods and services are provided, prevent pollution and decrease the reliance on non-renewable energy sources, and search for new socio-technical systems - involving both technological and organizational elements - that enhance the many dimensions of 'meaningful employment' through the integration, rather than coordination, of policy design and implementation (Ashford et al. 2002).

Table 4.3: Comparison of Current and Sustainable Development Policy Agendas

AGENDA	Competitiveness	Environment	Employment
Current	Improve Performance/Cut Costs	Control pollution/make simple substitutions or changes Conserve energy and resources	Ensure supply of adequately trained people; dialogue with workers Provide safe workplaces
Sustainable	Change nature of meeting market needs through radical or disrupting innovation (a systems change)	Prevent pollution through system changes Change resource and energy dependence	Radical improvement in human-technology interfaces (a systems change)

Source: (Ashford et al. 2002, p. 3).

In Section 2.3.1, the argument was made that the technological improvements necessary to realize more sustainable forms of development require major product, process, product-services, and system transformations that are often beyond what incumbent firms are willing, able, or have the opportunity to achieve. This point highlights an important difference between current and sustainable development planning agendas. The former encourages technology improvements along existing trajectories whereas the latter seeks the creation of disrupting technological change. Creating the regulatory environment in which major system transformations can occur will require the creative use of government policy. But regulations aimed at industry are only part of the equation. Government and societal institutions facing the challenges raised by the three inter-related dimensions of sustainability also require intelligent government policy to encourage a system-wide approach to problem solving. The role of government in achieving sustainable development is a reoccurring theme throughout Section 4.2.

It should be increasingly clear that definitions of sustainable development need to become broader in scope if all aspects of the concept are to be considered. Instead of providing a new definition that will be lost in the confusion of existing definitions, it seems more appropriate to highlight what are seen to be the core issues that development should address. It is possible to group these issues into five categories:

1. Development should be aimed at the satisfaction of basic human needs. From the research undertaken in Section 2.1.2, it is clear that human needs vary between cultures and over time as individuals mature. Therefore, when considering how to meet human needs, decision makers should work with each affected community to determine the potential impacts of any new social arrangements, technological forms, etc.

2. Development must be aimed towards reducing inequality (Agyeman et al. 2003). Today, major inequalities persist in the distribution of environmental pollution (giving rise to concerns of environmental justice), the availability and distribution of

goods and services, and the distribution of adequate and fair purchasing power. All three forms of inequality will require specific attention and their reduction will signal a major step towards more sustainable and just societies.

3. Development needs to address the adverse environmental effects of industrialization both within and among nations and on subsequent generations. Environmental protection and remediation will continue to be a major objective of development for the foreseeable future. In fact, with the rate at which environmentally-destructive technologies from developed nations are spreading to developing nations, it seems that the environmental quality is likely to worsen in these regions before it improves. This scenario raises the importance of *system innovation* as a mechanism to transform industrial systems towards sustainable development.

4. Development needs to assure that working conditions are fair and in line with acceptable levels of health and safety. In addition, consideration should be given to what constitutes rewarding and meaningful employment where people are satisfied and challenged by their work.

5. Development needs to ensure that nations have the *potential* for self reliance and are able to participate in trade on an equal footing.

4.1.4 The Role of Government in Sustainable Development

It is well understood that government has several important functions it needs to carry out in relation to a nation's development (Ashford 2004a; Dernbach 1998; Fukuda-Parr 2002; Leisinger 1998; PCSD, 1999). These are as follows:

- support and expand education and health opportunities;
- provide physical infrastructure and legal and institutional frameworks;
- act as a force to integrate, not just coordinate, policies;
- invest in and promote path-breaking science and technology development - for both environmental improvement and job design;
- act as a trustee of new technologies;
- sustain a healthy economy that creates rewarding and meaningful employment, reduces poverty, and provides the opportunity for a high quality of life for all;
- protect the environment and ensure that every person benefits from clean air, clean water, and a healthy home, work, and leisure environment;
- act as a trustee of worker and citizen interests to ensure a fair outcome;
- facilitate/arbitrate over competing interests to ensure a fair process; and
- extend equity considerations to future generations.

In addition to these national responsibilities, governments also have a corresponding set of international responsibilities (Dernbach 1998; Fukuda-Parr 2002; PCSD, 1999). These are as follows:

- reform institutions at the global level to ensure developing nations have equitable access to global markets, technology, and information;

- establish trade and foreign policies that further the achievement of sustainable development;
- ratify international treaties designed to protect the environment and the well-being of humans; and
- ensure peace and security.

In the previous section, and indeed throughout this chapter, it is argued that government has an essential role in leading and encouraging the industrial transformations deemed necessary to create more environmentally sustainable and equitable forms of development. However, we must be cognizant of the fact that industry and society also have important roles to play. Indeed, some argue that governments should not interfere with the market; instead, we should let the markets address our environmental and social problems. These opposing positions represent two predominant views: [1] there are basic needs and that is why we need *markets*; and [2] there are basic needs and that is why we need *government* (see Section 2.2).

One argument in support of market-oriented solutions rests upon consumer sovereignty. The basic idea is that consumer purchasing power will lead to the development of a more sustainable industrial state - i.e., firms will develop environmentally-sound products/services if consumers demand them. This argument passes the responsibility for achieving sustainability on to the consumer, whose purchasing behavior then becomes subject to moral inquiry. It also assumes that producer-created demand will not adversely influence consumer choice and that consumers have access to sufficient information to make rational and informed decisions. The validity of both of these assumptions is questioned in Section 2.1.4. Other approaches concentrate on 'getting the prices right,' ensuring competition in capital and labor markets, and increasing demand for a clean environment, product safety, and good working conditions through the provision of information and education (Ashford 2004a).

It should be clear that relying *solely* on the market to ensure that basic human needs are met is not a viable option since, for example, there is little incentive for firms to provide education and primary health care for the poor. Further, a reliance on social influence (or good will) to initiate change ignores evidence that unless the right environment and resources are made available, society will be asked to act beyond its capacity (Schmuck and Schultz 2002). Thus, government has an important role to play in ensuring that markets function for the benefit of society and to intervene where they fall short. Government intervention approaches tend to focus on environmental and worker health and safety standards; product/service standards; the disclosure of health and safety information about these products/services; 'industrial policy' aimed at technology development, transfer, and infrastructure; and decision-bargaining in industrial relations (Ashford 2004a).

To enable an acceptable balance of responsibility to be achieved between all parties, there needs to be a willingness on the part of governments, society, and industry to engage in discussion and analyze the connection between freedom, regulation, and control - and

their relationship to overall societal good - if and when radical changes to our social and physical systems become necessary (Haland 1999).

In 1999, the U.S. President's Council on Sustainable Development (PCSD, 1999, p. iii) reaffirmed its 'civic engagement' goal of creating the "*full opportunity for citizens, businesses, and communities to participate in and influence the natural resource, environmental, and economic decisions that affect them.*" The PCSD's idea was that federal, state, tribal, and local governments would collaborate to develop environmental protection goals that would set the standard for cooperation between communities, business, and governments (Zieba 1996). Achieving an equitable decision-making process was the primary objective.

Section 2.2.2 argues that the perceived and actual role of government in public participation is crucial to the final outcome of decision-making, as is the role adopted by stakeholders. A framework is presented that enables decision-makers to consider the likely outcomes from decision-making processes in which government acts either as a mediator/arbitrator of competing interests, or as a trustee of stakeholder interests. In each case government plays very different roles that are pronounced when stakeholders have largely disparate power - or when groups are not represented in the political process, as in the case of emerging or new technology-based firms. The roles adopted by stakeholders are equally important, specifically the participant dynamics that foster utilitarian outcomes versus communitarian outcomes. Thus, the outcome of discourses between government agencies and the public depends on the roles adopted by each. This indicates that the public participation mechanism should be chosen with care, with attention paid to the best way of achieving procedural fairness, procedural competence, and an optimal (in this case an equitable) outcome (Ashford and Rest 2001).

This framework is grounded upon John Rawls's (1971) theory of justice, where political and moral decisions are made using impartiality and new social arrangements make the most disadvantaged members of society relatively better off. Since the Rawlsian approach to decision-making only talks about *movement in the right direction*, it is proposed that it can be operationalized by 'bounding' the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian.

The value of the framework is that it can be applied to *any* situation in which government is needed to change or implement new social arrangements (i.e., rules, regulations, laws, or policies) to improve the well-being of society. By introducing the idea of *bounding the acceptable moves* when behind the *Veil of Ignorance*, it has been possible to discuss how Rawls's theory of 'justice as fairness' can be operationalized by explicitly relating it to utilitarianism. Bounding the acceptable moves enables stakeholders to move away from a purely utilitarian approach to problem solving which can be unfair to disadvantaged members of society. Justice and equality do not stem from unfair practices.

The significance of the Rawlsian/utilitarian decision-making philosophy developed in Section 2.2.2 is that it supports the fundamental elements of sustainable development. First and foremost, it places *social equity* at the center of decision-making. Second, it

supports the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society. Finally, it makes the 'movement' towards a better *environment* a critical component of any new social arrangements. Therefore, it can be argued that using the Rawlsian/utilitarian decision-making philosophy will help guide decisions towards more sustainable outcomes. While the framework does not include a timeframe of analysis, it does ensure that each new arrangement is one step closer to sustainable development, even if the step is small.

An interesting thought exercise is to try and visualize the difference between a hypothetical Rawlsian outcome and one that is likely to be achieved through the U.S. political process. In Section 2.2.2, it is suggested that the U.S. political climate can be characterized (in a very general sense) by a non-Rawlsian government and stakeholders with a utilitarian posture. Given that a Rawlsian outcome is most likely to occur with a Rawlsian government and stakeholders who have adopted a *communitarian* posture; it is not surprising that the expected outcomes from both decision-making processes do not overlap (Figure 4.3). In effect, the positions of the likely outcomes in Figure 4.3 mark the boundaries of the decision-making process. At one end is the likely outcome from the existing decision-making process and at the other is the Rawlsian outcome. Given that the Rawlsian outcome aligns closely with the objectives of sustainable development, an argument can be made that if the U.S. is to undergo a transformation towards sustainability, the outcomes from the decision-making process need to move towards the Rawlsian domain. Operationally, this means that outcomes from the decision-making process need to lie *between* the boundaries indicated in Figure 4.3 at a location which stakeholders believe is fair, economically feasible, and in line with the interests of society as a whole.

The pathway to achieving sustainable development is not just a case of developing equitable social arrangements. It is also a question of *trade* (which affects distribution) and *technological development* (which affects the environment and employment in particular). The value of the Rawlsian/utilitarian decision-making philosophy is that it is not only applicable for social outcomes. It can also be used to consider decisions that affect *trade* and *technological development* - two factors that have a significant influence on whether society moves towards or away from sustainable development.

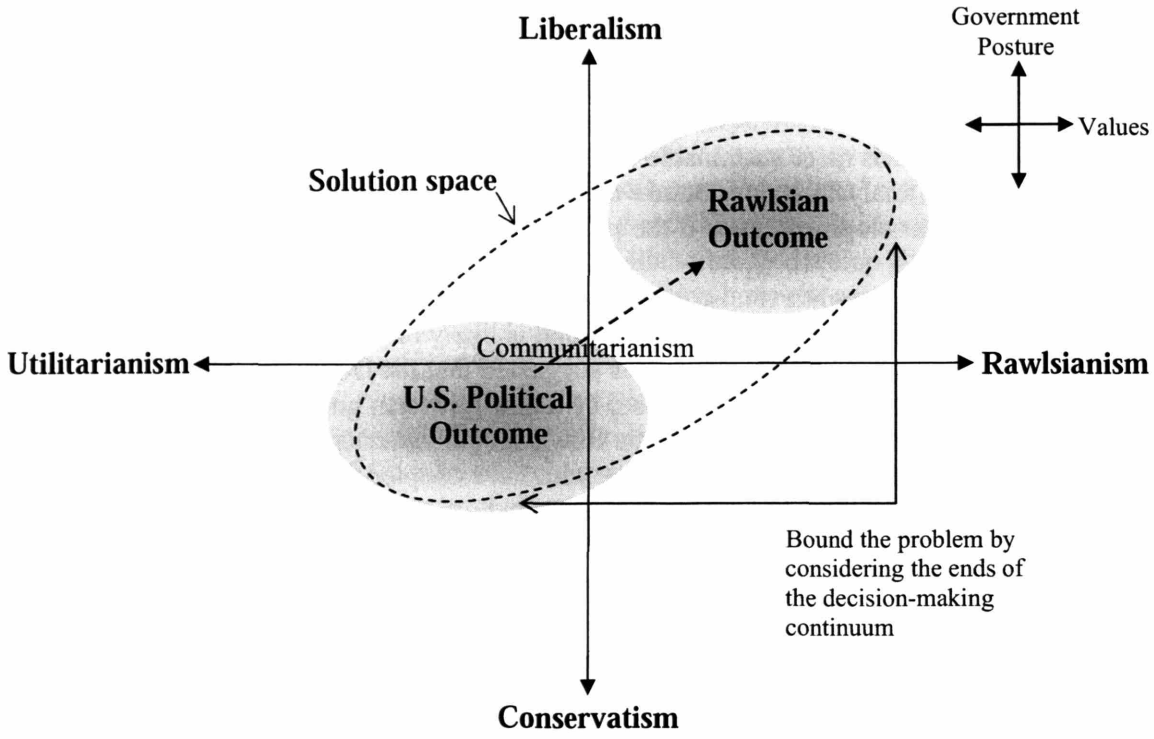


Figure 4.3: Mapping the Likely Outcomes from a Hypothetical Rawlsian and U.S. Decision-Making Process

Section 2.2.2 also argues that governments are the trustees of trade - i.e., they negotiate trade agreements and engage in designing the rules of international commerce. It is also argued that an equal province of a Rawlsian government is the trusteeship of technology. If technology is central to achieving a larger economy that can be divided in a fairer way, then someone needs to serve as a trustee for the birth of that technology. In a situation where the timeframe for the development of ecologically-sound technology exceeds what is practical in a commercial sense, government needs to assume the role as trustee. It should also assume this role if it is not possible - as a result of entrenched vested interests - to establish an inclusive and balanced decision-making process. However, if the desired outcome (i.e., form of technology) was agreed upon through a democratic and inclusive process, then who guides the development pathway (i.e., the government or industry) is simply a case of best fit (see discussion in Section 2.3.2).[493]

To conclude, it is believed that government has a crucial role to play in ensuring that a nation and its citizens adopt development patterns that support the basic principles of sustainable development. It is also believed that the Rawlsian/utilitarian decision-making philosophy presented in Chapter 2 provides decision-makers with a way to consider how they should design, and take part in, civic engagement processes that can achieve this goal. In addition to the process of decision-making, the importance of *integrating* industrial, environmental, employment, and trade policies should also be recognized

[493] The role of government in technology development is the subject of Section 4.2.3.

(Ashford 2004a). By moving beyond markets and acting as a trustee for minority interests, future generations, and new technologies - and by encouraging (or guiding) innovation through coordinated (or at best integrated) regulatory, industrial, employment, and trade policy - governments can establish a dynamic environment whereby transformations towards sustainability become a real possibility.

The implementation of policy initiatives in the regulatory, industrial, employment, and trade arenas is greatly influenced by the policy frameworks in which one views these initiatives. The following section sets out the value-laden philosophical bases of different approaches or lenses used to develop policy.

4.2 Organizing Frameworks

4.2.1 Environmental and Resource Economics

This section begins with the first, and possibly one of the most politically influential, organizing frameworks for advancing sustainable development - environmental and resource economics. The importance of environmental and resource economics lies in its impact on decision-making for protecting and conserving the environment and renewable and non-renewable resources upon which human life depends. The discussion below begins with a brief description of neo-classical economics, from which environmental and resource economics and benefit-cost analysis (BCA) are explored. The section concludes by introducing *trade-off* and *positional analysis* as alternative decision-support frameworks to BCA.

Economics is a social science that is concerned with the optimal allocation of resources in society (Edward-Jones et al. 2000). The term 'neo-classical economics' is a view of economics that evolved from the Classical School of economic thought which was established during the eighteenth century. A major contribution of the Classical School is the creation of principles to explain patterns in economic activity that occur due to individual or group actions beyond those patterns explained by central planning strategies (Gilpin 2000). Possibly the most famous economic theory was articulated by Adam Smith in his 1776 book *An Inquiry into the Nature and Causes of the Wealth of Nations.* Smith (1985 [1776]) argued that individuals who follow their own self-interests in a market economy would unknowingly promote the interests of society at large. His theory is often used to support arguments in favor of a free market economy.

> "... *every individual necessarily labours to render the annual revenue of the society as great as he can. He generally, indeed, neither intends to promote public interest, nor knows how much he is promoting it ... he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By pursuing his own interests he frequently promotes that of the society more effectually than when he really intends to promote it*" (Smith 1985, p. 572).

The theories developed by the early Classical economists[494] focused on three basic categories of resources deemed necessary for the production of goods and services: [1] land and natural resources; [2] labor; and [3] capital (Hussen 2004). These three factors remain central to modern neo-classical economics, established during the latter part of the twentieth century.

The field of neo-classical economics can be described by highlighting several important characteristics or principles that guide economic analysis (Edward-Jones et al. 2000; Gilpin 2000; Söderbaum 2000). First, in neo-classical economics the market economy is central to any analysis of the supply and demand of homogeneous commodities (goods and services). It is assumed that market actors have perfect information on all commodities, including the likely impacts associated with their selection. In addition, in a competitive market, equilibrium prices and quantities are determined through the laws of supply and demand, and consumer sovereignty guides the kinds of goods and services produced. The identification of these equilibrium prices and quantities is achieved by focusing primarily on static, rather than dynamic, efficiency.[495]

Second, neo-classical economic models of behavior focus on how 'firms' and 'individuals' maximize their profits and utility, respectively. Firms maximize profits by analyzing expenditures and revenues, given the constraints of prices and budgets. By identifying the marginal cost of producing one extra unit of commodity, firms are able to establish the level of production that maximizes profit. Similarly, individuals try to maximize their utility (or satisfaction) derived from consumption, given the constraint of monetary income. In neo-classical economics, the idea of 'welfare' is connected with the ability of individuals to buy and then consume commodities. It follows that an individual's welfare increases when his/her income increases, since more commodities can be purchased and consumed.[496] It is this rationale that fuels the growth economy discussed in Section 2.4.

Third, neo-classical economics views the economy as consisting of firms and households (Figure 4.4). Firms produce goods and services that are then purchased by households

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[494] Other influential members of the Classical School include Thomas Robert Malthus (1766-1834), David Ricardo (1772-1823), Nassas William Senior (1790-1864), James Mill (1773-1863), and John Stuart Mill (1806-73) (Gilpin, 2000).

[495] See Section 4.2.3 for a discussion of the differences between static and dynamic efficiency and how they affect the process of technological innovation.

[496] The field of 'welfare economics' is of particular interest to governments. Its focus is the well-being of society, which is assessed by considering "*the social desirability of alternative arrangements of economic activities involving allocations of resources. ... It involves judgements about how the economy should perform and how society should look, to maximize economic welfare*" (Gilpin, 2000, p. 6). Vilfredo Pareto (1848-1923) established the neo-classical foundations of welfare economics by formulating a way to measure how efficient the economy was at improving social welfare (Edward-Jones et al., 2000). His concept, known as Pareto efficiency, states that an efficient economy is one in which the initial distribution of resources is such that no one can be made better off without making at least one person worse off. The strength of Pareto's theory was that it was seen as 'value neutral.' A Pareto efficient solution meant that nobody was made worse off, but some people would gain under new arrangements. Thereby avoiding the difficult decisions of who should win and lose. Environmental economics, discussed below, is a branch of welfare economics (Gilpin, 2000).

and other firms. To produce these goods and services, firms need to employ labor from households and buy materials from other firms or extract them from the environment. The economy is circular in that the income received through labor is used to buy commodities/services, and the revenue generated from the sale of commodities/services is used to pay wages. In neo-classical economics, the scarcity of resources (raw materials/energy) and the negative effects of waste/energy from firms and households are generally not considered in - and are therefore invisible to - the analysis of supply and demand (Rees 1995a). It follows that this simple model can be extended to include the operation of national governments and international flows of labor and financial capital (Söderbaum 2000).

Finally, neo-classical economics is divided into two main fields of study: microeconomics and macroeconomics. The former studies the behavior of individuals, small groups, or firms, whereas the latter focuses on the performance of economies as a whole.

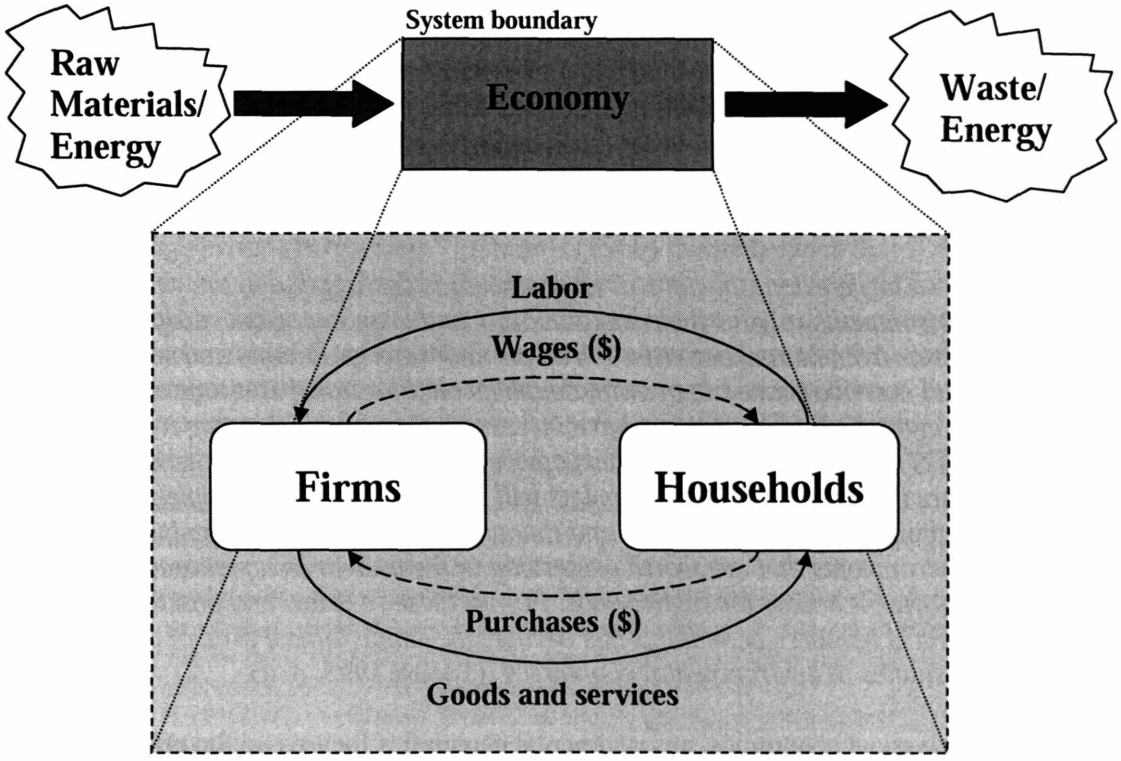

Figure 4.4: A Neo-classical Model of the Economy

John Stuart Mill (1909) was the first economist to warn of the negative environmental effects of growing production but it was not until the 1960s that the scale of industrial activity began to visibly affect ecosystem health, biological diversity, and human health, giving rise to the field of *environmental economics.* The primary objective of environmental economics is to study the problems associated with the economic inter-relationships between human activity and the environment (Tisdell 1993). More

specifically, environmental economics began by assessing the potential impacts of mechanisms or incentives designed to control or reduce pollution. In this regard, the domain of environmental economics is associated with the interactions surrounding the top right arrow in Figure 4.4. While environmental economics is based upon both micro and macroeconomic theories, the former is used more frequently to analyze how and why people make decisions that result in environmental consequences (Field 1994).

It is important to recognize that while environmental economics is concerned with human-environment interactions, it is not concerned with issues of equitable or safe employment. Employment is simply treated as a cost to be optimized, rather than a factor that enhances human well-being. As discussed in Section 2.2.2, the economically-efficient level of pay is generally set at the level which the market and employees will bear. However, this level of pay may not be optimal in a Rawlsian sense if those who accept the work are being exploited due to their socio-economic status, furthering inequality within a community and moving it away from sustainable development.

The top left arrow in Figure 4.4 represents the flow of raw materials into production and consumption. The study of nature as a source of raw material is the subject of *resource economics*. Its focus is to determine when to extract non-renewable resources (such as coal, oil, gas, etc.) from the ground (Hicks and Allen 1934a; 1934b; Hotelling 1931), and when to harvest renewable resources (such as forest products, animals, fish, etc.) (Fox 1970; Gordon 1954; Schaefer 1954). Tisdell (1993) provides a convincing case as to why resource economics is an important subset of environmental economics.

> "*To a large extent the natural environment is the foundation on which man-made environments rely for their sustainability and is an important receptor or sink for wastes from human activity such as air and water pollutants and solid wastes. With massive economic growth, demands on the natural environment to provide its myriad of 'free' services have increased, thereby overloading it and in some cases this has led to or threatens environmental disasters. Furthermore, there are fears that man-made environments will be threatened by the depletion of non-renewable natural resources and that mankind is irreversibly losing natural environments that are worth preserving in themselves as a resource of human enjoyment and/or for higher ends. For all these reasons, and possibly others, natural resource economics has become the single largest area of concentration in studies of environmental economics*" (Tisdell 1993, p. 4).

Like neo-classical economics, environmental economics focuses on the efficient operation of the market system. When there is a healthy level of competition between firms, it is generally assumed that markets will perform well. However, in the case where the market system - the invisible hand - fails to achieve a social optimum, the market is said to have failed. The existence of environmental problems is connected with such 'market failures.'[497] While economists have identified a number of causes of market

[497] While environmental problems are most commonly associated with 'market' failures, they can also occur due to the failure of [1] "*dominant ideas about science* [and technology];" [2] "*dominant ideas in specific disciplines, such as economics and business management*;" [3] "*dominant political ideology*;" and

failure, the most important source of market failure is the presence of uninternalized externalities or spillovers (Gilpin 2000; Söderbaum 2000; Tisdell 1993).

4.2.1.1 Externalities

The concept of an *externality* was first developed by Arthur Cecil Pigou (1932). Piguo argued that an externality occurs when an individual's decision to buy a product/service results in costs or benefits to other individuals or groups who are not part of the transaction. Thus, the individual does not bear all of the costs or receive all of the benefits from his/her action.[498] To address this problem, Piguo argued that the costs of 'negative' externalities need to be 'internalized' in the end price of a product/service to reflect its true social costs. This internalization of costs could be achieved by matching a firm's marginal cost of environmental damage with the marginal benefit received from the product/service provided. One mechanism for doing this is to use a Pigouvian tax to correct for the negative effects of externalities (Eskeland 1994; McKitrick and Collinge 2000). Pigou's notion of internalizing external costs is also commonly known as the *polluter pays principle*. A problem with Pigou's argument, however, is that environmental damage from economic activity is often not priced or occurs outside of market exchanges (Redclift 2000).

The idea that externalities can be addressed by internalizing external costs was rejected by Ronald Coase (1960), who suggested that a close to optimal outcome could be achieved through private bargaining.[499] Coase's (1960) theorem states that if there are zero transaction costs and legal rights (land rights in particular) are well defined, then the socially efficient solution to negative externalities will occur regardless of legal entitlement. Hence, under these assumptions, environmental disputes, for example, will be resolved through *private* negotiations. The problem with Coase's theory, however, is that transaction costs are almost never zero, property rights may be difficult to define, and identifying who is responsible for certain externalities can be complicated.[500] Thus, one

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[4] "*existing institutional arrangements*" (Söderbaum 2005, p. 4). Thus, a perceived failure should be assessed from a number of different perspectives or ideologies.

[498] "[T]*he essence of the matter is that one person A, in the course of rendering some service, for which payment is made, to a second person B, incidentally also renders services or disservices to other persons (not producers of like services), of such a sort that payment cannot be extracted from the benefited parties or compensation enforced on behalf of the injured parties*" (Pigou, 1932, p. 183).

[499] See Coase, R. H. (1960) *The Problem of Social Cost*, http://www.sfu.ca/~allen/CoaseJLE1960.pdf (accessed on 04/09/06).

[500] An interesting exercise is to consider the barriers to Coase's theorem by looking at environmental problems through the lens of sustainable development using an analogy to entropy. While the concept of entropy has a direct link to *resources* (Georgescu-Roegen, 1971), there is also a different link to *market negotiations*. For example, if there are a number of disaggregated victims of environmental pollution and one producer, the *entropy problem of disaggregated demand* becomes an insurmountable barrier to achieving an efficient (market) solution to the pollution problem. To be more specific, organizing (and more importantly compensating) the various people affected by pollution - some of whom are split across nations, some by oceans, and some by time (intergenerational equity) - is really an entropy problem of enormous magnitude. It is a markedly different issue to the physical entropy problem since it is based upon time (intergenerational equity) and geographical dispersion of affected people. Hence, the entropy problem of disaggregated demand becomes a *transaction entropy* problem. Coase's (1960) theory hinges on

inference from Coase's theorem is that government has a role in minimizing transaction costs to enable the market to function efficiently.

Whether a government chooses to follow a Pigouvian (regulatory)[501] or Coasian (market)[502, 503] approach to addressing negative environmental externalities (Schultze 1977), environmental economics plays an important role in providing information to decision-makers about the likely impacts of their actions.[504] The field is very much concerned with cost-effective ways and means of allocating resources, managing/preventing waste, and dealing with the economic implications of intragenerational and intergenerational equity (Padilla 2002; Stavins et al. 2002), all of which are important aspects of sustainable development. Thus, environmental economics is a valuable tool for analyzing proposed or existing environmental policy. By using a benefit-cost framework,[505] environmental economics attempts to identify the economic efficiency of environmental goals.

4.2.1.2 Benefit-Cost Analysis (BCA) and Valuation Techniques

Benefit-cost analysis (BCA) works by expressing both the costs and benefits of a policy or program in monetary terms. It evaluates all the *benefits* derived from protecting the

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transaction costs, but what makes up a transaction cost? There are the normal costs associated with one-on-one negotiations, but if we consider all of the people that are separated geographically and by time, the quantification of transaction costs becomes immense. It is impossible for a firm to talk to all the people it affects. An additional complication is that people act in political units which nucleate in certain ways. For example, the world doesn't unite around global warming, although a region or nation might. However, being concerned with everyone's right to clean air thousands of miles away and two generations hence is something that cannot be included in a utility function that we use when bargaining. Hence, the result is a transaction entropy problem which transcends the physical entropy problem and which states that large-scale, complex systems tend to maximum chaos or disorder.

[501] See Kolstad (2000) *Environmental Economics*, Chapter 8, 'Regulating Pollution.'

[502] See Reinhardt (1999) for a discussion of the opportunities for firms to provide environmental public goods that go 'beyond-compliance' and minimize environmental harm using free market solutions that respond to consumer sovereignty.

[503] Some economists from the Chicago School of Economics - which mostly favors free trade and small government - argue that the scale of market failure is over exaggerated (Tisdell, 1993). They suggest that market failures can be overcome by establishing conditions that suit market operations, such as establishing private property rights on resources and waste sinks that previously had common access.

[504] See Besley (2003) for an interesting discussion of how the organization of government is influenced by the regulation of externalities, transaction costs, and vested interests.

[505] While benefit-cost analysis (BCA) is possibly the most well known technique for analyzing environmental issues, there is a wide range of other approaches (both economic and comparative) that can be used to analyze environmental problems. Important environmental appraisal techniques include: environmental impact assessment (EIA); life cycle analysis (LCA); strategic environmental assessment (SEA); risk assessment (RA), including comparative risk assessment (CRA), risk-benefit analysis (RBA), health-health analysis (HHA), and risk-risk analysis (RRA); multi-criteria analysis (MCA); and cost effectiveness analysis (CEA). For a detailed discussion of all of these appraisal techniques, including a discussion of the applicability of each technique to a number of environmental problems, see Pearce et al. (1999) - available on line at http://www.defra.gov.uk/environment/economics/rtgea/index.htm (accessed on 04/09/06). Ashford (1978; 2003) and Söderbaum (1973; 2000) have independently offered two closely related techniques to benefit-cost analysis called *trade-off analysis* and *positional analysis*, respectively. Both of these decision-support tools are discussed in Section 4.2.1.4.

environment and natural resources against the *costs* associated with environmental damage and control mechanisms. As a decision-making tool, the BCA framework offers several compelling advantages (Ashford 2003; McAllister 1995). First, it is an established theory of value that has been reviewed and adjusted by economists to address some of its theoretical and operational limitations. Second, it clarifies choices among alternatives by evaluating consequences systematically and in an aggregated manner. Third, it claims to foster an open and fair policy-making process by making explicit the assumptions from which the benefits and costs are calculated. Fourth, it attempts to include the values of all stakeholders in the analysis by revealing their preferences using valuation techniques. Fifth, its extensive use means there is a large amount of literature describing how the technique can be applied to a wide range of issues. Finally, since money is the common denominator, BCA can express the impact of a policy in a single monetary value.

Since many environmental goods - such as scenery, wildlife, air, water, and soil quality - are not directly traded in the market, environmental economics uses a series of techniques to estimate the *non-market values* of these goods. The estimation of a single environmental good (or resource) is complicated by the fact that it can be valued in a number of ways. Therefore, obtaining the total economic value (TEV) of an environmental good in relation to 'human welfare' often requires the addition of a series of non-market values. While there is no firm taxonomy for measuring the TEV, it is widely accepted that non-market values can be obtained by estimating the *direct use*, *indirect use*, and *non-use* values of an environmental good, both in the *present* and *future* (Ostrom and Ostrom 1977).[506] Thus, the TEV for an environmental good such as wildlife might consist of a direct use value, a non-use (existence) value, and an option (or bequest) value that considers the value of wildlife for future generations. When adding such values together, care needs to be taken to avoid any form of double counting of economic value. A recent report by the National Research Council (2004), *Valuing Ecosystem Services*, endorses the TEV method and states that "*the valuation of services provided by ecosystems can inform the policy debate and lead to improved decision-making*" (ibid, p. 219).

Some of the most well known valuation techniques used by environmental economists include the following (Edward-Jones et al. 2000; Harris 2002; Markandya et al. 2002; van den Bergh 1999a):

- *Contingent valuation* - Surveys ask hypothetical questions to assess an individual's willingness to pay/accept a certain level of environmental protection.
- *Hedonic pricing (demand side method)* - Environmental goods/services are valued by relating them to marketed goods. For example, households identical in size, number of rooms, distance to the nearest school, etc., can be compared to determine whether their surrounding environment influences their value. A difference in price provides a proxy for the value of the environment.
- *Travel cost models (demand side method)* - The value of a recreational amenity (e.g., national park) is estimated by calculating the travel (or total) costs (e.g., fuel expenditure, highway tolls, fares, entry fees, and travel time) an individual pays to

[506] See Section 6.2.4.2 for a related discussion of 'quasi-option value' of human and manufactured capital.

access the amenity. The data is used to generate a demand curve to estimate how many people would visit the amenity for different total costs. The area under the curve provides an indication of the total value of the amenity to its visitors. The travel cost method provides a 'direct use' valuation and, therefore, does not consider non-use value for present and future generations (which might be obtained using a contingent valuation method).

- *Production function and engineering cost (supply side method)* - Environmental goods/services are valued by calculating how much it would cost to replace the services they provide. For example, if we put aside ethical questions relating to the loss of habitat for flora and fauna, the cost of replacing a wetland can be calculated by estimating the cost of building, operating, and maintaining a sewage treatment plant that has the same pollution-absorption capacity.

The valuation techniques listed above provide an indication of how environmental economics attempts to price goods and services provided by the environment. Once the monetary value of an environmental resource is obtained, the economic efficiency of environmental policies designed to control pollution can be assessed using the BCA framework.[507]

4.2.1.3 Problems with BCA

While the benefits of BCA have been discussed, there are a number of fundamental problems that make it an inappropriate tool for decision-making for sustainable development. First, the one-dimensional nature of BCA gives the impression that aggregating environmental, social, and economic concerns into a single monetary value is a simple process (Söderbaum 1987). Thus, the inherent complexity underlying many environmental and development issues is likely to be hidden behind a veil of simplicity. Further, the fact that BCA stems from economic theory "*gives the impression of rigor and precision when in fact the truth is largely otherwise*" (Bromley 1980, p 247).

Second, the valuation techniques that monetize environmental and social goods/services in a BCA suffer from a number of drawbacks. One major problem is the assumption that environmental benefits/costs can be adequately represented by a monetary value

[507] In general, the environmental policies used to address environmental externalities can be grouped under *incentive-based mechanisms* and *process reforms* (Hahn 2000). Incentive-based mechanisms are designed to encourage firms to make decisions that move the industrial sector towards a desired environmental objective, such as reducing sulfur dioxide emissions. The mechanisms used include tradable emissions permits, emission fees, deposit-refund programs, direct subsidies, the removal of adverse subsidies, and the removal/reduction of market barriers. Technology standards are generally not included in this group. The benefit of incentive-based mechanisms is that they align the objectives of environmental protection with the normal monetary drivers of a firm (Field 1994), generating win-win solutions. In contrast, process reforms focus specifically on accountability mechanisms and analytical requirements (Hahn 2000). The former are designed to increase a firm's accountability associated with specific environmental goals and enhance the information available for decision-making. Accountability mechanisms include standardized reports, peer reviews, auditing, and performance standards. Analytical requirements include mandates to use a certain type of analysis technique - such as BCA, risk-risk trade-offs, or cost-effectiveness - to assess different regulatory alternatives.

(McAllister 1995). Kapp (1970, p. 25) argues that valuation techniques do not take sufficient account of the fact that "*(a) markets are far from perfect ..., (b) the consequences of environmental disruption are highly heterogeneous and cannot be compared qualitatively with one another, and (c) the benefits obtainable from environmental control are equally heterogeneous and can neither be compared quantitatively with one another nor with the outlays for control.*" He concludes that any attempt to use monetary or market values to measure social benefits of environmental improvement or social costs from disruption is "*doomed to failure*" (ibid). The incommensurable nature of environmental, social, and economic factors is a significant problem facing BCA.

By making money the 'common denominator,' the environment, for instance, is valued (or interpreted) as a form of commodity that can be traded in real or imagined markets (Söderbaum 2000). In effect, the monetization of environmental and social goods/services "*is an attempt to extend the utilitarian and democratic principle of the free market into environmental decision-making*" (van den Bergh 1999a, p. 84). While this might seem like a rational approach, a closer look at the valuation techniques reveals a problem. Only the *market roles* of an individual are captured by the valuation techniques, largely to the exclusion of other (social) roles such as community participation, citizenship, etc. (Söderbaum 2004). The valuation techniques capture the preferences of the individuals affected, which are then translated into a monetary value and summed across different impacts, social groups/stakeholders, and time periods (Söderbaum 1987). The amount of economic goods - i.e., purchasing power - a person has in the marketplace influences his/her willingness to pay for a good/service or to accept a certain level of risk with employment. This observation is known as the 'wealth effect.' While the distribution of wealth collectively determines the market value of environmental, social, and economic goods, the position a market actor holds on a distribution of wealth determines what basket of goods (and bads) he/she receives. If a valuation technique fails to consider the distribution of wealth in a society, its outcome is likely to lead to misleading conclusions about the benefits/costs of a policy/project/regulation.[508]

A final concern with valuation techniques is that they do not provide any information about the implicit (and unavoidable) ethical decisions that an analyst makes as part of the valuation process (Söderbaum 2004). For example, assessing the market value of employment by only considering what lower income groups are willing to accept raises

[508] Markets determine prices for traded goods that can be used in BCA. An important problem with non-traded goods relates to the valuation of human life. The assumption of risk accepted/adopted by workers in exchange for wage differentials or 'risk premiums' should not be used to calculate the value of a human life (Sunstein and Rowell 2005). While it can be argued that the assumption of risk is traded - i.e., workers accept a certain amount of risk for a higher income - trading risk for money is not the same as trading a life for money. When making employment decisions, workers are not trading their lives for money; they are making a decision based upon the probability that their lives will be lost - i.e., they are using the 'value of a statistical life' (VSL) (Stavins 2004). This is a very different proposition. For example, firemen are acknowledged to receive increased wages for dangerous work. Assuming that the value of life can be calculated from the level of risk that workers are willing to assume confuses two different issues and is a leap of faith on the part of the analyst.

the question of whether the level of income included in the analysis is a fair estimation of the value of labor. In addition, Tribe (1972) argues that certain kinds of values are not adequately treated by BCA. For instance, when major environmental and social categories such as ecological balance and community cohesion are involved in an analysis, the BCA techniques employed "*will tend to either filter them out of the investigation altogether or to treat them in ways inconsistent with their special character*" (Tribe 1972, p. 97). Finally, Kelman (1981) makes the case that in the areas of environmental, safety, and health regulation the morally 'right' decision might be one in which the benefits are not greater than the costs. Kelman's argument stems from the premise that economists who support BCA are supporting the moral philosophy of utilitarianism.

> "*Utilitarianism is an important and powerful moral doctrine. But it is probably a minority position among contemporary moral philosophers. It is amazing that economists can proceed in unanimous endorsement of cost-benefit analysis as if unaware that their conceptual framework is highly controversial in the discipline from which it arose - moral philosophy*" (Kelman 1981, p. 34).

A third problem with BCA lies in the way in which the 'outcome' from a BCA ignores distributional effects. Under the moral philosophy of utilitarianism, a right decision is one that maximizes human satisfaction (or welfare). However, as argued in Section 2.2.1, utilitarianism suffers from two problems: [1] it raises moral conflicts, particularly in regards to fairness; and [2] it fails to support the more liberal nature of Western societies that emphasize liberty and individual rights (Brock 1971). In relation to the former point, the aggregative character of utilitarianism means that it is not concerned with the distribution of welfare, and therefore provides no justification for inequality in its distribution (Ashford 2000; Cohen 1993; Fischhoff 1977). If a BCA indicates that a new social arrangement will maximize the welfare of the majority, the simple application of this result - without any distributional adjustments - will disenfranchise the minority who must accept the new arrangements for the greater good. In effect, BCA's indifference to distributional effects means that maldistributions become invisible and hence disregarded.

One theory put forward by neo-classical welfare economists as a way to avoid distributive problems is the Pareto optimality criterion.[509] A Pareto efficient solution is one in which no one is made worse off, but at least one person gains under new arrangements (Pareto 1896). However, given the complexity of real world development, it is difficult to identify a project/new social arrangement where someone has not been made worse off. A less restrictive theory that can be used to arrive at a 'potential' Pareto outcome is the Kaldor-Hicks efficiency criterion (Hicks 1940; Kaldor 1939). A Kaldor-Hicks outcome is one where the total economic value of social resources is increased to a level at which those who gain can compensate those who lose and still be better off. However, there is no requirement that any transfer of wealth should actually take place.

[509] Supra note 496.

The fact that no transfer of wealth is required under the Kaldor-Hicks efficiency criterion is a significant problem, especially when those most likely to receive the benefits are already the more advantaged members of society. If we are interested in developing a more democratic and fair decision-making process that specifically addresses inequality, then a Rawlsian approach seems more appropriate. The Rawlsian/utilitarian decision-making philosophy developed in Sections 2.2.2 and 4.1.4 presents one way that decision-makers can move away from a purely utilitarian outcome towards one that is more compatible with decision-making for sustainable development.

A fourth problem with BCA is its failure to adequately deal with technological innovation (Driesen 2003). For example, calculating regulatory compliance costs using existing technology is likely to overestimate costs (which are often based upon upwardly biased industry estimates) since savings that accrue from technological improvements (i.e., efficiency gains) are ignored (ibid). If the costs are overestimated, then this implies that the imposed standards were too lenient and more pollution reductions could have been made. The dynamic effect of technological innovation is important since it exposes a problem with the static efficiency view of BCA.[510] Each time a new innovation enters the market, the BCA will need to be recalculated to reflect the new efficient 'state.' Therefore, BCA leaves considerations of the *process* of industrial transformations outside of the analysis framework.

A fifth problem with BCA is that environmental policies designed to *internalize* negative externalities are likely to increase the cost of goods and services to alter consumer behavior. Since the costs are compared to the benefits, a policy that is specifically designed to inflate costs may require special treatment beyond what is possible in a standard BCA.

The sixth concern is perhaps the most contentious issues with BCA - the selection and use of a discount rate (Donohue 1999; Glicksman and Shapiro 2003; Heinzerling 1998; Heinzerling and Ackerman 2002; Portney and Weyant 1999). The discount rate is used to translate future benefits and costs into present day values. The inherent problem here lies in the translation of non-economic issues such as the condition of the environment and human health into a present day monetary value. "[D]*iscounting as a general way of handling the future is conceptually weak. ... For those who consider evolutionary processes and the paths that ecosystems take over time, the idea that non-monetary impacts at different periods can somehow be pressed together to one point in time via calculation of present values is absurd, assuming that we want to know what we are doing*" (Söderbaum 1987, p. 151).

In addition, discounting long-term multigenerational impacts means that present day actions can proceed with little concern for future generations since the benefits/costs they will experience are close to zero today when discounted. For example, if we consider the long-term management costs for radioactive waste, the future expenditures required to maintain the waste three generations hence is small when discounted to today. In this regard, nuclear power might become a favorable option in a BCA. However, the fact that

[510] See the discussion of *static* versus *dynamic* efficiency in Section 4.2.3.3.

our grandchildren's children are left with the expense of managing this waste without any foreseeable benefit raises some serious ethical questions (Pearce 1979).

In an effort to address the shortcomings with the discount rate, Ashford (1981, p. 133) suggests three approaches which have been generalized from his original focus on health benefits. These approaches are to:

- "*discount the* ...[environmental and social benefits/costs] *at the same discount rate used in the monetary benefit or cost calculations;*
- *discount the* ...[environmental and social benefits/costs] *but at a lower* [or even negative] *discount rate than that used in the monetary benefit or cost calculations;*[511] *or*
- *do not discount* ...[environmental and social benefits/costs] *at all.*"

The application of each of these approaches in a BCA will result in very different outcomes, highlighting the difficulty of selecting an 'appropriate' discount rate.

The final problem discussed here lies in the adequacy with which BCA can support a democratic decision-making process. In this area, perhaps one of the most vocal critics of BCA is the economist Peter Söderbaum (1973; 1987; 2000; 2001; 2004). Söderbaum's (2001) concerns with BCA revolve around its inability to accommodate different ideological perspectives. While BCA is democratic in the sense that it counts the 'votes' (or preferences) of actors and interested parties, Söderbaum (1987; 2001) argues that an equally important aspect in a democracy is the ability to collectively understand and learn from different perspectives on an issue. Emphasizing BCA as the main decision-making tool adopts an economic lens to problem solving largely to the exclusion of other equally valid tools/perspectives.

The idea of being able to inform and shape decision-making is central to the social contract. "*Democracy ... encourages all kinds of arguments and alternatives to be put forward in a creative process through hearings and other forms of public participation. To facilitate such exchange of opinions and information, many-sidedness in the analysis of alternatives, impacts, and interests is an imperative*" (Söderbaum 1987, p. 152). A problem with BCA is that the 'expert' analyst has very little interaction with the relevant stakeholders. While there is a limited amount of interaction through the administration of willingness to pay/accept surveys, it is questionable as to whether the decision-making process is informed (Söderbaum 2001; 2004). Furthermore, imposing a BCA solution on a stakeholder group that feels it has been disenfranchised from the decision-making process is likely to result in social unrest.

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[511] See Costa and Kahn (2003) for an informative analysis that shows how the price of nonmarket goods has steadily increased between 1900 and 2000. Their results imply that the 'real' discount rate during the periods of 1990-2000 and 1980-2000 for the nonmarket goods analyzed was between 1 and 3 percent, respectively. This result indicates that human health and environmental quality, for instance, are becoming more valuable than normal consumer goods. This phenomenon was first recognized by Krutilla (1967, p. 784) who commented that "*it appears that the utility to individuals of direct association with natural environments may be increasing while the supply is not readily subject to enlargement by man.*"

All of the above concerns lead to the conclusion that BCA is an inappropriate decision-making tool for sustainable development. While decision-makers and analysts should recognize that BCA has made "*important contributions to the study of social regulation*" (Hahn 2005, p. 56), even its most ardent supporters agree that alternative decision-making frameworks are necessary.

> "*Despite my serious disagreement with many of the claims of the critics* [of BCA], *I find myself in substantial agreement on a number of policy propositions. The points of agreement include:* ***balancing quantitative and qualitative information in decision making; providing better treatment of uncertainty;*** *providing resources to investigate* ***effects of regulation on different socioeconomic groups; increasing regulatory transparency;*** *increasing funding to perform more retrospective analyses; and* ***creating new institutional approaches for improving regulation***" (Hahn 2005, p. 59, emphasis added).

Instead of attempting to aggregate and transform environmental, social, and cultural issues into a single monetary value, a better approach is to accept a certain amount of complexity and heterogeneity and adopt a more informed and disaggregated decision-making process. While BCA is not seen as a suitable decision-making tool for sustainable development, it is still the most suitable technique for evaluating the "*strictly economic impacts of public actions*" and should therefore be used, but in a more constrained manner (McAllister 1995, p. 143).

Alternative, more disaggregated decision-making approaches to BCA include Multi-Criteria Approaches (MCA), Environmental Impact Assessment (EIA), Trade-off Analysis (Ashford 1978), and Positional Analysis (Söderbaum 1973). Of these, it is believed that trade-off and positional analysis are more closely aligned with the conceptualization of sustainable development presented in this chapter. The following section describes these decision-support frameworks and discusses how they can be used to support decision-making for sustainable development.

4.2.1.4 Trade-off and Positional Analysis as Alternatives to BCA

Trade-off and positional analysis are two techniques that require decision-makers to explore the trade-offs that are often obscured in a benefit-cost analysis (BCA). Instead of aggregating a wide range of heterogeneous factors into a single monetary value, trade-off analysis keeps each factor in its natural units. By displaying these factors in a trade-off matrix, it is possible to assess who benefits and who is made worse off as the result of existing/new regulation.[512] A benefit of non-aggregation is that the time period in which each effect is experienced is revealed and future (non-financial) benefits/costs are not

[512] The idea of using a form of trade-off analysis that considers utilitarian and non-utilitarian factors as well as the consequences of alternative courses of action, was recently endorsed by the Millennium Ecosystem Assessment. See the Millennium Ecosystem Assessment report, *Ecosystems and Human Well-being: Summary* (pp. 19-21), http://www.millenniumassessment.org/en/Products.EHWB.aspx#downloads (04/09/06).

discounted to a present value.[513] Further, the trade-off between the costs of environmental or health improvements are made explicit.

Table 4.4 presents a generic matrix of benefits and costs associated with government policy. The matrix disaggregates the consequences of a policy into economic, health and safety, and environmental effects, and indicates how these relate to policy-relevant groups of actors such as producers, workers, consumers, and others (i.e., stakeholders who do not have a contractual or commercial relationship with producers) (Ashford 1978; 2003).[514] The benefits and costs are expressed in their *natural units*: economic effects are expressed in monetary terms ($B_{\$}$, $C_{\$}$); health and safety effects are expressed in terms of morbidity ($B_{H/S}$, $C_{H/S}$); and environmental effects are expressed in terms of damage to ecosystems (B_{Env}, C_{Env}). The two latter types of consequences are informed by health and environmental risk assessments, respectively. It is important to recognize that when constructing the matrix, the analyst is not forced to make decisions about how environmental, health/safety, and economic factors should be valued and summed across different actors or generations.

Table 4.4: Generic Trade-off Matrix

Group	Economic Effects	Health/Safety Effects	Environmental Effects
Producers	$B_{\$}$, $C_{\$}$		
Workers	$B_{\$}$, $C_{\$}$	$B_{H/S}$, $C_{H/S}$	
Consumers	$B_{\$}$, $C_{\$}$	$B_{H/S}$, $C_{H/S}$	
Others	$B_{\$}$, $C_{\$}$	$B_{H/S}$, $C_{H/S}$	B_{Env} , C_{Env}

Source: Adapted from Ashford (1978, p. 165).

Disaggregating the impacts of a policy in a trade-off matrix has the added advantage of informing decision-makers and stakeholders about who is reaping the benefits and who is bearing the costs. While it has been argued that the informational burden of such an approach to decision-making "*tends to reduce the efficacy of political institutions*" and leads to stakeholder conflict and delay (Congleton and Sweetser 1992, p. 16), hiding such information would surely be inappropriate in the democratic process. As Söderbaum (1987, p. 152) argues, rather than solving problems by counting votes in a BCA, "*the task*

[513] It is important to recognize that a BCA framework can be used within the trade-off matrix to translate the 'economic' costs or benefits of a policy or program into a net present value (NPV) or future value (FV) for comparison purposes. The 'non-economic' costs and benefits remain in their natural units and are not 'valued' in an economic sense.

[514] When developing the stakeholder groups, it is important to consider whether there are any conflicts within each stakeholder group that might impact the analysis or success of a policy alternative. In the situation where value conflicts amongst members of the *same* stakeholder group are pronounced, it might be more effective to focus the distributional analysis on 'interests' rather than the traditional stakeholder groups (such as producers, workers, consumers, low-income groups, etc.). Thus, members of different (traditional) stakeholder groups might find their interests align; allowing them to form an 'interest group' whose members cannot be grouped into a uniform category.

... should be to produce reliable knowledge through systematic inquiry and to ***illuminate*** *the decision-making situation with all its conflicts, uncertainties, and other complexities.*" Hence, one benefit of using a trade-off matrix is that stakeholders have the option to become involved in the process of deciding the trade-offs.[515] In this regard, decision-making becomes more open and transparent and is "*based on accountability rather than accounting*" (Ashford 2003, p. 5).

The transparency achieved by non-aggregation means that decision-makers become more accountable for their decisions. When pursuing a new policy initiative or assessing an existing regulation, the decision-maker is required to acknowledge who is receiving the benefits/costs and how these evolve over time. Hence, a time series of trade-off matrices is required to capture the changing dynamics of the system under analysis. For example, tightening air quality standards is likely to increase costs for producers and consumers in the near-term while improving the quality of the environment and the health of workers, consumers, and others over the medium-/long-term. In this instance, both the magnitude and the distributional or equity effects of the decision-maker's choices are revealed. Whereas BCA abdicates the responsibility for these choices to the analysts (Tribe 1984), trade-off analysis places them firmly on the shoulders of decision-makers, making them accountable for their actions.

Table 4.5 shows how the generic trade-off matrix shown previously can be used in a *comparative* sense to present the changes in each indicator between time periods. This 'back of the envelope' approach to policy analysis is relatively straightforward and is based upon the same type of data that supports a BCA. It is also of particular value to decision-makers who will be able to see the likely implications of strengthening/weakening an existing policy or the expected impacts from the introduction of an entirely new policy alternative.

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[515] "*The principles of democracy state that all stakeholders or interested parties should be encouraged to 'participate' in the planning and decision process. Participation thus refers to the right to be informed about what is going on. Each party should be respected and should be able to influence the process. A willingness to listen and learn should characterize all actors and interested parties. Ideally, each actor should be open to the possible value of the ideological thinking and orientation of others and to their ideas about theories and methods. There should be a search for consensus, but also a readiness to accept and understand that the actors and interested parties do not share the same vision, and that a conflict of interest is a normal state of affairs. Such conflicting views should be dealt with as constructively as possible and indeed represent a source of creativity and new thinking for all actors and stakeholders*" (Söderbaum 2000, p. 78).

Table 4.5: Using the Trade-off Matrix for a Comparative Analysis of Policy Alternatives

Group	Economic Effects	Health/Safety Effects	Environmental Effects
Producers	$\Delta B_{\$}$, $\Delta C_{\$}$		
Workers	$\Delta B_{\$}$, $\Delta C_{\$}$	$\Delta B_{H/S}$, $\Delta C_{H/S}$	
Consumers	$\Delta B_{\$}$, $\Delta C_{\$}$	$\Delta B_{H/S}$, $\Delta C_{H/S}$	
Others	$\Delta B_{\$}$, $\Delta C_{\$}$	$\Delta B_{H/S}$, $\Delta C_{H/S}$	ΔB_{Env} , ΔC_{Env}

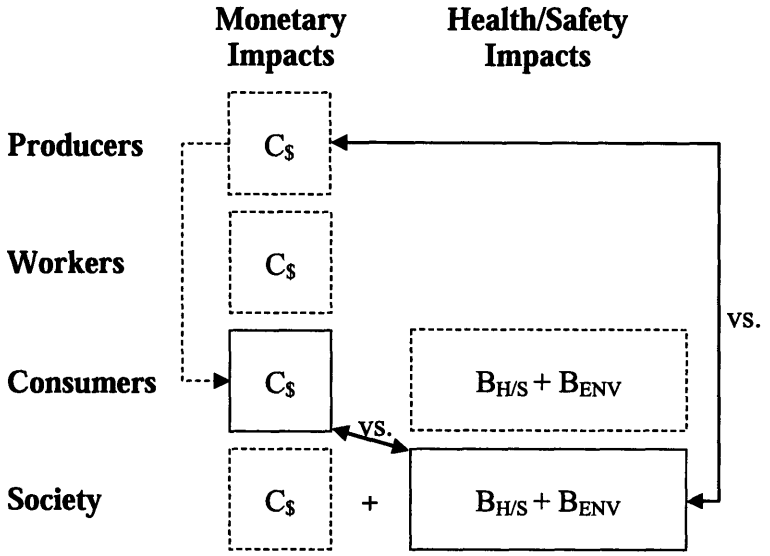
Source: Adapted from Ashford (1978, p. 165).

It is helpful to look at several simple examples to explain how decisions can be informed by a trade-off matrix. The first example explores the type of trade-offs that face the Environmental Protection Agency (EPA) when formulating air and water pollution regulations. Figure 4.5 shows how the costs of more stringent regulation are borne by all stakeholder groups (to varying degrees) and how the benefits are received primarily by customers and others (i.e., society). If the EPA were to promulgate more rigorous air quality standards aimed at electricity utilities, for instance, much of the compliance costs would likely fall upon consumers (assuming the producers pass on the costs). This example demonstrates a classic externality problem where the health risks are unknowingly and involuntarily assumed by society (Ashford 1978). Thus, a critical question is how much pollution abatement are we willing to pay for?

The trade-off matrix enables a range of solutions to be explored. If we adopt a polluter pays approach, the regulation will focus on making utilities take the necessary steps for compliance.[516] Thus, the major trade-off is between monetary costs to the producer/consumer and environmental and health benefits to society. An alternative, however, is for government to subsidize the costs of compliance, thereby passing the costs onto society. Under each regulatory scenario, a *comparative analysis* of the benefits, costs, and distributional effects over time can be undertaken using a trade-off matrix. In addition, consideration needs to be given to the likely effects of technological change, the proper treatment of uncertainty, and potential future changes to the legal environment (Ashford 1978; Driesen 2003; 2004). Each of these factors can change the

[516] In this situation, a utility might decide to buy the right to pollute, adopt a more efficient technology, or search for alternative fuels or methods for producing electricity. If the focus is placed on the *availability* and *price* of electricity, the method by which it is generated becomes less of a concern to the consumer. Therefore, adopting a polluter pays approach might raise the price of electricity (e.g., through the introduction of a carbon tax) to a point at where new ways of generating electricity that were previously too expensive become feasible. For example, households may find it is more cost-effective to buy an array of photovoltaic cells and produce their own electricity than pay the higher price for electricity generated by coal or gas. Interestingly, the term *polluter pays* can be confusing since it is the customer - not the producer - who will ultimately pay for the internalization of negative externalities. However, if an increase in the price of electricity results in a change in consumer behavior, the producer might 'pay' in the long-term if its business is disrupted by a more effective way of producing electricity.

outcomes in a trade-off matrix and therefore should not be excluded from the decision-making process.



Source: Adapted from Ashford (1978, p. 166).

Figure 4.5: EPA Air and Water Pollution Regulations

The second example asks the question of whether asbestos should be used in brake linings. This example is selected to demonstrate the equity problems that arise when a person is either not fully compensated for a loss or assumes a loss that others are able to avoid (Ashford 1981).

Suppose it was true that asbestos brake linings made the most effective type of brake that saved an estimated 2,500 drivers lives a year. Suppose it also estimated that some 2,000 workers die each year from asbestos-related diseases as a result of manufacturing or repairing these brake linings. If we look at this scenario using BCA, one might say that the outcome is acceptable since there is a net saving of 500 lives per year. However, if the same scenario is assessed using a trade-off analysis an inequality is revealed. The problem lies with the fact that the 2,000 workers that die each year are likely to come from a certain socioeconomic class (and do not represent a group really taking on that risk voluntarily), whereas drivers come from all classes (and by-and-large represent a random group). By considering what constitutes a fair outcome, a decision-maker might decide that the increase in driver fatalities that might occur from using a less effective brake lining material is justified in fairness to the workers who are assuming a disproportionate amount of risk.

If we assume that there is a less effective - though more expensive - substitute for the brake linings that does not harm the workers, the trade-off in Figure 4.6 arises. The monetary cost of using the new material is likely to fall onto the drivers (through higher vehicle prices) who might also face a small increase in fatal accident rates along with other groups such as passengers and pedestrians who are likely to face an increased risk

of being killed in or by a vehicle, respectively. In this scenario the decision-maker must decide whether the costs imposed on drivers and others are outweighed by the benefits received by the workers.

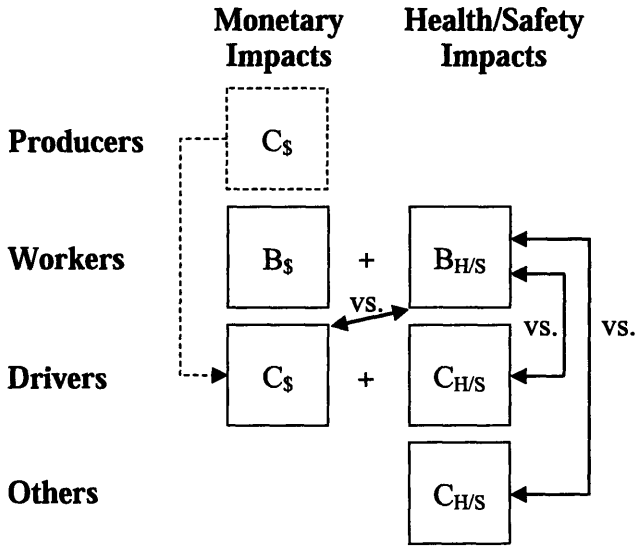


Figure 4.6: Asbestos Brake Lining Regulation

It is important to recognize that a decision to improve the health of the workers at the expense of consumers and others may be defensible on the grounds of fairness. However, what happens if it is estimated that 3,000 or 4,000 drivers, passengers, and pedestrians are likely to be killed as a result of the change to the brake linings to make it safer for 2,000 workers? What is the appropriate trade-off between economic efficiency and equity? The answer to these questions is that there is no unique solution. *The real decision is political, it is not formulaic.*[517] The fact that the answer is not unique increases the importance of making transparent decisions - which means that decision-makers become accountable for their decisions.

In a situation where the potential outcomes require a compromise in economic efficiency or equity, trade-off analysis enables the decision-maker to explore more effective policy alternatives. For example, reducing speed limits and/or improving the layout of accident hotspots are ways to reduce the severity of accidents. Similarly, reducing the speed limit in all school zones and/or deploying smart cars that detect pedestrians (or objects) in the road are two potential ways that pedestrian accidents can be reduced. In this regard, trade-off analysis resists simplistic thinking and allows decision-makers to deal with those difficult questions involving [1] economic efficiency/equity trade-offs and [2]

[517] Nobel Prize-winning economist Kenneth Arrow (1963) was the first to highlight an inherent problem with democratic decision-making - i.e., democratic voting may not lead to a clear solution and the will of the majority might contradict itself. In situations where the collective will does not reveal a clear solution - i.e., *Arrow's paradox* prevails - the stalemate is likely to be resolved by political persuasion or coalition building. Thus, the solution to public policy problems characterized by Arrow's paradox is political rather than formulaic.

alternatives analysis. In effect, uncertainties and distributive inequalities are accepted as part of the normal (real world) decision-making process. A critical point is that trade-off analysis holds the potential for environmental, social, and economic factors to be considered on a more equal footing and provides an environment where alternatives can be considered that do not raise Hobson's choices.

The history of trade-off analysis can be traced back to the 1970s when Ashford (1978) and Söderbaum (1973) independently offered trade-off analysis - what Söderbaum calls *positional analysis* (PA) - as an alternative to BCA. While there are important similarities between the two approaches, the way in which the trade-off matrix is used in each approach is different. Whereas Ashford (1978) views the trade-off matrix from the perspective of the decision-maker, Söderbaum (2000) considers the trade-off matrix from a number of different ideological orientations. "*The purpose of PA is one of illuminating an issue in a many-sided way with respect to:*

- *options or alternatives of choice;*
- *impacts;*
- *interests affected, conflicts between interests included; and*
- *possible ideological orientations that can be useful for valuation and decision-making*" (ibid, p. 87).

Söderbaum (2000; 2001; 2003) argues that BCA makes the unrealistic assumption that all politicians and citizens adopt the market ideology built into the analysis framework. He suggests PA is a more democratic process that incorporates the ideological orientation of politicians and citizens. Therefore, instead of identifying the economically efficient outcome, PA is a many-sided analysis that aims to articulate the options or alternatives of choice; the impacts associated with these; the interests/stakeholders that are affected and whether there are conflicts between these interests/stakeholders;[518] and whether the ideological orientations (e.g., neo-liberal market, ecological economic, technologist, deep ecology, religious, etc.) can provide a new lens for valuation and decision-making (Söderbaum 2000, p. 87). The basic idea of PA is to reach 'conditional conclusions,' "*that is conclusions that are conditional in relation to each ideological orientation articulated and considered. The idea is to facilitate learning processes and decision-making and not to dictate the 'correct' way of arriving at the best and optimal decision*" (ibid, p. 66).

The phrase 'positional analysis' can be confusing and requires some clarification. PA can be described as a *systems analysis*. The word 'positional' is borrowed from cybernetics where reference is made to the 'position' of a biological unit or system. Therefore, PA refers to an analysis of the position or state of a system at different time intervals. If we consider a system as a combination of stocks and flows, the *stocks* of a system (e.g., environmental quality, health, happiness, wealth, etc.) describe its position or state and the *flows* (e.g., emissions, reproduction rates, etc.) are the driving forces or pressures that

[518] Whereas trade-off analysis (in its original formulation) focuses on stakeholder groups, PA also considers interests since the heterogeneity within stakeholder groups means that one group might hold a variety of different interests. However, later research by Ashford and Rest (2001) does recognize different interests in the residents of contaminated communities.

change the position or state between time periods.[519] Söderbaum (2000, p. 103) describes the assessment of the position or state of a system as "*a disaggregated analysis where monetary and non-monetary impacts are kept separate and where the distinction between flows and positions is observed.*"[520] Hence, Söderbaum's disaggregated analysis is very similar to trade-off analysis.[521]

PA is described in terms of paths and movements from one state or position to another using a decision-tree. Figure 4.7 provides a representation of a decision tree in positional terms, where '$P_{ti}n$' represents the position or state at different time intervals (t_i) and 'An' identifies a particular 'alternative' or pathway (guided by regulation or policies) from one position to the next. Whereas a traditional decision-tree analysis assigns monetary values to each position (P_0, P_1a, P_1b, P_2ac, P_2ad, P_2be and P_2bf) and a probability to each pathway (Aa, Ab, Aac, Aad, Abe, and Abf), in PA the positions are mostly *non-monetary* and the pathways are associated with choices rather than probabilities. Söderbaum (2000, p. 90) argues that "*if we are interested in the 'welfare' or the 'wealth' of individuals and nations, it would be an excellent idea to focus (mainly) on non-monetary states or positions over time.*"

The value of using a decision-tree to track policy alternatives is that 'path dependency' or 'lock-in' become an explicit part of the analysis. If a decision is made to select alternative *Aa*, for instance, the future states *P_2be* and *P_2bf* are no longer feasible (Figure 4.7). This implies that past actions/decisions might constrain future actions/decisions, especially when natural capital is used in an irreversible way - e.g., a highway is built across arable land that could be used for crop production (Söderbaum 2000).[522] In addition, once a development pathway or policy initiative has been selected, the rationality of decision-makers can be *bounded* by the knowledge, procedures, and habits that are associated with the chosen path of action.[523] This increases the importance of considering future policy initiatives (in the trade-off matrix) in a 'many-sided' and open way.

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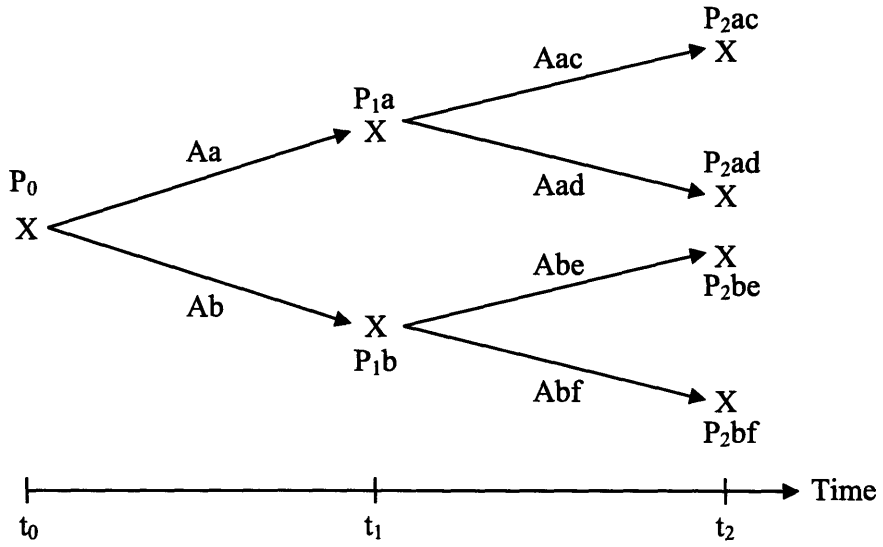
[519] See Section 5.6 for a discussion of the OECD's Pressure-State-Response (PSR) model that is used to assess the position or state of a system.

[520] More recently, Söderbaum (2005) reiterated the importance of keeping monetary and non-monetary impacts separate in the analysis of policy alternatives. "*Positional Analysis is built on the premise that **monetary and non-monetary impacts should be kept separate throughout the analysis**. Just as monetary flows (referring to periods of time) and stocks – or positions – (referring to points in time) are important, the same holds for no-monetary flows and positions. Non-monetary dimensions furthermore differ among themselves and from monetary dimensions. Pollution as a non-monetary flow may accumulate (in positional terms) and different kinds of inertia and irreversibility become issues to be considered rather than assumed away*" (Söderbaum 2005, p. 14, emphasis added).

[521] While it might be tempting to categorize trade-off and positional analysis as Multi-Criteria Approaches (MCAs), a problem with using the word 'multi-criteria' is that it engenders an approach in which differences among stakeholders are not explicitly considered. Thus, the effects of a policy are considered using a number of (economic, social, and environmental) criteria, but the impacts of changes in these criteria on different stakeholders are not made explicit.

[522] See Section 6.2.4.2 for a related discussion on 'quasi-option value' of human and manufactured capital.

[523] See Section 4.2.3.3 for a related discussion on *static* versus *dynamic* efficiency.



Source: Söderbaum (2000, p. 94).

Figure 4.7: Decision Tree in Positional Terms

A final point worth mentioning is the type of indicators that Söderbaum (2000) uses in the trade-off matrix. Ideally, these indicators should capture changes in the state of the system as well as the intensity of the flows (or pressures) that change the system's state between time periods. If achieving sustainable development is the ultimate objective of decision-making, then these indicators need to set parameters that can guide future development away from unsustainable activities.[524]

4.2.1.5 A Hybrid Trade-off/Positional Analysis Framework

While trade-off and positional analysis both use a 'trade-off matrix' to analyze policy alternatives, the two approaches are not identical in a procedural sense. To help clarify how a trade-off matrix can be used to assess policy alternatives, this section combines important elements from Ashford's (1978; 2004b) and Söderbaum's (2000) approaches to create a hybrid framework (or series of steps) that one can follow when using a trade-off matrix. This hybrid framework focuses on how a trade-off matrix can be used to support decision-making for sustainable development.

The six steps of the hybrid trade-off/positional analysis framework are as follows:

1. Describe the problem in an institutional context. Identify stakeholder groups and their associated roles.

[524] In addition to this core (or fixed) set of indicators, it would be useful to include a set of *adaptive* indicators that are developed by stakeholders - and are subject to change over time - which measure issues of particular importance to the affected parties.

2. Identify the problem. Describe the societal or technical problem in need of attention (e.g., unmet needs or technical/institutional failure). How is the problem perceived by the different stakeholders? Describe any prior attempts to resolve/improve the problem, and discuss their inadequacy/failures in terms of:[525]
   - *economics and markets*
     — inadequate and/or perverse incentives, prices, markets, institutional/organizational structure and behavior, free-rider problems, and unrecognized/unmet needs and demands
   - *legislation and political process*
     — inadequacy of existing legislation/regulations, lack of knowledge/enforcement thereof, and inadequate stakeholder involvement
   - *public/private sector management*
     — lack of adequate incentives or perverse incentives for, or commitment to, management of the problem
   - *technical system capabilities*

3. Represent the initial problem (P_0) using a trade-off matrix. Identify the extent to which the problem affects each stakeholder group and highlight any inequalities.

4. Make a creative effort to formulate several policy alternatives (A_n) to address the problem, paying special attention to distributional inequalities. The policy alternatives should be developed in consultation with the stakeholder groups[526] and should be formulated using the Rawlsian/utilitarian decision-making philosophy[527] developed in Section 2.2.2. The policy alternatives should consider improving:
   - *economics and markets*
     — changes in prices, markets, and industry structure
     — changes in demand

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[525] These four categories should be considered as *lenses* for assessing the problem. Each lens focuses on a particular system - i.e., economics and markets, legislation and the political process, public/private sector management, and the technical system - and assesses whether [1] the system is broken and [2] if so, what needs to be changed to fix the problem. It is important to *deliberately* consider these lenses when formulating the problem to ensure that policy alternatives (developed in Step 4) are not constrained by *path dependency* or *bounded rationality*. Adopting an approach to decision-making that seeks to uncover issues - rather than ignoring an issue/lens that does not fall under one's area of responsibility - is essential if society is to make progress towards sustainable development. In this regard, *sins of omission* are just as important as *sins of commission* that occur when a policy alternative is influenced/captured by special interests. Also, a *lens* should not be confused with *value conflicts* or *ideological orientations* (discussed in Step 6).

[526] An alternative step here is to use a *participatory backcasting approach* (see Section 4.2.6) to identify a future position that represents a *solution* to the current problem and work backwards from this position to identify a series of policies/choices to realize this future. Under this approach, there is only one final position or state, which means that it may not be appropriate to use a decision-tree to represent the various policy alternatives or choices. Adopting a participatory backcasting approach is recommended if a decision-maker/agency/community is confident of the future position or state that is to be achieved. However, if the desired future is unclear, a portfolio approach may be better since a variety of alternative futures can be investigated.

[527] By developing the policy alternatives using the Rawlsian/utilitarian decision-making philosophy, it is recognized that an ideological view/perspective is being applied to the solution space. However, since the overall objective is to move society towards sustainable development, constraining or guiding policy alternatives in this manner is seen as a necessary step.

- *legislation and the political process*
  — changes in law and political process (legislation, regulation, negotiation, and stakeholder participation)
- *public/private sector management*
  — system changes related to organizational/institutional structure
  — changes in public and private sector activity
- *the technical system*
  — technological/scientific changes (options for R&D, innovation, and diffusion)

5. Use the trade-off matrix to qualitatively and quantitatively assess (in a *comparative* manner) the likely outcomes ($P_{ti}n$) from each policy alternative (A_n). Evaluate the likelihood that a policy alternative (A_n) will solve the problem under different future scenarios.[528] Particular attention should be paid to whether distributional inequalities are adequately addressed. It is also important to consider each indicator in the aggregate to determine how the system is changing over time. Identify the impact each policy alternative (A_n) is likely to have on important systems connected to the system under analysis. Determine whether the policy alternative is sufficient to encourage a system transformation to sustainable development.

6. Inform the decision-maker(s) of different values and/or ideological orientations (e.g., ideas of development and progress) that are relevant to the situation under analysis and identify how these might create barriers to the implementation of a specific policy alternative. In general, 'value conflicts' may be characterized as "*(a) conflicts arising from differences in legitimate interests of different actors/institutions; (b) conflicts in moral and legal duties of each actor/institution; and (c) conflicts among actors/institutions arising from different perceptions of what is right or wrong, fair or unfair*" (Ashford 1994, p. 1427). Identify strategies to address value conflicts, recognizing that political coalition-building is likely to play an important role in shaping the final policy.

This hybrid trade-off/positional analysis framework is generic and can be applied to any situation where a policy can affect equity within - or the state of - the system under analysis. The framework is *neutral* in that it does not specify a final decision. To guide decisions towards sustainable development the Rawlsian/utilitarian decision-making philosophy is used to create policy options/alternatives. While this approach requires the adoption of one ideological perspective for policy formulation, the final step in the trade-off/positional analysis framework requires the policies to be considered from different values and/or ideological orientations. Therefore, any important value conflicts can be identified and addressed.

[528] Since the future is uncertain, creating several scenarios against which a policy alternative can be assessed is likely to provide an indication of the *robustness* of the policy alternative.

4.2.1.6 Using a Trade-off Matrix for Technology Assessment to Encourage Dynamic System Transformations

In addition to evaluating the multivariate impacts of different *policy alternatives*, a trade-off matrix can also be used to assess the impacts of different *technology options* (Ashford 2000; Ashford et al. 1980). The strength of combining both in a trade-off matrix is that it can be used to compare multivariate criteria - such as economic, social, and environmental and health/safety factors - to determine how new technology options compare with each other and with the 'business as usual' scenario. Further, the impacts of each technology option on different stakeholders are made explicit. The comparative analysis of different technology options in a trade-off matrix constitutes what is known as Technology Options Analysis (TOA) (Ashford 2000; O'Brien 2000).

The idea of TOA was first applied to the chemical industry to facilitate the consideration of technology options that could make production processes inherently safer to workers and the surrounding community. Either new technologies could be added to existing systems to *mitigate* risks, or a production process could be designed to remove the risk altogether (a process known as *primary prevention*). The purpose of a TOA is to inform the firm, regulating Agency, and stakeholders of the full range of technological options that can be used to address a problem or achieve a desired objective.

The benefit of using TOA is that analyzing comparable factors between the technology options is easier than using techniques such as BCA that usually require monetary quantification, the aggregation of variables, and discounting to present value. Keeping the variables in their natural units within a trade-off matrix avoids unnecessary assumptions about how to translate environmental or health and safety impacts, for instance, into a dollar value. The result is a more believable, disaggregated analysis of options where the impacts of technologies are made explicit and win-win solutions can be more easily identified.

TOA can be used in both a *static* and a *dynamic* sense. When used in a *static* sense, TOA simply compares available technology to decide which option should be selected. This is the approach adopted by neo-classical environmental economics (as currently practiced), which searches for optimal outcomes using static efficiency.[529] A failure by environmental economists to take technological change into account means that their analysis is likely to overestimate the cost of compliance with new, more stringent, environmental regulation. Setting regulation based upon existing technology or what is deemed feasible from a static efficiency perspective is not likely to establish an environment for system transformations towards sustainable development.

When used in a *dynamic* sense, TOA is able to compare *available* technology with technology that *could* be developed. Using the trade-off matrix in this manner leads to a form of dynamic environmental economics that includes the consideration of technological change over time (Ashford 2001; Driesen 2003; 2004).

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[529] Supra note 523.

Achieving dynamic efficiency requires the analyst/decision-maker to focus on the transformation *process*, paying special attention to *path dependency* and *bounded rationality* of institutions and stakeholders.[530] Given that changing a socio-technical (or large-scale engineering) system is likely to require a long timeframe, the role of government in setting technology and (stringent) environmental policy to guide innovation is of particular importance (see Section 4.2.3). Adopting an approach that *guides* technological change means that decision-makers are not relying on serendipitous technological development. Instead, they are pursuing an approach where the development of technology is more likely to progress along a desired pathway. Therefore, it is the dynamic use of TOA that is likely to lead to system transformations towards sustainable development.

4.2.1.7 Conclusion

The focus of environmental and resource economics is how to address negative environmental externalities and manage the intergenerational allocation of natural resources. In its current form, neo-classical environmental economics uses techniques that monetize the likely health, environmental, and economic impacts of government policy so that the aggregated benefits and costs (summed across actors and timeframes) can be expressed in a BCA framework. While BCA does enable economically rational decisions to be made, since it is unable to consider distributional equity it is not likely to move society towards sustainable development in a purposeful manner. Indeed, one might argue that the justification of major public works using BCA has led to environmental injustices and unsustainable development.

In this section, trade-off and positional analysis were introduced as more democratic and accountable approaches to decision-making than BCA. A central component of each framework is the trade-off matrix, which is seen to have several important attributes. First, it allows decision-makers not to monetize. Second, it allows decision-makers not to aggregate over time. Third, it invites the entrance of stakeholders into the debate since there is greater transparency as to who benefits and who is harmed by a particular decision. Fourth, it enables analysts to undertake a comparative analysis of policy alternatives over time. Finally, it takes into account the important role of technological change in shaping the state or position of a system.

Since the procedure for using a trade-off matrix is somewhat different for trade-off and positional analysis, a hybrid framework (or set of steps) for using a trade-off matrix to compare policy alternatives has been developed.

The decision to use BCA or trade-off/positional analysis is likely to depend upon one's values and beliefs. While BCA provides a structured framework for decision-making, it

[530] The trade-off matrix enables decision-makers to ask the question of what could be done to improve the prevailing situation. Since the trade-off matrix for each technology option (existing and undeveloped) presents information in a disaggregated form, the potential political implications of setting more stringent regulation or investing in a certain type of technology become apparent. Once these factors are identified, steps can be taken to address the problems of path dependency and bounded rationality.

does so by considering only *one* perspective/ideology - i.e., that of neo-classical economics. In contrast, trade-off/positional analysis is able to consider a wide range of perspectives/ideologies, but this flexibility comes at the expense of being able to provide a single solution to a problem. Hence, trade-off/positional analysis is a *decision-support* (rather than decision-making) tool. Further, while trade-off/positional analysis disaggregates costs and benefits, at some point the decision-maker must *implicitly* co-measure factors in order to make a decision. What the trade-off matrix does is make the value system behind this co-measurability explicit. For example, if a decision-maker values human health above the costs of adopting a pollution abatement technology, then this fact is captured by the trade-off matrix and is visible to the public. Indeed, a decision-maker might want to make this fact known for political reasons. While the knowledge that one's value system is visible might make some elected officials uncomfortable with the trade-off matrix, one can argue that such an outcome is an essential component of a healthy democratic society.

In conclusion, the trade-off/positional analysis framework provides a neutral decision-support tool that when combined with the Rawlsian/utilitarian decision-making philosophy guides decisions toward sustainable development.

4.2.2 Ecological Economics

> "*Environmental and resource economics, as it is currently practiced, covers only the application of neo-classical economics to environmental and resource problems. Ecology, as it is currently practiced, sometimes deals with human impacts on ecosystems, but the more common tendency is to stick to 'natural' systems.* ***Ecological Economics*** *aims to extend these modest areas of overlap. It will include neo-classical environmental economics and ecological impact studies as subsets, but will also encourage new ways of thinking about the linkages between ecological and economic systems*" (Costanza 1989, p. 1).

This quote, from the first edition of the journal *Ecological Economics*, provides a good indication of the objectives of ecological economics. Costanza (1991, p. 3) later extended this definition, describing ecological economics as a "***transdisciplinary*** *field of study that addresses the relationships between ecosystems and economic systems in the broadest sense.*" The 'transdisciplinary' focus is important since it "*goes beyond ... normal conceptions of scientific disciplines and tries to integrate and synthesize many different disciplinary perspectives. One way it does this is by focusing more directly on the problems, rather than the particular intellectual tools and models used to solve them, and by ignoring arbitrary intellectual turf boundaries*" (ibid, p. 3).

It is likely that ecological economics will become an important organizing framework for sustainable development in the twenty-first century. Indeed, ecological economics is often referred to as "*Economics for Sustainable Development*" or "*Sustainability*

Economics" (Söderbaum 2005, p. 1).[531] Ecological economics does not present a new analytical framework. Instead, it establishes goals (limits) from an ecological perspective and argues that economic activity must operate within these limits. Given the complexity and scale of modern industrial systems and the fact that externalities from systems affect the global environment, the microeconomic focus of environmental economics will not be sufficient to address the most pressing global problems of our time. This section looks at the ideas behind the emerging transdisciplinary field of ecological economics.

As with environmental economics, the field of ecological economics began during the 1960s with the formation of national environmental movements. While environmental economics is an extension of neo-classical economic theories, ecological economics began by rejecting the neo-classical traditions. It challenged the very foundations of neo-classical theories, arguing that the entire economic system was itself embedded in a wider environmental system that must be incorporated into any economic analysis (Costanza 1991; Costanza et al. 1997; Daly and Farley 2004; Edward-Jones et al. 2000; Faber et al. 1996; Krishnan et al. 1995; Lawn 2000; Söderbaum 2000).

In 1966, Kenneth Boulding published one of the first articles to call into question the prevailing model of economic growth. In a short paper, *The Economics of the Coming Spaceship Earth*, Boulding (1966) criticized what he called the 'cowboy' economy of the past, which viewed frontiers as limitless, had no regard for resource scarcity, and was unconcerned with pollution and wastes.[532] In such a cowboy economy, production and consumption are seen to enhance welfare and are openly encouraged. Yet, Boulding (1966) argued that if the earth is conceived as a closed system - a spaceship - the manner in which production and consumption is viewed is reversed.

> "[I]*n a spaceman economy, throughput* [of energy and matter] *is by no means a desideratum, and is indeed to be regarded as something to be minimized rather than maximized. The essential measure of the success of the economy is not production and consumption at all but the nature, extent, quality and complexity of the total capital stock, including in this the state of the human bodies and minds included in the system. In the spaceman economy, what we are primarily concerned with is stock maintenance, and any technological change that results in the maintenance of a given total stock with a lessened throughput (that is, less*

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[531] Söderbaum (2005, p. 2) argues that "[e]*cological economics is not a clear-cut paradigm comparable to neoclassical economics. It is rather an interdisciplinary theme with many sources of inspiration in terms of paradigms and ideological orientations.*" Interestingly, Söderbaum (2005) argues that the transdisciplinary focus of the *Journal of Ecological Economics* (quoted above) is 'reasonable,' but does not go far enough. His main concern is that it encourages 'synthesis,' which tends to lead to a 'one-paradigm-idea' rather than accepting that a "*reference to pluralism is needed*" (ibid, p. 6). Thus, Söderbaum (2005, p. 6) suggests a better approach would be to address a problem using "*different theoretical perspectives or more than one 'synthesis'.*" Söderbaum's views are closely related to his idea of 'conditional conclusions' that is discussed in Section 4.2.1.4.

[532] To provide a frame of reference, frontier (or cowboy) economics is the polar opposite of the field of deep ecology (Colby, 1991). The former adopts an almost purely anthropocentric view of the world, where resources are free and unlimited and there is no concern for environmental pollution and wastes. In contrast, deep ecology adopts a biocentric view of the world, where resources are limited, there is equality amongst all species, and pollution and wastes can be dealt with through simple symbiosis.

production and consumption) is clearly a gain. The idea that production and consumption are both bad things rather than good things is very strange to economists, who have been obsessed with the income-flow concepts to the exclusion, almost, of capital-stock concepts" (Boulding 1966, pp. 9-10).

In contrast to Pigou's microeconomic view of environmental externalities, Boulding's paper articulated a macroeconomic problem where the environmental costs of continual economic growth are externalized upon societies throughout the world. Thus, addressing externalities on this scale would require the establishment of an economic culture that is willing to internalize the costs of these problems on a massive *public* scale (Kysar 2001).

In the years following Boulding's paper, two prominent economists, Nicholas Georgescu-Roegen (1971) and Herman Daly (1991a; 1991b), used the laws of thermodynamics and ecological principles to reveal the biophysical limits to economic growth. Both were heavily critical of neo-classical economics, which they argued had overlooked the limited supply of low-entropy matter-energy (in the form of natural resources) that is the life blood of the economy. Neo-classical economics views *technological innovation* and *reproducible human-made capital* as providing 'substitutes' for natural capital (Hartwick 1977; 1978a; 1978b; Solow 1974). Under these assumptions of *weak sustainability*,[533] consumption can be sustained, environmental externalities can be overcome, and resource scarcity problems can be solved. Neo-classical economists argue that as prices increase due to scarcity, investment in technological innovation creates substitutes to replace the scarce resources. This belief in human ingenuity means that economists need only focus on what they do best - the valuation and efficient allocation of resources in society - since technology and human-made capital will solve even the most pressing environmental problems (see Section 2.4 and 2.4.1).

The idea that technological innovation would free society from concerns of resource scarcity, enabling economies to become less reliant on natural resources, was soon rejected. Ayres (1978) presented a convincing case that the laws of thermodynamics place limits on the ability of human-made resources to replace, or substitute, natural capital. The basic argument is that human-made capital is built and maintained using natural capital. Thus, both forms of capital are complementary and cannot be substituted for one another. It follows that the maintenance of natural capital stock is, therefore, *essential* for the economic process. The same argument is also made by Georgescu-Roegen (1993).

In addition to questioning the science behind the idea of 'substitution,' ecological economics also questions the neo-classical approach to markets. While markets are efficient at allocating scarce resources, they have no mechanism to ensure that the use of resources stays within ecologically sustainable limits, or that the distribution of income and wealth is fair or just (Lawn 2000). Garrett Hardin's (1968) essay, *The Tragedy of the*

[533] We recall that *weak sustainability* refers to the condition where the 'total capital stock' (i.e., natural capital plus human-made capital) is maintained between generations (Edward-Jones et al. 2000; Jabreen 2004; Munda 1997; Pearce 1992; Perrings 1996). In contrast, *strong sustainability* refers to the condition where 'natural capital' is either maintained or increased between generations.

Commons, provides an excellent description of the first of these concerns. Hardin used the problem of public commons, or common pool resources, to explain how the actions of a group of economically rational individuals could lead to the overuse and degradation of the commons. His theory explains many contemporary problems with public commons, such as over-fishing, air and water pollution, and overpopulation. Today, climate change is probably the most well known and pressing example of what we might call a global commons problem.

To address the problem of the commons, Hardin (1968, p. 1247) recommends "*mutual coercion* [or government regulation], *mutually agreed upon by the majority of the people affected.*" In essence, Hardin's view is that a desirable social contract is one in which we agree to certain constraints of our freedoms in exchange for improved social welfare stemming from a protected environment. "*Individuals locked into the logic of the commons are free only to bring on universal ruin; once they see the necessity of mutual coercion, they become free to pursue other goals*" (ibid, p. 1248).

Hardin's 'Tragedy of the Commons' played an influential role in the formation of ecological economics. It showed that the economic system does not exist in a vacuum and the failure of economists to look beyond their disciplinary boundaries could severely impact the health of ecological systems and societal welfare on a global scale. Around the time Hardin published his essay, the Club of Rome released its controversial report, *Limits to Growth*, which articulated in no uncertain terms the potential problems associated with rapid economic growth.[534]

The environmental problems identified by Boulding, Georgescu-Roegen, Daly, and Hardin are essentially all connected to the growing scale of the economy. Up until the middle of the twentieth century, only man-made stocks were considered to be capital since natural capital was abundant throughout the world. The scale of human activities was simply too small relative to natural processes to interfere with the free provision of natural goods and services. However, it is now becoming increasingly clear that we are entering an era in which natural capital is the limiting factor (Costanza 1994; Costanza et al. 1997). Human economic activities can significantly reduce the capacity of natural capital to yield the flow of ecosystem goods and services upon which the very productivity of human-made capital depends (Ayres 1978). Figure 4.8 provides a visual representation of how the growing circular and closed economy is in fact open, and is embedded within the larger global ecosystem. In this new model of the economy, natural resources (energy and matter) flow from the ecosystem into the economy, and pollution and wastes (transformed energy and matter) flow from the economy back into the ecosystem. Under this new mindset, we move from "*polluter pays to 'pollution prevention pays', explicitly restructuring the economy according to ecological principles to reduce the 'throughput' to sustainable levels*" (Colby 1991, p. 205). This alternative model to the neo-classical growth economy is most commonly referred to as the steady-state economy (SSE) (1991a; Daly 1991b).

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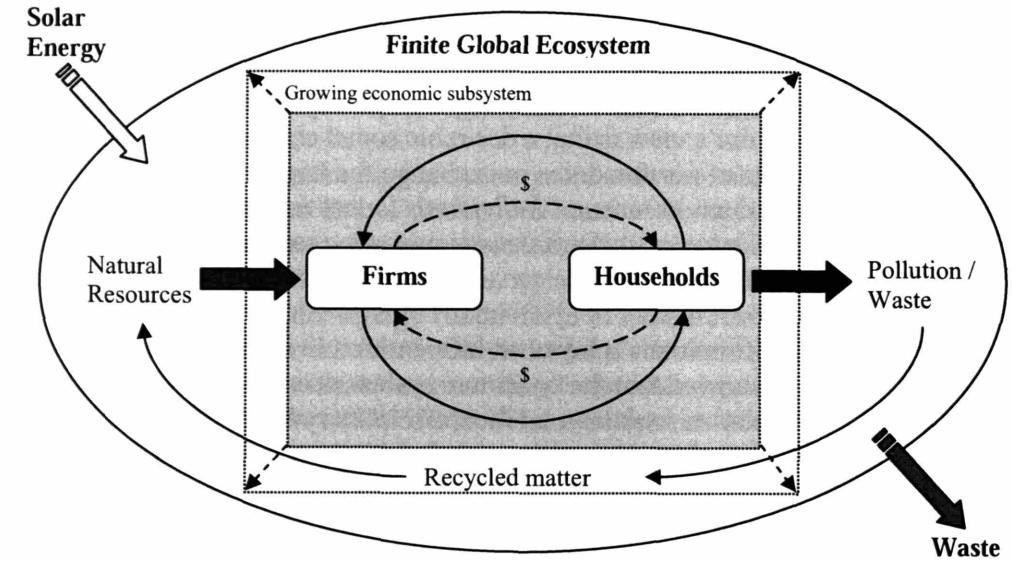
[534] For a detailed discussion of *Limits to Growth*, including the arguments from its detractors, see Section 3.3.2.

During the 1970s, the notion of ecologically sound economic development - *eco-development* (Dasmann 2002; Glaeser 1984; Riddell 1981; Sachs 1976; 1984a; 1984b) - was seen as presenting a new development trajectory, one which integrated social, ecological, and economic objectives.[535] To a large extent, ecological economics is the child of the eco-development movement.



Source: Adapted from Goodland et al. (1992).

Figure 4.8: The Economic Subsystem

In much the same way that Hardin (1968) saw mutual coercion as the major solution to problems with the commons, Colby (1991, p. 206) argues that from the eco-development perspective, the most important attitude that modern society needs to change is "*the notion that people have the right to do whatever they have done in the past (business as usual).*" Colby (1991), Sagasti and Colby (1995), and Rees (1995b) recommend the gradual 'ecologizing' of tax codes, whereby taxes are increased on resource extraction and pollution activities, and decreased on activities that support eco-development objectives.[536] It is argued that such action can be a more flexible and socially equitable way of attaining sustainability than the use of tradable emission/pollution rights.

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[535] As discussed in Chapter 3 (Sections 3.3.3.3 and 3.3.4), the concept of eco-development was the precursor to sustainable development. Its objective was to achieve sustainability at the local or regional scale by responding to the potentials of the area involved, using available natural resources in a rational/ecologically sound manner, and working with indigenous technology styles (UNEP, 1975). An important idea central to eco-development was *self-reliance* (Sachs 1976; 1984b), which ran counter to the forces of rapid technological change and globalization that ultimately redefined eco-development as sustainable development during the 1980s. Today, many argue that economic globalization is producing the exact opposite results to those promised (IFG 2002; Mander and Goldsmith 2000). As an alternative, these opponents to trade liberalization call for a return to forms of development that revitalize democracy, basic human rights, local self-sufficiency, and ecological sustainability - arguably the core principles of eco-development.

[536] In his farewell speech to the World Bank, Daly (1994a) made a convincing argument to reduce taxes on labor and income and increase taxes on either resource extraction/depletion or pollution - also see Daly

In addition, Colby (1991) suggests that if eco-development is to gain wide acceptance, ecological economics must re-integrate three types of concerns that have been treated separately in economics for the past two centuries - i.e., allocation, distribution, and scale (Figure 4.9).[537]

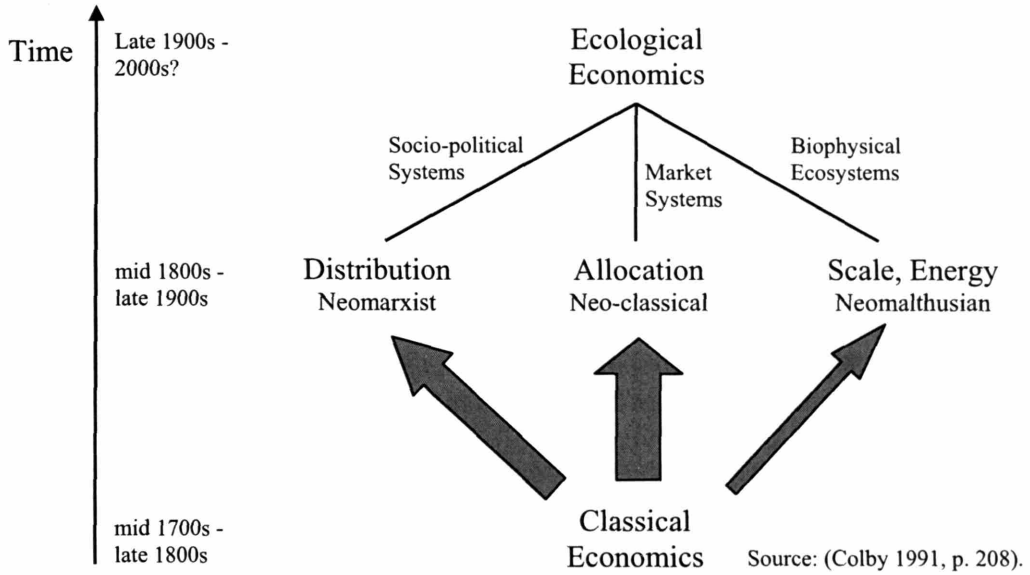

Figure 4.9: Evolution of Economics Paradigms

Formulating ecological economics using the most useful analysis techniques from each area of economic study provides ecological economists with the tools necessary to transcend existing economic techniques and address problems in a more comprehensive (transdisciplinary) manner. However, there are some who question whether ecological economics will be able to provide anything beyond what can already be achieved through the use of neo-classical environmental economics (Turner 1999). Van den Bergh (1999b, p. 18) argues that "*many 'ecological economists' (ecologists, economists and others) may realize that 'neoclassical' economics is the only approach that has been able to come up*

(2002). The objective of these measures was to remove the financial and environmental subsidies that encourage firms to substitute labor with capital and resource throughput. "*Shifting the tax base to throughput induces greater throughput efficiency, and internalizes, in a gross, blunt manner the externalities from depletion and pollution*" (Daly, 1994a). By 'environmental subsidies,' Daly means the low price of products/services that do not internalize (in a Pigouvian sense) the external social costs they generate.

[537] Daly (1992) and Costanza et al. (1997) provide a succinct discussion of these three concerns. *Allocation* refers to the efficient allocation of resources among alternative product uses through prices determined by supply and demand in competitive markets. *Distribution* refers to the division of resources (embodied in goods and services) among people using transfers - i.e., taxes and welfare payments. *Scale* refers to the physical volume of resource throughput and, since it has not been formally recognized by economics, it has no corresponding policy instrument. However, tradable emission permits do provide a proxy for the type of instrument needed to integrate all three concerns. Yet, the problem with this instrument is that it has been considered as the "*individualistic 'free market' solution, without emphasizing that this market is free only after having been firmly and collectively fixed within scale and distributive limits*" (Daly 1992, p. 189).

with an impressive and coherent structure of rigorous, clearly founded and subtle insights, in particular related to environmental policy analysis and economic valuation of environmental change." The problem with such a position is that it is based on being able to define and quantify a future sustainable state, rather than viewing sustainable development as a process, able to undergo continuous change and be receptive to feedback. After 12 years as the founding editor of *Ecological Economics*, Robert Constanza stepped down with the following remarks that echo those he made at the start of his career in the field of ecological economics.

> "***Ecological Economics** is a **transdiscipline**. It is also a **metaparadigm**. Rather than espousing and defending a single discipline or paradigm, it seeks to allow a broad, pluralistic range of viewpoints and models to be represented, compared, and hopefully synthesized into a richer understanding of the inherently complex systems it deals with. ... There have been continuing calls to make Ecological Economics into a single paradigm or a new discipline in the mold of the older, more established disciplines. But this would ultimately be self-defeating, since a primary reason for founding Ecological Economics in the first place was to avoid the traps that the established disciplines had fallen into*" (Costanza 2002, p. 351).

Finally, the proponents of ecological economics not only argue that the form and scale of economic growth is degrading natural capital, but it also has the potential to negatively affect human capital (i.e., employment). For example, Daly's (1994a) notion of taxing the *bads* (such as resource extraction/depletion or pollution) and not the *goods* (such as labor and income) provides a good example of where both the environment and employment are considered in one macroeconomic framework. Bringing considerations of employment into the analysis is a markedly different approach to decision-making than that offered by neo-classical environmental economics, which treats employment as a separate issue.

An alternative decision-making framework to environmental economics and benefit-cost analysis, which permits the consideration of employment, the environment, and the economy, is trade-off/positional analysis. Therefore, combining the principles of ecological economics with trade-off/positional analysis begins to form - what might be called - a decision-support framework for sustainable development.

In summary, where environmental economics sees the major system failure as the inability to price or assign property rights, ecological economics sees the problem as the inability of the economy to operate within biophysical limits. The fundamental question is whether the rules of commerce will be dictated by markets, or alternatively, nature. In essence, ecological economics is attempting to change the rules of what can be traded and by whom.

4.2.3 Technology as a Driver: The Role of Government in Stimulating Technological Innovation

4.2.3.1 Implicit Assumptions about Technological Innovation in Neo-Classical Environmental and Ecological Economics

The previous sections on environmental and ecological economics implicitly adopt or assume contrasting views on the ability of technology to overcome social and environmental problems stemming from economic (or human) activity. Whereas neo-classical economics leans towards technological optimism, ecological economics is more pessimistic about the ability of new technology to address negative externalities (or spillovers) without extensive government intervention.

In neo-classical economics, technology is treated as an exogenous factor in the economy (Huber 2004b) and the price of resources is determined using static, rather than dynamic, efficiency. As resources become scarce, prices will rise until they reach a level (an *upper limit*) that will enable a substitute to enter the market.[538] If technological innovation (either in the realm of resource extraction technology or product/material development) is not able to provide a substitute - and the incumbent resource is essential - then the resource is likely to be used until an ecological limit is reached, after which the environment will be irreparably damaged. This point highlights the major difference between neo-classical and ecological economics. Neo-classical economics is not directly concerned about ecological limits per se, whereas identifying these limits and living within them is a primary focus of ecological economics.

Like neo-classical economics, ecological economics does not explicitly address the process of technological (or system) innovation. It assumes that if it is possible to set ecological limits, then technology and large-scale engineering systems will somehow adjust (using pricing or other economic or legal instruments) to operate within these limits. Capping global CO_2 emissions and establishing a mechanism to trade emission rights is one approach that ecological economists might use to address the problem of global warming. However, there is evidence to suggest that emission trading schemes do not encourage technological innovation, but rather the diffusion of existing technology (Ashford and Caldart 2004; Driesen 2004; Kemp 2000). If a factor 10 or more improvement in efficiency is what is required to transition towards sustainable development, then simply diffusing existing technology is not likely to be sufficient (see Section 2.4.1).

A tenuous argument - based upon the notion of a Faustian Pact - against the idea of living within ecological limits is that given the societal benefit received from a particular engineering system (such as the transportation system), societies around the world might be willing to tolerate a certain amount of environmental degradation (e.g., global climate change) to continue receiving an important service (such as mobility). One way to avoid the debate over whether we should or should not stress ecological limits is to ask the question of how much we can make technology into a driver for sustainable development.

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[538] This idea follows Solow's (1993) notion of resource *fungibility*.

Focusing on technology as a driver raises several important questions. Do we need incremental, revolutionary, or disrupting forms of change? Are marginal changes to large-scale engineering systems adequate? For the most part, disrupting technology was originally discussed in the realm of products displacing other products (Christensen 1997); how can disrupting technology lead to a process change, or further to a system innovation? The following sections explore the literature on technological innovation and address these questions. A particular focus is the role of government in stimulating technological change.

4.2.3.2 The Classical Linear Model of Technological Innovation

The classical linear model of technological innovation consists of three core components: *invention*, *innovation*, and *diffusion* (Kline and Rosenberg 1986; Schumpeter 1962). An ***invention*** is an idea, a sketch, or model for a new or improved device, product, process, or system (Freeman 1982). An ***innovation*** occurs when the invention is put to use (Moors 2000), or more specifically, when the first transaction involving the new product, process, or device occurs (Freeman 1982). Finally, ***diffusion*** is the widespread adoption (or implementation) of an innovative technology (Luiten 2001). The diffusion of a technology is important from an economical and social perspective since an innovative technology only pays off economically, environmentally, or socially when it is applied and replicated.

In general there are two main categories of technological innovation - *product* and *process* innovation (Utterback 1996). A *product innovation* occurs along the lines described above, where a new product is invented and sold in the market, or the composition, design, operation, quality, or function of an existing product is changed in an incremental or radical way. A *process innovation* occurs when an improvement is made in the way a product is manufactured without significantly changing the final product.[539]

Early criticisms of the linear model of technological innovation stemmed from the realization that the process was not unidirectional, but rather involved feedback between the three stages (Figure 4.10). Later models of technological innovation recognize the importance of knowledge transfer (Fischer 1999; Kline and Rosenberg 1986) and, more specifically, how learning and feedback are central to the diffusion and adoption of a new technology.

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[539] In the realm of transportation operations, a *process innovation* describes an improvement in the operation of an existing system without any (significant) changes being made to the transportation modes. The topic is particularly relevant to the question of how transportation investment should be made. For example, should an agency make a large capital investment to improve system performance, or can this improvement be achieved through a process innovation? In general, a process innovation is likely to be achieved through the application of intelligent transportation systems (ITS) at a margin of the cost of a major capital project (Sussman 2005).

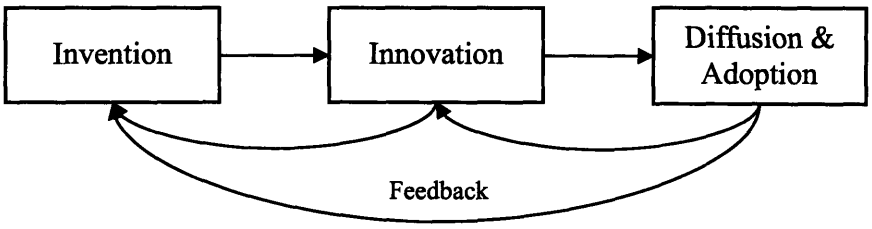
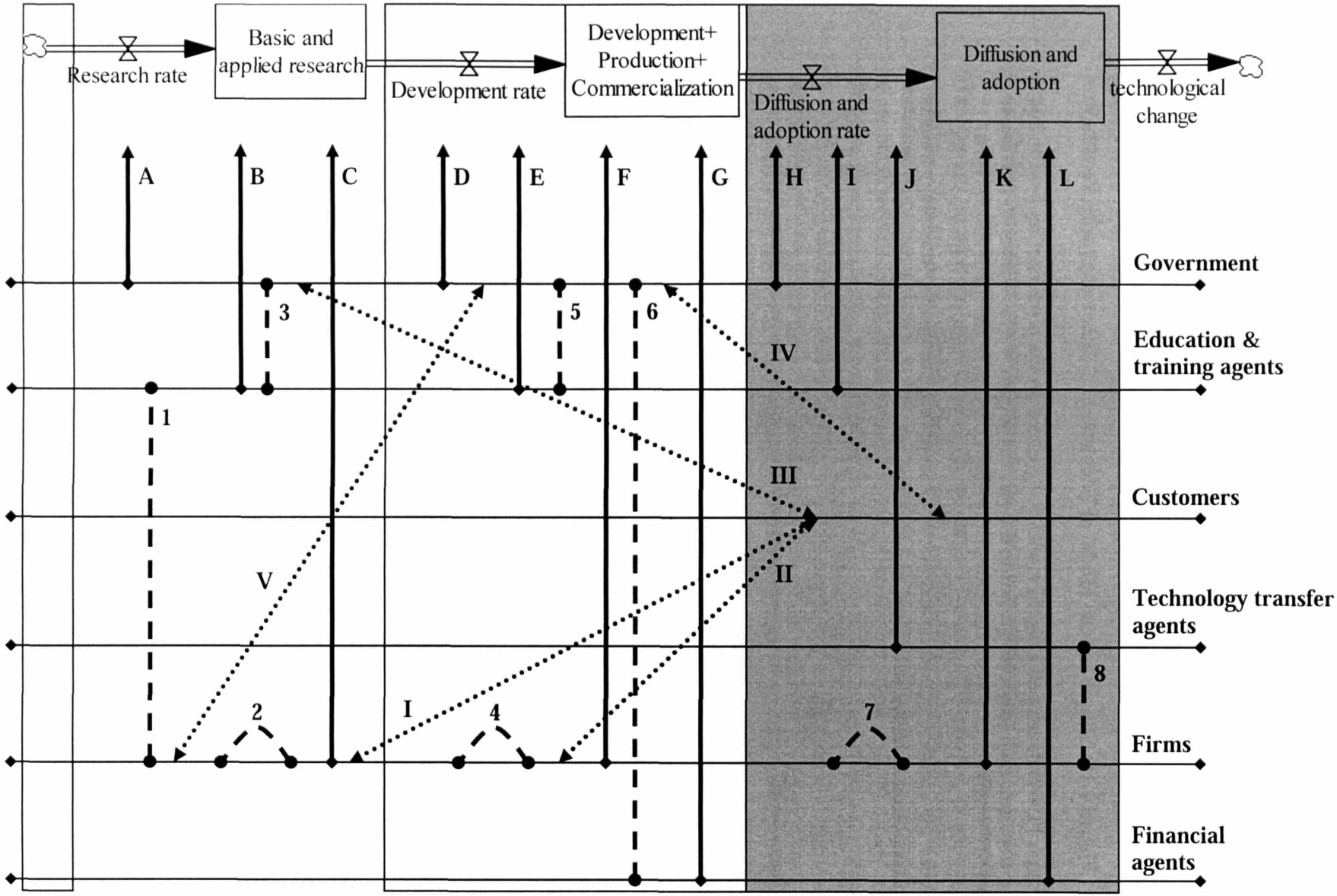


Figure 4.10: Simple Linear Model of Technological Innovation with Feedback

Tsamis (1999) developed a useful model that focuses on the *process* of innovation and the *roles* that each major player has in the process (Figure 4.11). While it is possible to identify a number of ways to categorize the major players in the innovation process (Braczyk et al. 1998; Padmore et al. 1998), Tsamis (1999) uses the following in his model: government, education and training institutions, customers, technology transfer and diffusion agencies, firms, and financial services.

The value of Tsamis's qualitative model of a regional innovation system is that it [1] identifies how each player influences different aspects of the innovation process (see arrows A to L), [2] indicates the type of interactions that occur among the players *within* each step of the innovation process (see dashed connectors 1 to 8), and [3] recognizes the interactions that occur among the players *across* the three steps of the innovation process (see the dotted arrows I to V).



Source: Tsamis (1999, p. 39).

Figure 4.11: Diagram of a Generic Innovation System

4.2.3.3 Static versus Dynamic Efficiency

It is important to emphasize the difference between achieving *static* and *dynamic* efficiency in applying technological solutions to societal problems. Having static efficiency as the mainstay of neo-classical environmental economics ignores the important role of innovation in achieving better environmental outcomes (Ashford 2001; Driesen 2003; 2004; Jänicke et al. 2000). It assumes the objective of decision-makers is to reach an efficient state where social welfare is maximized. If the prevailing state of the world is sub-optimal, a more efficient state is identified and changes are made to move the system towards that state. In general, neo-classical economists define this efficient state by matching supply and demand in a competitive market, with the assumption that technology remains constant. In contrast, dynamic efficiency places considerable attention on instruments that will encourage transformations. "*Economic dynamic analysis emphasizes change over time, systematic change, and precise analysis of how incentives affect individuals and institutions*" (Driesen 2004, p. 515).

The roots of dynamic efficiency can be traced to institutional economics and organizational theory (Driesen 2003). Thus, it tries to understand how a new incentive is likely to capture the attention of institutions and individuals, given their decisions are influenced by *path dependency* or *lock-in* (i.e., past actions/decisions might constrain future actions/decisions) and *bounded rationality* (i.e., purposes, knowledge, and habits combine to constrain the choices an institution/individual makes) (Driesen 2003; 2004).

Dynamic efficiency views technological change (with accompanying institutional, organizational, and social changes) as a central variable in the analysis of environmental policy, increasing the importance of understanding the direction of change and how technology might alter benefits/costs over an appropriate time horizon (Ashford 2002a). Given that changing a socio-technical (or large-scale engineering) system is likely to require a long timeframe, the role of government in setting technology and environmental policy to guide innovation increases in importance. Further, whereas static efficiency focuses on 'the' efficient state that appropriately balances competing goals, dynamic efficiency emphasizes win-win outcomes that are achieved through the co-optimization of multiple societal goals. Thus, achieving dynamic efficiency focuses on the *process* of a sustainable *transformation*, while achieving static efficiency focuses on a sustainable, or more optimal, *state*. This observation highlights the implicit bias embedded in analysis tools. Tools such as benefit-cost analysis, which are based on static efficiency (or optimality), move considerations of the *process* of transformations outside of the analysis framework. In contrast, Driesen's (2003) focus on the economic dynamics of environmental law places the *process* of transformation at the center of the analysis.

4.2.3.4 Government's Role in Achieving Dynamic Efficiency: Beyond the Porter Hypothesis

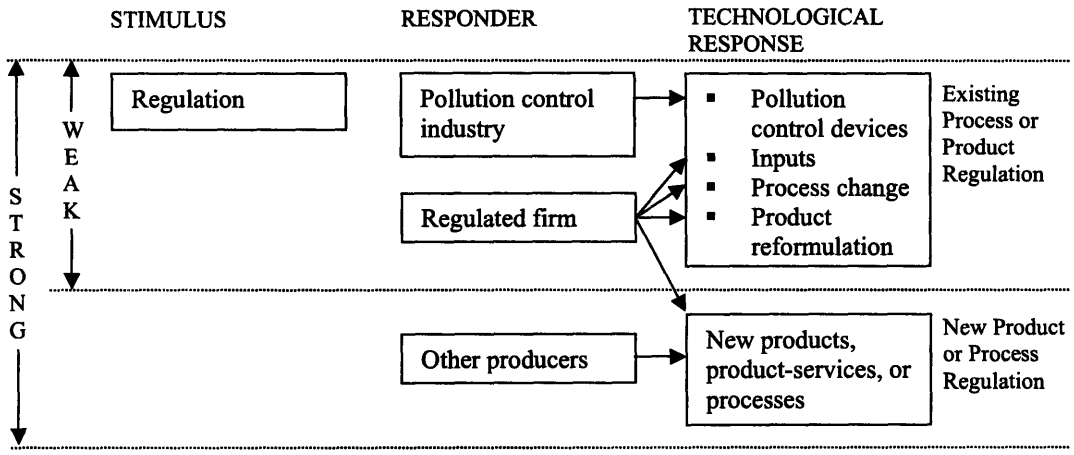
In general, economic analysis of regulation and competitiveness is based upon the assumption that stringent regulation increases production costs (Jaffe et al. 1995; Rennings et al. 2003). This assumption was challenged in 1991 by the so-called 'Porter hypothesis.'

Based upon his research into the competitive advantage of nations (Porter 1990), Porter claimed that "[s]*trict environmental regulations do not inevitably hinder competitive advantage against foreign rivals; indeed, they often enhance it. Tough standards trigger innovation and upgrading*" (Porter 1991, p. 168). He continues, "[p]*roperly constructed regulatory standards, which aim at outcomes and not methods, will encourage companies to re-engineer their technology. The result in many cases is a process that not only pollutes less but lowers costs or improves quality. ... Strict product regulations can also prod companies into innovating to produce less polluting or more resource-efficient products that will be highly valued internationally*" (ibid, p. 168). The basic premise of Porter's hypothesis is that firms which respond to stringent regulation by developing new technologies have a 'first mover' advantage and can capture the market for their products/services. A recent comparison of national competitiveness with good environmental governance and private sector responsiveness showed support for the Porter hypothesis (World Economic Forum et al. 2002). It states that "*good economic management and good environmental management are related*" and that "*firms which succeed in developing innovative responses to environmental challenges benefit both environmentally and economically*" (ibid, p. 17).

Earlier work on this concept, along with empirical evidence, dates back some twelve years to research undertaken at MIT (Ashford 1993; Ashford et al. 1985; Ashford and Heaton 1983; Ashford et al. 1979). This work showed how stringent and focused regulations in the U.S. chemical producing and using industries had the effect of stimulating fundamental product and process innovations (Ashford et al. 1985). A later analysis of the situation since the MIT studies revealed that environmental and health and safety regulation - if appropriately designed, implemented, and complemented by economic incentives - can lead to radical technological developments that can significantly reduce exposure to toxic chemicals in the natural and working environments, and in consumer products (Strasser 1997).

A weakness of Porter's hypothesis is that it does not provide any detailed analysis of the process of technological innovation and, more importantly, its focus on how incumbent firms respond to more stringent regulations ignores the important dynamics of new entrants (Ashford 1999). Porter's focus on 'innovation offsets' - i.e., the cost savings due to induced innovation that could exceed the cost of the regulation (Porter and van den Linden 1995a; 1995b) - indicate that he is mainly concerned with the costs to incumbent firms. From this insight, it is possible to differentiate between 'weak' and 'strong' forms of the Porter hypothesis (Ashford 1999). [Note: Porter does not make this distinction.] In its weak form, firms subject to more stringent regulation respond with incremental (or

sustaining) product and process innovations. Thus, while environmental and worker health and safety improvements may be realized, the offending products and processes remain intact, albeit in a greener, more efficient state. In its strong form, stringent regulation could stimulate the entrance of entirely new products and processes into the market, thereby displacing dominant technologies (see Section 2.3.1). In this situation, unless incumbent firms have the willingness and capability to produce and compete with the new forms of technology, they too are likely to be displaced from the market (Christensen 1997). Figure 4.12 provides a simple diagram of the likely technological response to the strong and weak forms of Porter's hypothesis.



Source: Adapted from Ashford (2000).

Figure 4.12: Model for Regulation-induced Technological Change for 'Weak' and 'Strong' Forms of the Porter Hypothesis

While some question whether environmental regulation does generate a positive effect on innovation (Jaffe and Palmer 1997; Robinson 1995; Walley and Whitehead 1994), this type of analysis tends to miss the essence of the 'strong' form of the Porter hypothesis.[540, 541] While it is likely that stringent regulation will not stimulate

[540] For a contrasting view on the 'strong' form of the Porter hypothesis, see Gunningham and Sinclair (1999). They argue that "*the most appropriate role for governmental regulation lies in nudging firms at the margin toward cleaner production, heightening their awareness of environmental issues, and encouraging the re-ordering of corporate priorities in order to reap the benefits of improved environmental performance*" (ibid, p. 883). Gunningham and Sinclair (1999) disagree with the argument that more stringent regulation is the best way to encourage the development of environmental technologies, and present a series of less-intrusive policy options than regulation. Under their policy framework, the use of regulation is only supported as a last resort, when covenants between industry and government and pressure from environmental groups, for example, fail to initiate innovation and environmental improvement.

[541] With regards to the 'weak' form of the Porter hypothesis, ambitious environmental policies in developed nations can lead to the formation of 'lead markets' for environmental technologies (Janicke and Jacob 2005). However, the evidence suggests that "*the international diffusion of environmental innovations must be accompanied by international policy diffusion, or the adoption by other countries of the induced innovation must be economically reasonable*" (Beise et al. 2003, p. 1). Both of these factors make it difficult to predict with any certainty whether an ambitious environmental policy is likely to create a lead market for the international diffusion of innovations (leading ecological modernization). The uncertainty surrounding the likely impacts to national industries of more stringent environmental [and health and

technological innovation in most firms, some firms are likely to rise to the challenge and become technological leaders in the process. As Ashford (1999, p. 3) argues, the "*evidence is necessarily anecdotal.*" The very presence of Kondratieff-waves of technological development indicate that dominant technologies are being continually displaced as new technologies become available (see Section 2.3). The question is whether existing, undesirable technologies can be retired (or displaced) through a combination of regulation and market incentives.

Using the trade-off matrix introduced in Section 4.2.1.4, it is possible to consider the dynamics of the impacts associated with more stringent regulation over a number of time periods. Developing a series of trade-off matrices that capture how the distributed impacts adjust with improving technology might be a useful way to explain to stakeholders how their situations are likely to improve, even if at first they worsen. Not only does disaggregating the stakeholders and assessing their interests/influence align well with the innovation model represented by Figure 4.11, it also supports Driesen's (2003) description of the economic dynamics of environmental law. Further, the Rawlsian/utilitarian decision-making philosophy discussed in Section 2.2.2 provides the philosophical basis upon which decisions for sustainable development can be made within the trade-off matrix.

By using trade-off matrices to assess the stringency and distributed impacts of regulation over time, along with careful consideration of the *path dependency* and *bounded rationality* of institutions and stakeholders/players, we are beginning to develop an analysis tool and way of thinking that can help formulate initiatives to nurture sustainable transformations.

4.2.3.5 The Need to Go Beyond Product and Process Innovation

The approach to addressing environmental problems is evolving and can be conceptualized as encompassing four different stages in the evolution of technological thinking:

1. **Pollution control** - the development of end-of-pipe technologies to capture and reduce emissions/waste.
2. **Cleaner production** - the creation of better, more environmentally sound products, processes, and services. Pollution from the manufacture and the use of products is reduced or eliminated.
3. **Product services** - the establishment of services to replace the need to purchase products. For example, washing services replace the need to buy a washer and dryer, photocopying services replace the need to buy expensive photocopying machinery that is loaned and maintained as part of a service contract, innovative car sharing programs in cities replace the need to buy an automobile, etc.
4. **System changes** - in contrast to the narrow use of innovation in relation to advances in products, processes, and services it can also be applied in a much broader sense to

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safety] regulation is seen as one reason why governments hesitate to implement such policies (Blazejczak and Edler 2004).

achieve a system innovation. Hence, the focus should not be on the word *technology* per se. It should be on the term *innovation* - i.e., different ways of doing things. A system innovation not only changes technology, but also institutional, organizational, and social structures. Since these four natural constituencies tend to be somewhat fragmented, at least with regards to communication, there is no direct channel through which initiatives can be formally integrated. This is why government needs to play an active role in encouraging change. Existing barriers need to be removed and an integrated systems approach to planning needs to be introduced if we are to realize the *Natural Capitalism* vision espoused by Hawken et al. (2000).

In Section 2.2.1, the argument that government has a trusteeship role in guiding the development of new technology is made. This argument becomes particularly important if the long-term development of the next generation of technology lies outside of what existing firms are able or willing to pursue. Focusing on innovation for products and processes, if we consider the factor X debate (Reijnders 1998), the government is seen to have a critical role in assisting the development and adoption of factor X technologies (the 'weak' form of the Porter hypothesis). An important point to recognize, though, is that the factor X improvements might either result in advances in *existing* technology, or be achieved through *disrupting* technology that displaces existing products, processes, and services from the market (the 'strong' form of the Porter hypothesis). These waves of creative destruction are not likely to be propagated by the dominant firms in the market (Christensen 1997), which increases the importance of the role of government to guide research and development through to the final diffusion of the new technologies.[542]

The critical question, however, is *how* should government stimulate technological innovation/development to realize the factor X improvements? In the previous section we focused on more stringent (technology-forcing) regulation. However, regulation and other government initiatives designed to stimulate technological innovation can come in numerous forms.[543] Luiten (2001) highlights the following government policy

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[542] The ability of industry to influence government standard setting and regulations often stifles technological innovation, enabling incumbent firms to focus on maximizing the production of existing less environmentally sound technology (Wallace 1995). In such circumstances, firms seek the coercive power of government to establish regulations that restrict market entry, provide subsidies, and/or support prices (Becker 1983; Keohane et al. 1998; Peltzman 1976; Posner 1974; Stigler 1971). Changing the dynamics between government and industry to prevent regulatory capture will be extremely difficult, but not impossible. However, it has been argued that under some circumstances regulatory capture and environmental performance go hand in hand (Oye and Foster 2002; White 1989).

[543] Luiten (2001) argues that during the 1960s and 1970s governments tried to stimulate technological development by generating knowledge through investments in R&D in both private firms and national public research institutes. The intention was to use the knowledge generated to improve the competitiveness of industry. In the early 1980s, the focus shifted from R&D funding to the under-exploitation of the new knowledge and available technologies. Generating knowledge by itself was not seen as being adequate, and efforts were made to channel technology directly to firms that could use them (e.g., using demonstration projects, etc.). In the early 1990s, technological development became a more systemic and interactive process. Thus, government measures shifted towards the stimulation of learning and co-operation. Interaction between the actors involved with a research project was seen as being essential. Such action not only had the benefit of sharing the costs and risks of R&D over a greater number of actors, it also prevented replication of efforts and improved the public sector return on R&D funding by increasing private sector involvement.

instruments that can be used to stimulate *supply* of and/or *demand* for technological development and innovation. She also indicates whether the instrument is *generic* (designed to maintain basic infrastructure or to enhance the competitiveness of the national industry) or *specific* (designed to address a particular problem or issue).

- **Research priorities** - Matching supply and demand; generic and specific
- **Technology standards** - Demand; specific
- **Performance or emission standards** - Demand; specific
- **Technology-forcing standards** - Demand; specific
- **Taxes, fees, and tradeable emission permits** - Demand; specific
- **R&D support or subsidies** - Supply; specific (can also be generic)
- **Venture capital** - Supply; specific (can also be generic)
- **Voluntary (R&D) agreements** - Matching supply and demand; specific
- **Technology procurement** - Demand; specific
- **Initiating and stimulating networks** - Matching supply and demand; specific or generic

Moving beyond product and process innovation into *system changes*, in addition to the wide range of instruments that can be used to guide technological development (in the product and process context), there are a number of theories that describe the process of technological innovation. Box 4.2 shows how the various schools of economic, historical, and sociological thought differ in their approaches to conceptualizing technological development. The description of these approaches draws upon the work of Partidario (2003), Luiten (2001), and Moors (2000). In each description the role of government is identified.

Box 4.2: Theories of Technological Innovation

Neo-classical economic approach: Technological development is *exogenous* and technology is treated as a black box. Using such an approach a rational actor will attempt to maximize the production function. Government intervention corrects under-investment by stimulating fundamental R&D and supporting universities.

Evolutionary economic approach: Technological development is *endogenous* and is a path-dependent process of variation and selection. Technology is described as evolving from a firm's knowledge base. Technological development tends to occur along known directions, favoring path dependency and lock-in. The role of the government is to generate variation within an entrepreneurial climate that enhances innovation.

Systems of innovation approach: Technological development is a process of interactive learning and includes not only R&D and knowledge production, but also the transfer, exchange, and use of knowledge and the demand for knowledge. The aim of technological development is to optimize the use of knowledge generated by a system of related and linked actors. The role of the government is to maintain the institutional knowledge infrastructure of universities and research institutes.

Industrial network approach: Technological development takes place in a process of interactions between actors who perform activities and have access to different resources. Thus, technology is the result of interactions between firms. No explicit attention is given to directing technological development. The role of the government is to build and renew local knowledge-intensive networks and to stimulate co-operation.

Social constructivism approaches: Technological development is led by a process of social interaction

Box 4.2: Theories of Technological Innovation

that is directed by the values and beliefs of interest groups and actors (including government). The role of government is to understand and articulate specific positions during negotiations and to develop networks that support social interaction.

Quasi-evolutionary approach: Technological development is a process of co-evolution at different levels of analysis (micro, meso, and macro). Hence, technology is an object in a co-evolutionary learning process. The *technological regime*[544] guides, but does not fix, R&D activities. The role of government is to influence the rules of a technological regime to facilitate learning processes among the various actors, and to establish *niches* of protected learning.

Large technical systems approach: Technological development is the process of solving critical problems of a technical (or engineering) system. Technology is seen as part of an expanding technical system. Critical problems - or *reverse salients* (Hughes 1987) - of the technical system have to be solved before the system can expand. The role of government is to avoid causing or strengthening reverse salients and to reinforce the capacities or possibilities of system builders.

The theories of technological innovation shown in Box 4.2 provide an indication as to why focusing on government intervention in the process of technological innovation is important, even necessary. In addition, while the policy instruments above have been listed in a general form, we should recognize that the success of a particular instrument in directing or stimulating technological development is *context sensitive* (Wallace 1995).

Understanding the role of societal (or cultural) change and how new technology forms can regulate social behavior is essential. If society is unwilling to accept (or buy) a new technology, then it will not be diffused sufficiently to affect the overall system. It is also important to consider whether new forms of technology are supporting the satisfaction of fundamental human needs for [1] safety, security, and sustenance; [2] competence, efficacy, and self-esteem; [3] autonomy and authenticity; and [4] connectedness (Kasser 2002) (see Section 2.1.2 and 2.3.2).

Asking the question of whether a new technology form is likely to be diffused sufficiently to affect the overall system is critical for sustainable development. In Europe, and the Netherlands more specifically, there is a growing body of research looking into how society can *transition* [i.e., transform] to sustainable forms of development through *system innovation* (Elzen 2003; Elzen et al. 2004; Kemp and Rotmans 2005). However, the research is not constrained to Europe. The U.S. National Research Council (NRC) (2002) recently undertook an important study that focuses on the 'transition toward sustainability.'

A 'transition' [transformation] is described as "*a long-term change process in an important subsystem encompassing various functional systems (e.g., food production and consumption, mobility, energy supply and use) in which both the technical and the social/cultural dimensions of such systems change drastically*" (Elzen 2003, p. 1). A

[544] Rip and Kemp (1998, p. 340) define a technological regime as "*the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artifacts and persons, ways of defining problems - all of them embedded in institutions and infrastructures.*"

'system innovation' is described as "*a set of innovations combined in order to provide a service in a novel way or offering new services. System innovations involve a new logic (guiding principle) and new types of practices*" (Rennings et al. 2003, p. 14). Geels (2004, pp. 19-20) describes a system innovation as consisting of three important aspects: [1] *technological substitution* - which includes the emergence, diffusion, and replacement of existing technology by new technology; [2] the *co-evolution* of technological and social systems - where both types of systems are continually interacting and changing; and [3] the *emergence of new functionalities* - where a new product or service provides a new functional characteristic. It follows that a 'sustainable' system innovation would provide economic, environmental, *and* social benefits with the offering of new products, processes, or services.

An important characteristic of research focusing on system innovation is the recognition that the relationship between sets of technologies are dynamic, complex, and non-linear, and that these technologies are socially embedded. This focus supports the objectives of dynamic efficiency and the importance of considering the fourfold co-evolution of technology, institutions, organizations, and society. Since the *evolutionary economic* and *quasi-evolutionary* approach to technological innovation (Box 4.2) make technology and innovation explicit and adopt a system approach, the frameworks developed to assess system innovation are built upon these theories. Since neo-classical economic theory treats technology as exogenous, it does not provide fertile ground for considerations of system innovation.

Briefly, *evolutionary economics* focuses on the process of technological innovation from the perspective of the survival of the fittest - i.e., its roots are Darwinian and Schumpeterian.[545] Nelson and Winter (1977; 1982) were the first to develop an economic theory in which the evolutionary theory of technological innovation was embedded. The theory is based upon two independent processes: *variation* and *selection*. In addition, since technology is treated as being socially embedded, the ideas of *path dependency* or *lock-in* and *bounded rationality* play important roles in the analysis of technological innovation. The evolutionary model of technological innovation was later extended by focusing on the sociological aspects of the evolutionary approach (Rip 1992; van de belt and Rip 1987). The so-called 'quasi-evolutionary' approach treats the variation and selection of technology as non-independent events (Moors 2000). Thus, the focus is on how technological variations are influenced by the selection environment.

The field of evolutionary economics is beginning to emerge as an important framework for understanding how modern economies work. *Development* is conceived as an evolutionary process. In general, evolutionary theory views innovation as a dynamic, interactive process of variation and selection where institutions and actors continually influence and learn from each other.

Evolutionary theory has five important characteristics which differ from the neo-classical economic approach (Butter 2002; OECD 1997b). First, since the process of innovation is

[545] See the Association for Evolutionary Economics (AFEE), http://www.orgs.bucknell.edu/afee/ (accessed on 04/09/06).

uncertain and is based upon risk-taking, there is *no rational maximization behaviour* or *optimal solution.* Performance objectives can be achieved in many different ways through the creation of entirely new products, processes, or services. Thus, the selection of an optimal outcome using a specific form of technology ignores the possible emergence of new, disruptive ideas. Second, since innovation is a state of constant change and is not predictable, there is *no one point of equilibrium.* Third, *technology* is made explicit and is treated as a system of interacting sub-technologies designed to achieve an overall objective. Fourth, *innovation* is made explicit as a dynamic and interactive process of variation and selection. Finally, the technological (or physical) and social (including institutions) *structure* of a system is made explicit. This enables economic performance to be considered as a function of the facilitating structure - i.e., the infrastructure, institutions, financial system, geographic location, etc.

There are currently three important frameworks that can be used to develop initiatives to stimulate system innovation for sustainable transformations. Kemp (2002) discusses 'strategic niche management' - a quasi-evolutionary approach - for achieving system changes necessary for sustainability. Butter (2002) suggests a three-layered approach for 'green system innovation,' based upon a combination of evolutionary theory and national systems of innovation. Ashford (2002b) argues for *integrating* rather than coordinating government interventions in order to bring about the needed technological, organizational, institutional, and social transformations to achieve significant sustainable system change. A role for government is anticipated by all three of these commentators, but to different degrees and in different ways. The following three sections look at these frameworks more closely.

4.2.3.6 Strategic Niche Management and Transition Management

The concept of Strategic Niche Management (SNM) emerged from the two opposing views of the *technological fix ideology* (or technological optimism) and *cultural fix paradigm* (Hoogma et al. 2002). The former argues that the benefits associated with technological progress are likely to far outweigh costs, and that a technological solution can be found to all problems. The latter suggests that the technology itself is actually part of the problem and that real solutions will have to come from *social* and *cultural* change. Therefore, SNM was created to "*allow for working on both the technical and the social side in a simultaneous and coherent manner*" (Hoogma et al. 2002, p. 3).

Kemp (2002, p. 10) describes SNM as the "*creation and management of a niche for an innovation with the aim of promoting processes of co-evolution.*" The idea is that a new product will be used by *real* users (i.e., society, industry, or government), and its use will promote interactive learning and build a product constituency. The underlying notion is that new technologies will be introduced in a socially embedded manner. It is important to realize that SNM is primarily focused on *product* innovation, not *process* innovation. However, its proponents argue that process innovation will be part of technological regime transformations (see discussion of regime change below). SNM also enables institutions and organizations to adjust the technological development and deployment process to stimulate the adoption and diffusion of a new product. Hoogma et al. (2002)

provide convincing evidence that the transportation sector's initial experience with SNM has been successful.

A key element of the SNM concept is that technological change occurs in a co-evolutionary manner - i.e., technologies evolve within institutional networks. Saviotti (2001) suggests that there are two important general points that can be made about the co-evolution of technologies and institutions. "*First, the emergence of new technologies increases the division of labor in the economy, but in the meantime creates new co-ordination problems. One of the roles of co-evolving institutions is to provide co-ordination. Second, although the firms producing and using the new technologies compete, other co-evolving institutions are in a complementary relationship with the main technology*" (Saviotti 2001, p.21). Saviotti's comments highlight the complexity which surrounds the introduction of a new technology and provide weight to Kemp's arguments for the creation of protective niches in which promising technology can be tested and developed. The ability to *experiment* with new technology - through demonstration projects that help users and suppliers learn about new possibilities - is a vital component of SNM.

The process of experimentation is likely to achieve one of two outcomes: *regime optimization*[546] or *regime-shifts*.[547] These two outcomes can be described as *sustaining* or *disrupting* changes, respectively. A technological regime is defined as "*the whole complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, established user needs, regulatory requirements, institutions and infrastructures*" (Hoogma et al. 2002, p. 19). In general, the type of technologies that are suitable for experimentation should be ones that hold the potential to bridge the gap between existing and new (sustainable) technological regimes (Kemp 2002). This type of technology is referred to as a 'pathway technology.' In essence, SNM is a bottom up, non-disruptive process where once the niche for experimentation has been established by government policy/regulation, the new technology form *evolves* from interactions between society, government, non-governmental organizations, and industry.

Technological regime shifts that occur through SNM are likely to entail a number of structural changes at different levels - "*of companies, production chains, users and government policies - and are connected with new ideas, beliefs and sometimes even new norms and values*" (Hoogma et al. 2002, p. 198). In addition, many of the elements involved in transitions cannot be managed. However, Kemp and Rotmans (2005) argue that by using a technique they call 'Transition Management' (TM) the process can at least be *guided.*

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[546] An example of a regime optimization is the development/deployment of highly efficient vehicles that use the internal combustion engine as a base (i.e., hybrid vehicles).

[547] Hoogma et al. (2002) provide the following examples of innovations that have regime-shift potential: battery-powered vehicles, telematics for traffic management, car-sharing, smartcards, individualized self-service rental systems, dial-a-ride service, and bicycle pools.

Kemp (2002, p. 9) defines TM as a "*deliberate attempt to bring about structural change in a stepwise manner.*" The concept is based upon the philosophy of modulation (i.e., it attempts to utilize existing dynamics and orient these dynamics to transition goals that are chosen by society) (Kemp 2002; Kemp and Rotmans 2005). Kemp (2002) describes TM as a two-pronged strategy. It focuses on both *system improvement* (improvement of an existing trajectory - i.e., sustaining innovation) and *system innovation* (representing a new trajectory of development or transformation). It is debatable whether Kemp's description of the latter strategy will result in disrupting innovation. However, the concept could hold particular merit in the right context. If revolutionary change - or a technological regime-shift - can occur via a stepwise system innovation process, then this will be an extremely useful tool that can be applied to large-scale engineering systems, such as the transportation system (Hoogma et al. 2002; Hoogma et al. 2001).

Opponents to SNM argue that one of the shortcomings of the technique is that at some point the 'probe and learn' ideology needs to become action and transformation, and Kemp's theory is unclear on how transformation will occur (Smith 2003). Further, if niches grow within or alongside *existing* regimes, they are unlikely to have radically different practices and rules, which raises the question of whether the new products, processes, or services will offer significant benefits. A final point raised by Smith (2003) is the fact that the localization of niches may run against the nationalization or globalization ideology of mainstream government and business institutions (see Section 2.5). Thus, a valid question is whether the 'transformative potential' of SNM will be inhibited by these powerful forces (Smith 2003).

Vergragt (2001) raises a slightly different concern to Smith (2003). He argues that if the role of government is to legitimize the transition process - including its own reform and the abolition of existing institutional and economic barriers to sustainable development - then a quandary exists since the national government may in fact be part of the problem rather than part of the solution. Therefore, a valid question is who will manage the transition process? Quist and Vergragt (2004) also question whether an emerging niche market will survive once its protection mechanisms are removed.

Ashford (2002b) argues that while Kemp acknowledges that regulation can be a useful tool to stimulate radical (system) changes, his faith in the formation of strategic niches and stepwise change *within* the original technology regime is not likely to result in disrupting forms of technology that are necessary for sustainable development. The problem lies in the fact that firms are likely to resist initiatives or regulations that threaten their market position, focusing instead on activities that maintain the status quo. Thus, a reliance on evolutionary, rather than revolutionary change, is not likely to support the emergence of new market entrants who play an important role in introducing radically different (and potentially more sustainable) forms of technology (Reinhardt 1999). Berkhout et al. (2004) make a similar case to Ashford. They argue that the tendency for SNM to target the "*incumbent regime, rather than its potential successor, ... represents a direct anti-thesis of the bottom-up niche-based model*" (ibid, p. 61). Further, they argue that the landscape of public opinion, legislation, the structure of markets, etc. (i.e., macro-

level processes) are more likely to encourage a system innovation than a focus on micro- or meso-level niche projects.

Finally, Jacob (2005) raises similar questions to Ashford and Berkhout et al. and asks whether SNM's experimental arena is likely to capture and maintain the necessary political [and financial] support for a real transition. Further, Jacob (2005) argues that while 'discourse and persuasion' are useful tools, they are unlikely to resolve any opposing core beliefs held by the actors. Thus, bargaining [and making trade-offs] are likely to play an inevitable role in any decision-making and transition process.

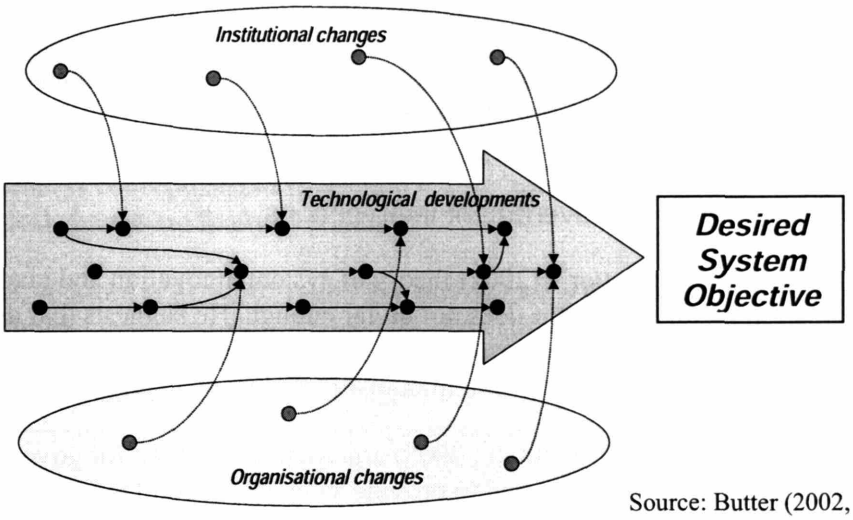
4.2.3.7 The Three-layered Approach for System Innovation

A systemic view of technological development is presented by Butter (2002),[548] who considers the role of institutional frameworks, networks, organizations, practices, and guiding principles in stimulating system innovation. The framework is based upon evolutionary economics and National Systems of Innovation (NSI),[549] and focuses on the role government can play in stimulating system change towards sustainable development.

Butter (2002) argues that while technological innovation takes place at a micro (or firm) level, *system innovations* (or transformations) only occur as a result of a *combination* of technological, institutional, and organizational innovations (Figure 4.13). The notion is that the alignment of several singular technological innovations, combined with suitable institutional and organizational changes, will result in a system (or *functional*) change towards a desired system objective. "*System innovations will lead to changes in organisations, changes of regimes and will be long-term processes of change*" (Butter, p. 4).

To formalize the concepts behind Figure 4.13, Butter (2002) describes a three-layered approach to developing a policy for system innovation. (Note: these three layers are different than the three types of innovation shown in Figure 4.13.) The first layer focuses on the alignment of different actors towards a common objective - the *system innovation*. By developing stakeholder endorsed visions of the future [using participatory backcasting (Quist and Vergragt 2004), see Section 4.2.6], establishing co-operation networks (between universities, government, industry, NGOs, etc.) focused on system change, and reallocating funding to support long-term planning and the creation of niche markets, Butter (2002) suggests it is possible to stimulate and align singular innovations so that together they will contribute towards a system innovation.

[548] Also see Butter and Montalvo (2004).
[549] See Freeman (1987) and OECD (1997b) for a discussion of NSI.



Source: Butter (2002, p.4).

Figure 4.13: The Interconnections between Institutional, Technological, and Organizational Development/Change

However, a major barrier to system innovation is the *financial consequences* associated with a system-wide change (Butter 2002). For example, the relatively large research budgets required to develop a new mode of transportation - such as the hydrogen fuel cell vehicle - often exceed the capabilities of a single actor. Hence, a *normal* entrepreneur or firm is unlikely to take the risk of developing a technology capable of radically altering a system. From similar arguments, Butter (2002) draws the conclusion that governments have a high legitimization to intervene in the technological innovation process, especially when there is a focus on solving societal problems.

The second layer addresses *singular innovations* and incorporates the more traditional innovation process of invention, innovation, and diffusion of singular technologies. Butter (2002) argues that government has a role in stimulating innovation, but he stops at negotiation, tax incentives, and financial instruments, and ignores the potential gains that can be achieved from more stringent regulation.

The final layer emphasizes the importance of creating an *innovation climate.* This is a climate in which the vision of sustainable development is clear, financial incentives support sustainable forms of development, and long-term investments and initiatives for sustainable development are nurtured. Butter (2002) states that the largest barrier to the creation of such a climate is the current lack of a long-term vision towards the future.

In his guidelines for policy, Butter (2002) argues that the role of government is not to select winning technologies, but rather to facilitate the process of variation and selection. This role aligns well with the evolutionary economic approach. In addition, he states that technological lock-in effects can be avoided by using outsiders who can initiate system innovations. However, he does not provide any guidance on how this can be achieved.

In summary, the theories of Butter (2002) and Kemp (2002) both rely on the role of government to varying degrees. This raises a critical question - *how much government intervention should there be?* Perhaps the most involved role for government in system innovation is put forward by Ashford (2000; 2002b).

4.2.3.8 The Integration of Government Interventions

Ashford (2002b) endorses Butter's (2002) theory of system innovation and taxonomy of policy approaches, but argues that it does not go far enough. He suggests that the multipurpose (rather than single-purpose) design of policy, where government policy is co-optimized, is much more likely to lead to dramatic system changes.

At the center of Ashford's (2000; 2002b; 2005) argument is the need for government to create winning forces and scenarios and to provide an enabling and facilitating role by creating visions for sustainable transformations. Depending on the type of transformation required, Ashford (2002b, pp. 18-19) suggests that the roles of government should encompass:

- "*the direct support of R&D and incentives for innovation through appropriate tax treatment of investment;*
- *the creation and dissemination of knowledge through experimentation and demonstration projects;*
- *the creation of markets through government purchasing;*
- *the removal of perverse incentives of regulations in some instances and the deliberate design and use of regulation to stimulate change in others; and*
- *the training of owners, workers, and entrepreneurs, and educating consumers.*"

It is clear how these roles build upon the ideas embedded in Kemp (2002) and Butter's (2002) approaches, but Ashford (2002b) calls for a much stronger role for government in stimulating technological innovation. Under his policy framework, government should go beyond simply creating a favorable investment climate. "*Without deliberate design, significant changes - even system changes - are unlikely to improve competitiveness, environment, and employment at the same time*" (Ashford 2002b, p. 18). Hence, *stringent regulation* (focusing on environmental issues) is seen as essential to stimulating significant technological changes. And such *regulation*, may, in fact, be necessary to create *niches* which facilitate the entry of new firms and organizations into a new market.

Others who support the view that stringent (or 'properly conceived') regulation is necessary for environmental innovation include Huber (2004b), Foxon et al. (2004), and Jänicke (1990). For instance, Huber (2004a, p. 447) comments that "*strict environmental performance standards* ... [remain] *by far the most effective controls instrument for environment and innovation alike (which is not astonishing given the fact that environmental standards are, or immediately translate into, technical standards).*"

Ashford et al. (2002) argue that an *evolutionary* (or incremental) pathway is insufficient for achieving factor ten or greater improvement in a system's performance. Further, since changes in socio-technical systems (such as the transportation system) are difficult, the

"*creative use of government intervention is a more promising strategic approach for achieving sustainable industrial transformations, than the reliance on the more neo-liberal policies relying on firms' more short-term economic self-interest*" (Ashford et al. 2002, p. 10). Hence, relying on Christensen's (1997) approach to radical disrupting innovation is seen as being unlikely to result in 'system' transitions towards sustainable development (as conceptualized in Section 4.1.3); however, disrupting forms of technological change are likely to continue.

In addition, Ashford et al. (2002) state that governments should work with stakeholders to define future targets - while ensuring that their agendas are not captured by incumbent firms - and then use their position as trustee to "*represent the future generations and the future technologies to 'backcast' what specific policies are necessary to produce the required technical, organizational, and social transformations*" (Ashford et al. 2002, p. 10).[550]

In Ashford's (2002b) model of integrating policy development, government needs to develop initiatives for change *and* be willing to change its own institutions in the transformation process. A simple matrix that can help decision-makers explore whether change is needed with the existing decision-making architecture or an entirely new architecture is required is presented in Figure 4.14.

Cells A and C in Figure 4.14 represent situations where the necessary system transformations can be achieved within the existing legal, institutional, and political system. The difference between the two cells is whether it is necessary to bring new stakeholders into the transformation process.[551] Kemp's (2002) idea of strategic niche management covers both of these approaches. Cells B and D in Figure 4.14 represent situations where the necessary system transformations cannot be achieved within the existing system. Again, the difference between the two cells is whether it is necessary to bring new stakeholders into the transformation process. If a more radical system innovation is required to move towards sustainable development, it is likely that the necessary solutions will emerge from the right-hand column of the matrix, especially if new stakeholders are included in the analysis (Cell D). It is believed that Ashford's (2002b) ideas for integrating policy for sustainable transformations cover all four of these scenarios.

Returning to Butter's (2002) three-layered approach to policy development, different strategies might be used to stimulate singular and system innovations, and to establish an innovation climate or policy architecture, depending on the extent to which technological, institutional, organizational, and societal change is contemplated or desired.

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[550] The concept of backcasting first was introduced by Amory Lovins in the 1970s and has since been applied and developed in Sweden and the Netherlands (Quist and Vergragt 2004; Vergragt 2001). The backcasting approach enables policy makers to *look back* from a desirable future to create strategies that will hopefully enable the future visions to materialize. Such an approach is in contrast to current planning processes that develop strategies based upon forecasts.

[551] See van de Poel (2000) for a discussion of the importance of outside involvement in technological development.

	Identify solutions ***within*** existing legal, institutional, and political system	Identify solutions ***outside*** existing legal, institutional, and political system - e.g., the creation of a new transportation planning architecture
Work with ***existing stakeholders***	**A**	**B**
Include ***new stakeholders*** in the decision-making process	**C**	**D**

Figure 4.14: Options for Analysis Framework

4.2.4 Trade, and International and National/Regional Markets, as Drivers of Change

Although modern development theory emphasizes technological innovation as the 'engine of economic growth,' trade also contributed to advancing industrializing nations during the nineteenth and twentieth centuries. Trade is increasingly described as a major engine of economic growth, both for advanced economies with 'excess productive capacity' and saturated domestic markets and for less-industrialized countries with unutilized natural resources increasingly needed by the industrialized economies. For both, outward-looking strategies are being fashioned for more participation in world markets.[552] The purpose of this section is to articulate why trade is seen as an important driver of development.

The rationale for trade can be traced back to the nineteenth century to Ricardo's (1996 [1817]) theory of *comparative advantage*[553] and more recently to Heckscher-Ohlin's *factor endowment trade theory* (Heckscher 1949 [1919]; Ohlin 1933). The Heckscher-

[552] See Schmidheiny (1992, pp. 69-81) for an insightful discussion on 'trade and sustainable development.' Schmidheiny (1992, p. 79) makes the observation that "[t]*raditionally, the industrial nations of North America and Europe have championed free trade, against the resistance of most developing nations and centrally planned economies. Today, it is the former that tend to question the benefits of liberalized trade, while developing nations and the newly emerged democracies of Eastern Europe see it as their main hope for economic development.*" To address the inherent conflicts associated with the expansion of trade and environmental protection, Schmidheiny (1992) calls for the harmonization of environmental regulations throughout the world.

[553] In a self-contained economy, an example of this theory is exemplified by bartering between a dentist and a carpenter. The carpenter needs his teeth fixed and the dentist needs shelves in his study. They agree freely on an exchange of services and it sounds like a marriage made in heaven. Both are made better off by the exchange. The dentist fixes 2 teeth and the carpenter builds 3 shelves. Five years later, the carpenter needs 4 teeth fixed, but the dentist has enough shelves and wants a tool shed built in his garden. At that particular moment in time, the exchange still looks like a marriage made in heaven. Both are benefiting from the exchange. Ten years later, the exchange is 6 teeth fixed in exchange for a garage. It is still a mutually advantageous exchange, but note that one party to the bargain (the carpenter) is increasingly impoverished relative to the other (the dentist). While at any point in time welfare is maximized, examination over time reveals a problem. The analogy to first world economies (providing advanced goods) trading with third world countries (providing basic commodities) is obvious.

Ohlin model of trade suggests that countries should *specialize* in the production of commodities for which they have an advantage in resource endowments and/or productive capabilities, and exchange any surplus home-produced commodities for those more easily produced by others (Todaro and Smith 2003).[554] For example, if a country is endowed with labor, using the neo-classical theory of supply and demand, the price of labor will be relatively cheap when compared to countries where labor is scarce, ceteris paribus. Therefore, the labor-endowed country is described has having a *comparative advantage* in relation to the cost of labor. Using the Heckscher-Ohlin model, it follows that labor-endowed countries should focus on the production of labor-intensive commodities (such as agricultural goods, raw materials, minerals, etc.) and export any surplus in exchange for imports of capital-intensive commodities.

Conversely, if a country is endowed with capital, it will have a relative advantage in the production of manufactured goods (such as automobiles, trains, aircraft, electronic equipment, etc.) that require large capital investments in technology/equipment compared to labor (Todaro and Smith 2003). Thus, using the Heckscher-Ohlin model, capital-endowed countries should focus on the production of capital-intensive commodities and export any surplus in return for imports of labor-intensive commodities. In effect, the Heckscher-Ohlin model brings the neo-classical price mechanism into the realm of (international) trade theory.

By understanding which productive factors are required to manufacture commodities and relating this information to the relative endowments and factors of production of each country, factor endowment trade theory encourages countries to *specialize* in commodities in which they have a comparative advantage. Hence, the most efficient (worldwide) allocation of resources will be achieved if all countries specialize in their relative strengths and trade their surplus for needed commodities that are more easily produced by others. This view on trade ultimately leads to the integration of regional and national markets, increasing the importance of transnational corporations and the need to transport resources and commodities between nations (Korten 2001).

It is becoming increasingly apparent that developed nations (the U.S. in particular) believe that trade is critical to achieving sustainable development (see Section 3.4.6). It is seen as the mechanism through which poverty will be reduced, human well-being will

[554] The early theories of comparative advantage were based upon a set of *static* (endowment) factors - namely labor, natural resources, land, and population size. However, comparative advantage is now understood to be more of a dynamic process (Dicken 1994). Possibly the most well known description of the factors that determine a nation's competitiveness is Porter's (1990) 'Diamond of Competitive Advantage.' Porter's (1990) 'diamond' consists of four interacting factors: *factor conditions* (such as resources, labor, infrastructure, etc.); *demand conditions* (i.e., demand from customers); *related and supporting industries*; and *industry strategy, structure, and rivalry* (i.e., the factors that influence an industry's/firm's attitude towards competition and innovation). These factors can combine to generate new advanced factor endowments (such as a high-technology sector or a large pool of skilled labor) that determine a nation's comparative advantage. A clear omission from Porter's (1990) theory, however, is the failure to include government as a factor (Dicken 1994). Instead, government is described as having a proactive 'influence' on the four core factors.

increase, and environmental problems will be addressed. However, focusing on trade as a driver of sustainable development has its supporters and critics.

The proponents of trade generally ground their arguments in the notion that *free* trade will enhance the welfare of humans by increasing prosperity. The basic economic theory is that international trade that is 'free' from protectionist barriers will reduce prices and increase the amount of goods and services available (Driesen 2001). Since free trade enables corporations (predominately based in developed nations) to become global in their operations, proponents argue that less developed nations will benefit from job creation and the spread of advanced technology, occupational health and safety standards, and environmental management techniques (OECD 1997a). In addition, as individual prosperity increases, so too does the tax base for environmental and social programs that governments can implement in response to increasing demands for a healthier environment (Bhagwati 1993; Speth 2003).[555] In effect, proponents argue that international trade is opening up new opportunities to protect and enhance the environment through the reorientation of economic policies (OECD 1997a). Further, as governments' ability to manage their economic affairs is enhanced, there are likely to be spillover effects that will enable them to address environmental concerns (Speth 2003).

Behind the majority of arguments in support of international trade is some form of 'economic rationalism.' Dryzek (1997)[556] describes an economic rationalist as someone who believes in the [free][557] market and the rational pursuit of material self-interest. Advocates of pure economic rationalism believe the free market can provide society with all the products and services it needs, reducing the role of government to the provision of a competitive economy. Thus, an economic rationalist is primarily concerned with removing barriers to competition; reducing government spending; expanding the privatization of public services (such as public transportation); and the deregulation of heavily regulated markets/industries.[558] Economic rationalists might, for example, construct the problem of unsustainable development through the lens of inadequate property rights. They would argue that if property rights were reassembled in a more

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[555] This type of argument is often put forward by those who believe in U-shape or Kuznets relationships - i.e., environmental quality falls during the initial stages of economic growth/industrial expansion, but later improves with increasing GDP.

[556] John Dryzek's (1997) book, *The Politics of the Earth - Environmental Discourses*, provides an alternative and valuable formulation to the emergence of sustainable development adopted in Chapter 3. Instead of taking an historical approach to describe sustainable development, Dryzek uses discourses to address the concept from the full range of positions and arguments - many of which are touched upon in this chapter (see Table 4.1).

[557] Dryzek (1997) questions the use of the term 'free' market, and argues that a "*market is a market; so why does it need to be called a free market, especially given that markets can only operate if government supplies a supportive legal context?*" (ibid, p. 114). Thus, 'free' market is used as a rhetorical device to represent the removal of barriers to trade on protected or insulated products and services. To many, the concept of a free market also means the elimination or minimization of 'oppressive' health, safety, and environmental regulation that hampers the free flow of goods or the conduct of commerce. The more fundamental concept traceable to both Ricardo and Adam Smith is a 'competitive market,' i.e., one free from the excesses of monopoly power - but not market controls - that seeks to 'internalize social costs.' A sleight of hand is used in confusing laissez faire capitalism (free markets) with competitive markets.

[558] See Australian Broadcasting Corporation (ABC), Money, Markets and the Economy, Program 11, *The Rise of Economic Rationalism*, http://abc.net.au/money/vault/programs/prog11.htm (accessed on 04/09/06).

appropriate manner, environmental resources would be "*treated as inputs to the social machine*" resulting in more sustainable forms of development (Dryzek 1997, p. 114).

Economic rationalists believe that governments should act in the best interests of the public, though their actions should be defined in economic rationalist terms. However, Dryzek (1997) notes that this type of economic rationalism is an inadequate mechanism through which the environment can be protected or enhanced. A major problem is that economic rationalists respond to consumer preferences and ignore citizen preferences (Sagoff 1988), thereby undermining the democratic process and the well-being of the disadvantaged. Therefore, a more moderate position tends to be adopted by those (neo-classical economists) in support of trade that recognizes the need for government to account for the environmental and social costs (or negative externalities) of the market (Driesen 2001).[559] This position aligns well with environmental and resource economics, which attempt to place appropriate market valuations on goods and services by internalizing negative externalities.

While international trade has some positive effects on developing communities and can potentially help protect/enhance the environment, it is also seen to have negative environmental (OECD 1994) and social (welfare) impacts (Rees and Westra 2003). Some of the main arguments against the international integration of economies are that free trade:

- is accompanied by environmental degradation and growing economic inequality (Borghesi and Vercelli 2003; Held and McGrew 2002);
- weakens the democratic accountability of governments through the transfer of power from people (and society in general) to global financial institutions and corporations (Korten 2001). Such a transfer of power is mirrored by "*a corresponding shift in economic priorities from the production of goods and services to meet human needs to a wholly different agenda centered on extracting wealth from the larger society to increase the financial assets and power of the wealthiest among us*;"[560]
- is not proceeding in a fair and equitable manner. A main contention is that industrialized nations have pressured developing nations to eliminate their trade barriers while keeping their own intact. This has the effect of opening up the markets of developing nations to capital-intensive products from developed nations, but has prevented them from exporting their labor-intensive products, depriving them of vital export income (Stiglitz 2002);
- encourages economically rational corporations to invest capital in countries with the lowest environmental and health and safety standards. Such action reduces the cost of producing commodities and might also lead countries to specialize in those sectors where regulations are weakest (Cole 2000). Alternatively, the pressure to produce commodities at or below the price dictated by the international market creates a

[559] A major challenge faced by governments is that these environmental and social costs tend to have a long maturation time, which is "*at odds with political democracy, which does not tend to favor long-term planning, especially if it is costly in the short-term*" (Hutter 2002, p. 14).

[560] Source: People-Centered Development Forum, *History*, http://www.pcdf.org/About_PCDF/history.htm (accessed on 04/09/06).

perverse incentive to lower health and safety and environmental standards to improve the competitiveness of national sectors (Daly 1993);

- creates a situation in which capital from developed nations is only invested in nations that offer the potential for a high rate of return. This means it is more profitable to invest in the inefficient and polluting industries of Eastern Europe, for example, than to invest in the less attractive markets of developing nations (Reid 1995). Hence, economic 'logic' is reducing the already limited financial flows reaching developing nations; and
- leads to the "*spatial and temporal separation of action and impact from responsibility*" (Speth 2003, p. 13). As commodity chains grow in length, become more complex and more international, the spatial and social distance between production and consumption is widened (Conca 2002; Princen 2002). The result of this *distancing effect* is that consumers lack the information and incentives to behave in a more sustainable manner even if they wished to do so. To put it another way, as trade increases and countries continue to specialize, the transaction costs (linked to externalities) become hidden by the distancing effect. Therefore, it becomes increasingly difficult for communities in different nations to communicate and agree on collective solutions to externality problems (Costanza et al. 1997).[561] Further, the growing movement of resources between nations in response to *market demands* is reducing the effectiveness of traditional local controls over resource use (Speth 2003). This loss of indigenous control can lead to the exploitation of resources as a result of unsustainable rates of extraction.

Interestingly, those who oppose international trade recognize that the removal of trade barriers and the integration of national economies have the *potential* to improve the well-being of humans, especially for the poor (Stiglitz 2002). Further, private enterprise, rather than government intervention, is seen as an effective mechanism for creating wealth (Soros 2002). This indicates that potential solutions to the problems raised above will lie in balancing the role of government with the benefits of the market.

While the case that international trade can stimulate economic growth is relatively clear, the challenge is to ensure that this growth supports, and does not undermine, sustainable forms of development.[562] In Section 4.2.3.4, the argument is made that more stringent environmental regulation is likely to result in either an incremental/radical improvement in the *existing* trajectory (i.e., better versions) of technology (the weak form of the Porter

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[561] Supra note 500.

[562] As an interesting aside, the effectiveness of trade measures in pursuing environmental goals was a question posed by Congress to the Office of Technology Assessment (OTA) in 1992. The final report, *Trade and Environment: Conflicts and Opportunities*, concluded that "*[t]rade measures (especially import restrictions), and the threat of such measures, can potentially further environmental goals in various ways. They can help* ***convince*** *a country to join an international environmental agreement or to behave according to certain environmental norms;* ***deny*** *a country economic gain from failing to follow such norms;* ***prevent*** *a country's actions from undermining the environmental effectiveness of other countries' efforts; and* ***remove*** *the economic incentive for certain environmentally undesirable economic activity*" (OTA 1992, p. 42). Examples of such measures can be found in the Convention on International Trade in Endangered Species of wild fauna and flora (CITES), established to ensure that international trade in specimens of wild animals and plants does not threaten their survival, and the Basel Convention on the control of transboundary movements of hazardous waste and its disposal.

hypothesis) or a disrupting change (the strong form of the Porter hypothesis), whereby new products, product-services, and processes enter the market and displace dominant technologies. Section 4.2.3.5 continues this line of argument by stating that if progress is to be made towards sustainable development, we need to go beyond incremental product and process innovations and search for ways to facilitate dramatic changes in products/processes, or further still, *system changes*. Two corollary questions arise: (1) how are strategies designed to encourage disrupting change likely to affect international trade?; and (2) how do various trade strategies affect the nature of technological change [see the discussion of Lehner and Charles (1998) below]?

The introduction of more stringent standards (designed to facilitate dramatic and/or possibly disrupting technological change) is likely to increase production costs and *might* encourage industries to relocate to countries with more lenient standards.[563] However, in practice, it appears that environmental compliance has not yet reached a level of stringency where it influences trade flows or firm location decisions (Steininger 1994). A major concern here is that while more stringent environmental regulation regarding production is likely to improve the national environment, it might also lead to a reduction in a nation's share of international production. Steininger (1994) makes a convincing case that if countries are to implement more stringent environmental standards, the threat of competitive disadvantage must be removed. He argues that concerns for the competitiveness of national industries could be addressed if one or both of two counterbalancing measures would be incorporated in trade agreements:

- "*the implementation of countervailing duties on countries with more lenient regulations (the lax standard could be seen as an unfair ... subsidy), and/or*
- *the implementation of domestic subsidies for environmental control costs*" (Steininger 1994, p. 28).

Steininger (1994) argues that implementing such changes to trade laws would encourage the unilateral introduction of more stringent environmental regulations that are necessary to bring economies within appropriate ecological limits. These changes, which can lead

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[563] Dicken (1994) provides an insightful discussion of the complex relationship that exists between international firms and nation states. On the one hand the international firm "*seeks to maximize its freedom to locate its production chain components in the most advantageous locations for the firm as a whole in its pursuit of global profits or global market share*" (Dicken 1994, p. 117). On the other hand the state "*wishes to maximize its share of value-adding activities*" (ibid, p. 117). Therefore, the outcome of firm-state interactions is predictably uneasy, one of conflict and/or collaboration. Further, firm-state interactions are also influenced by whether the international firm is based in its home country or is a guest in a host country. On the topic of regulatory structures, Dicken (1994) argues that international firms are primarily interested in access to markets and the rules of operations. What they seek would seem to be the "*removal of all barriers to entry, whether to imports or to direct presence; freedom to export capital and profits from local operations; freedom to import materials, components, and corporate services;* [and] *freedom to operate unhindered in local labor markets*" (ibid, p. 119). Dicken (1994) suggests that the variation in regulatory structures between nation states enables firms to engage in a form of 'regulatory arbitrage,' whereby firms move activities in search of more profitable operations. Such activity might be construed as a race to the bottom where environmental and health and safety standards are concerned. What Dicken does not address, however, is the notion of whether more stringent regulatory structures might, in fact, provide firms with an opportunity to capture markets through the creation of advanced (possibly disrupting) technology (Oye and Foster 2002; White 1989).

to the harmonization of environmental standards, possibly through the participation of trading nations in multilateral environmental agreements, seek to equalize environmental burdens and responsibilities.[564]

Correcting sustainability-driven concerns by harmonizing environmental or occupational health and safety standards is one thing, but different trade strategies themselves can affect the kinds of innovation that an economy or sector undertakes. Presumably, trade is directed towards increasing revenues in a globalized economy. A comparison of policies that seek to maintain national competitiveness by relying on innovation-driven strategies versus cost-cutting revenue enhancement is put forward by Charles and Lehner (1998).

Charles and Lehner (1998) argue that if government and industry approach national competitiveness and international productivity using a 'cost-driven strategy,' the end result is likely to be a reduction in mass wealth (through the lowering of wages) and an increase in unemployment (through the introduction of lean production processes). In essence, competitiveness is traded off against employment. To address this problem, they suggest that an alternative approach would be to adopt an 'innovation-driven strategy' for competitiveness.[565] It is argued that such an approach focuses on increasing wealth and welfare.

The objective of innovation-driven strategies is to reduce the relevance of prices and costs for competitiveness and shift the focus onto the creation of *new* products, services, and markets. Thus, *innovation* becomes the mechanism through which a nation can sustain or improve its international share of production. The idea is that if a large enough group of firms adopt such a strategy, it would create a 'leading-edge' economy that is less concerned about price competition and generates more opportunities for long-term competitiveness and employment. Innovation-driven strategies rely on what Charles and Lehner (1998, p. 218) call 'intelligent production systems,' which exploit the potential for creativity that exists at the interfaces of an organization's production system where different knowledge and experience intertwine. This approach is the opposite of lean-production strategies that seek to minimize the interfaces in a production system to save costs.

The challenge facing government is how to develop industrial policies that support innovation-driven strategies for competitiveness. Charles and Lehner (1998) argue that identifying the appropriate role for government is a complex task that is plagued with uncertainty; however, they suggest a couple of ways in which innovation-driven strategies can be supported. First, industrial policies should be designed to incorporate

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[564] Equalizing environmental (or safety and health) performance is likely to impose similar, but not entirely equal financial burdens on all producers. Pollution control/safety equipment will cost about the same in all countries, but human resource inputs may be relatively cheaper in developing countries. On the other hand, labor standards that equalize *purchasing power* and impose lower costs on developing countries reflect an increasing concern about outsourcing labor to third world countries by industrialized nations.

[565] It is important to recognize that cost-driven strategies also rely on innovation. However, rather than focusing on the creation of products and new markets, cost-driven strategies rely on *process* innovation to cut costs (Charles and Lehner 1998). Also, if a product innovation occurs, it arises within an existing product line and market.

differences across firms and industries. The challenge is to strike the right balance between the welfare of industries, regions, and the nation and create a regulatory framework that enables competition and cooperation. Second, new forms of state intervention are required. In particular, Charles and Lehner (1998) suggest that such intervention should support networks of innovation and play an active role in managing the dynamics of new interdependencies between the nation state, regions, and the international economy. However, a note of caution is offered: too much intervention might be self-defeating.

Finally, if it is possible to create a leading-edge economy based upon environmentally-focused, innovation-driven strategies that facilitate disrupting change, such an outcome presents a significant opportunity to maintain/improve a nation's competitiveness while encouraging more sustainable forms of development. While it is difficult to know how disruptive change might affect international trade, there are likely to be improvements in the environmental performance of products and services that are traded.

4.2.5 Financing for Sustainable Development

The topic of financing for sustainable development generally brings to mind an array of mechanisms that could be used to finance the development of less developed countries. Possibly the most well-known mechanism is Overseas Development Assistance (ODA), where developed nations have been asked to provide 0.7 percent of their nation's GNP to aid developing nations. Today, only a handful of countries have reached this level of aid.

While such mechanisms provide an important lifeline to many developing nations, our interest here does not lie with international financing mechanisms. This is because most of the changes that occur within a nation are not the result of international financial aid. Instead they are a product of the financing of public goods.

The way in which public goods (such as transportation) are financed has an important impact on technological and system changes within a nation state. Whether it is government aid, private sector finance, or some mechanism that combines public and private funding, raising sufficient money to maintain existing systems and fund system changes (or transformations) is a vital aspect of sustainable development. A good example of how financing could affect a nation's impact on the environment is the rate at which it transitions to a hydrogen economy. Without an adequate and reliable source of funding, a transition of this scale is likely to be significantly delayed, thereby prolonging the negative impacts of the petroleum-based economy. Therefore, it is argued that the financing of public goods is an important organizing framework for sustainable development.

Recently, the idea of internalizing the external costs of transportation - where users pay a 'true-cost charge' for a service they receive (i.e., the *polluter pays*) - appears to be gaining political support in the UK (RAE 2005). The benefit of true-cost charging is that it provides a revenue stream for public goods that directly links human activity with

associated environmental and social costs. As government agencies seek innovative ways to finance sustainable development, such mechanisms are likely to grow in popularity.

4.2.6 Stakeholder Participation

Public and stakeholder participation lies at the heart of the democratic process and has been an important part of decision-making for millennia. During the eighteenth century, Jean Jacques Rousseau introduced the idea of the social contract between the governed and the government which has since become the cornerstone of many political philosophies of government (see Section 2.2.1).

In recent years, the rationale for public/stakeholder involvement in decision-making has been well documented (Ashford and Rest 2001; NRC 1996; Renn et al. 1995; Shepherd and Bowler 1997; Söderbaum 1973; 2004; Yosie and Herbst 1998)[566] along with the mechanisms through which this involvement can occur (Arnstein 1969; Hale 1993; Nagy et al. 1994; van Gunsteren and van Loon 2000). The concurrent conclusion is that public/stakeholder participation is likely to lead to more democratic and informed decision-making that addresses the needs of citizens and affected stakeholders.

In the U.S. the demand for public involvement in decision-making can be traced back to the social activism and environmental movements of the 1960s and 1970s (Shepherd and Bowler 1997). With the passing of the National Environmental Policy Act (NEPA) in 1969 came the requirement that federal agencies undertake environmental impact assessments (EIA) for all major projects. In addition to identifying and informing the public of the likely impacts of a project, NEPA stipulated that the public must be able to participate in the development and review of the EIA. NEPA also gave the public the right to challenge final rulings in the courts. These requirements have led to the institutionalization of public participation in the federal government's environmental decision-making process (ibid).

While the terms 'public' and 'stakeholder' participation are often used interchangeably, there is an important distinction between them (English et al. 1993). The former does not differentiate between stakeholders, whereas the latter seeks to identify only those groups affected by a specific policy or regulation. While public participation is necessary to ensure that government is responsive to its citizens, our interest here lies with stakeholder participation (also known as stakeholder 'involvement' or 'engagement'). Identifying stakeholder groups is important since it can reveal distributive inequalities that occur as a result of government decisions.

Ensuring that stakeholders are included in the decision-making process is critical to sustainable development. As rapid technological change and globalization continue to affect our lives in unforeseen ways, the importance of establishing a democratic political philosophy to guide the development of social and technological systems becomes increasingly important.

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[566] Supra note 515.

In Section 2.2.2, the concept of the Rawlsian/utilitarian decision-making philosophy is developed. The value of this framework is that it enables stakeholder involvement to be considered in a number of different ways depending upon how government and stakeholders see their roles in the decision-making process. Within the framework, government either acts as a trustee of stakeholder interests or as a facilitator for utilitarian/majoritarian consensus; the posture of the stakeholders is idealized as utilitarian or communitarian. Using these four dimensions, it is possible to qualitatively evaluate the likelihood of achieving a Rawlsian solution from the decision-making process - i.e., an outcome where new legislation, policies, or programs support initiatives that uphold individual liberties and offer greater advantage to individuals or groups who are relatively worse off to begin with. This definition of a Rawlsian solution has been extended by the *environmental principle* (discussed below) to include an additional requirement to enhance the environment.

A core argument made in Section 2.2.2 is that the philosophy of government and the stakeholder posture adopted by society will have a significant influence on whether it is able to move towards sustainability. This argument stems from the belief that the ultimate rationale of governance is to support and encourage a way of life that recognizes and values human needs and the natural environment, is just and fair, and continually strives to achieve an acceptable balance between civil liberty and regulation.

An important amendment to Rawls's (1971) Theory of Justice is the addition of a third (*environmental*) principle to the two principles of justice. The environmental principle is designed to combine both the social and natural worlds in the decision-making process and is relevant here since it requires either the government or stakeholder groups to act as trustee on behalf of species and the natural environment. The rationale for including species and the environment in the Rawlsian framework is that a "*sustainable society must also be a just society, locally, nationally and internationally, both within and between generations and species*" (Agyeman et al. 2003, p. 3). We need only look to the growing numbers of endangered or extinct species to see the effects of inadequately representing species and the environment in the decision-making process.

It is recognized that on a practical level the process of stakeholder involvement is far more complex than what is described above. For example, knowing when to involve stakeholders (Mostashari 2005), how to identify and include affected groups, and which engagement mechanism to use are not simple decisions. However, our intent here is not to explore each and every nuance of stakeholder participation, but to focus on how stakeholders can be involved in identifying desirable system transformations (or system innovations) towards sustainable development. Two somewhat related techniques that lend themselves to such tasks are *scenario planning* and *backcasting*.[567]

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[567] Two alternative, more localized, visioning techniques of interest include PLACE^{3}S (**PLA**nning for **C**ommunity **E**nergy, **E**conomic and **E**nvironmental **S**ustainability) and CommunityViz. Both techniques use geographical information systems (GIS) and quantitative assessment models to help stakeholders understand the future implications of their current decisions. For more information see: California Energy Commission, *The Energy Yardstick: Using PLACE^{3}S to Create More Sustainable Communities*,

Scenario planning was pioneered during the late 1960s and early 1970s by Royal Dutch Shell as a strategic planning tool (Wack 1985a; 1985b). By using scenarios to create a series of stories about future environments, Shell's strategic planning team was able to inform the *perceptions* of its managers and key decision-makers about how their decisions might play out in the future. Thus, the technique goes beyond the provision of scenarios and attempts to change "*the image of reality in the heads of critical decision-makers*" (Wack 1985b, p. 84). By allowing decision-makers to 'perceive reality,' Shell has been able to respond more effectively to major events such as the oil shocks of the 1970s. The value of scenario planning is that it allows decision-makers to [1] anticipate and better understand risk, and [2] develop strategic options that were previously concealed by incomplete perceptions of reality (Wack 1985a).

Like scenario planning, the roots of backcasting can be traced back to the 1970s. The technique was first proposed by Lovins (1976), who suggested that a better approach to predicting energy futures might be to describe a desirable future and then work 'backwards' to develop a set of policies to realize that future. The basic idea was that the future is a function of prevailing policies and choices. Thus, a strategic change in policy today is likely to influence the future by guiding political, economic, and social systems in a certain direction.

Interestingly, scenario planning and backcasting approach the notion of system transformations/innovation from quite different perspectives. Scenario planning accepts that system transformations are likely to occur, but does not attempt to directly influence them. Instead, it focuses on developing strategies today that will perform well under a range of potential scenarios (or transformations). Backcasting is more proactive in that it purposefully tries to shape system transformations. Given its focus on guiding change, it can be argued that backcasting is a more useful technique for decision-making for sustainable development. To a certain extent, backcasting rejects the 'invisible hand' of a laissez faire economy as an appropriate means through which sustainable development can be achieved (Anderson 2001). Instead, it places importance on the role of government and stakeholders in guiding system transformations. The form of guidance selected will depend upon the roles adopted by government and stakeholders - outlined in the Rawlsian/utilitarian decision-making philosophy - and upon the expected timescale of the transformation.[568]

While the 'traditional' use of scenario planning does not directly attempt to influence the future, there is evidence to suggest that if scenarios are developed by a representative group of leaders from within a nation, the scenarios can have a significant influence on how the future of that nation unfolds (Kahane 2001). In addition to creating a series of

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http://www.energy.ca.gov/places/ (accessed on 04/09/06); and the Orton Family Foundation, *CommunityViz*, http://www.communityviz.com/ (accessed on 04/09/06).

[568] The timescale of a transformation is important since it will indicate whether industry or government should be responsible for guiding the pathway towards sustainable development. It is argued that as the timescale increases, the role of government in guiding the transformation becomes greater - 'indispensable' even (Vergragt 2005). See the related discussions in Sections 2.2.2, 2.3.1, 4.2.3.4, and 4.2.3.5.

stories about how their nation might develop, leaders of government, business, and civil society have a direct interest in shaping the future they desire. Thus, the 'process' of building a scenario can be an important learning experience where leaders can explore how their actions might support a particular future. The end result is that the collective group of decision-makers can take steps to ensure that the more desirable scenarios are supported by their present-day actions. In this regard, the distinction between 'participatory' scenario planning and backcasting becomes blurred. Since backcasting focuses explicitly on shaping the future, the following text looks more closely at this technique.

During the 1990s, the idea of backcasting was used in Sweden and the Netherlands to explore potential solutions to sustainable development (Quist and Vergragt 2004). As Anderson (2001, p. 622) comments, "[t]*he structure and characteristics of the backcasting process are, in many respects, a natural complement to the inclusive and conciliatory ethos of sustainable development. While sustainable development provides a strategic framing of environmental reform, backcasting provides the procedural vehicle for translating subsequent objectives into practical policy initiatives. Or, put another way, the objectives arising from sustainable development provide the macro-targets to be achieved through the evolution of micro-policy initiatives developed within the backcast.*"

While backcasting was not originally designed as a participatory approach to decision-making, Quist and Vergragt (2004, p. 429, emphasis added) make a convincing case of how "***participatory backcasting*** *...*[is] *a novel, innovative and promising approach for long-term strategising for sustainability,* ***based on stakeholder involvement****, construction of normative sustainable futures,* [and] ***stakeholder learning****, in combination with design and analysis activities and construction of follow-up agendas meant for guiding implementation.*"

The concept of participatory backcasting also provides a way in which technological development can become more responsive to the concerns of stakeholders (or citizens). In Section 2.3.2, the case for creating a democratic decision-making process to guide the development of technological systems is made. It revolves around the belief that the rate of technological change is outpacing the ability of government to monitor and guide its progress - meaning that technology is changing without a plan. Further, as technology plays a more dominant role in our lives, it is argued that our freedoms are in some way being inadvertently 'regulated' by technology (Lessig 2000; Sclove 1995; Winner 1977; 1986).[569]

The link between democratic decision-making for technological development, participatory backcasting, and sustainable development seems relatively clear.

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[569] Sclove (1995) presents a set of recommendations that focus on designing technologies that support democracy in communities, employment, and politics (see Box 2.1). In addition, he highlights the importance of creating technologies that support sustainable development. Interestingly, Sclove's (1995) focus on developing technologies that support local economic self-reliance, maintain environmental/social harms within political boundaries, and support ecological sustainability leans heavily towards the notion of *eco-development.*

Participatory backcasting is one mechanism through which technological development can be democratized by the interaction of decision-makers, technology developers, and stakeholder groups. Further, the process of looking back from a shared vision of a sustainable future can be a catalyst for the creation of more sustainable technological systems. "*Participatory backcasting has potential for planning in sustainable development, for identification and exploration of promising sustainable technologies, sustainable system innovations and transitions, for guiding technology choices and for generating alternative more sustainable trajectories for present dominant trends and developments.*" (Quist and Vergragt 2004, p. 429)

In conclusion, public/stakeholder participation is an essential component of sustainable development. While public/stakeholder participation in the environmental decision-making process is now institutionalized in federal government, it is argued that the philosophy of government and stakeholder posture adopted by society can have a significant influence on whether it is able to move towards sustainable development. Further, given the ethical and intergenerational importance of protecting species and the environment, it is argued that either government or stakeholder groups should adhere to the (suggested) *third principle of justice* to adequately represent these groups in the decision-making process. Finally, it is believed that *participatory backcasting* presents a novel way to focus decision-making onto sustainable development and include stakeholders in the process of technological development.

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5 Measuring Sustainable Development (the choice of metrics)

> "*Not everything that can be counted counts, and not everything that counts can be counted*" (Albert Einstein).
>
> "*What gets measured gets done; what gets recognized gets done even better*" (Unknown).

Navigating the field of indicators of sustainable development can be a daunting experience. The purpose of this chapter is to provide some structure to the literature on indicators of sustainable development and to introduce a revised framework of indicators based on the work of the UN Commission on Sustainable Development.

5.1 The Cybernetic Society

At a basic level, the problem of sustainable development can be described using rates/flows, stocks/conditions, and feedback (Sterman 2000). For example, the rate at which a resource is used will directly impact its availability (i.e., stock). As a resource becomes scarce, if this information is fed back into the market its price is likely to rise, increasing its rate of extraction. Using such information as extraction rates, resource stocks, the substitutability of natural resources for produced assets, and available labor and capital, economists have attempted to optimize economic growth (and resource extraction and use) along a weak sustainability pathway (Dasgupta and Heal 1979; Hamilton et al. 1997; Hartwick 1977; Hotelling 1931). If we consider pollution, a similar process can be seen. The rate at which a pollutant is emitted into the environment is likely to have a direct impact on the environment's ability to absorb/dissipate that pollution. If the emission rate is greater than the absorption/dissipation rate, the level of pollution will increase, affecting the condition of the environment and possibly human health. How the level of pollution or condition of the environment is measured is likely to have a direct impact on how the pollution problem is understood and addressed.

In the above examples, indicators play a vital role in providing information on the state of a system. Such information (or system feedback) can inform a society/government of how its actions might be beneficial and/or harmful/unsustainable, enabling adjustments to be made to avoid serious problems and maintain overall societal well-being. What is being described here is a form of *cybernetic society* - a society that is able to achieve its desired objectives/goals in changing circumstances (Cauthen 1975).

The notion of a cybernetic society - as envisioned here - rests upon two basic assumptions. First, government (as trustee of the people) has an implicit role in steering or coercing actions of societal actors. Activities deemed to be harmful (in an economic, social, or environment sense) can be addressed through policy, regulation, and/or law. Second, indicators must be able to measure the right kind of processes/conditions to

enable decision-makers to know whether a system (e.g., an industry, sector, etc.) is operating within tolerable social and environmental limits. Defining such limits, developing a set of indicators to measure them, and creating suitable responses to perceived problems remains an area of intense debate in the realm of sustainable development.

The discourse on indicators of sustainable development is fueled by the fact that different knowledge domains (such as economics, ecology, sociology, psychology, etc.) view sustainable development and hence, sustainability indicators, differently (Simon 2003). Similarly, different societies and cultures place different values on what is deemed acceptable in an environmental, social, and economic sense. If we relate these differences to the discussion in Sections 2.2.1 and 2.2.2, we might say that they occur because we each have our own interpretation of the *social contract*. Further, uncertainty relating to causal chain mechanisms and gaps in information, and differences between how the public and experts perceive information, all combine to make the task of defining, measuring, and responding to perceived problems highly complex (Reiner 2002).

It therefore seems unlikely that there will be one golden set of sustainability indicators that are applicable, or acceptable, to all nations and communities. This realization mirrors the problem with definitions of sustainable development. A solution to this problem is the creation of an overarching framework that can guide indicator development using a 'fitness-for-purpose' approach - i.e., "*using different indicator sets for different purposes. (Although, ... **different** does not mean **unconnected** or **inconsistent***" (Levett 1998, p. 291).

5.2 What is an indicator? How should indicators be developed?

An *indicator* is a tool that quantifies complex physical and social phenomena and presents them in a way that can inform the decision-making process. If designed correctly, indicators can help judge the process of development by highlighting whether it is moving towards or away from desired objectives. One of the more commonly accepted definitions of an indicator is provided by the Organisation for Economic Co-operation and Development (OECD 1993; 2002; 2003).

> "*Indicator: a parameter, or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment/ area, with a significance extending beyond that directly associated with a parameter value.*
> *Index: a set of aggregated or weighted parameters or indicators.*
> *Parameter: a property that is measured or observed*" (OECD 2003, p. 5).

When considering an indicator, it is useful to make the distinction between *component*, *composite*, and *determinant/derived* indicators. Each of these types of indicators differs in its degree of specificity and often in its quantifiability. **Component indicators** measure only one factor/value - e.g., concentrations of CO_2, NO_x, SO_x, etc. **Composite indicators** (or indexes) are created by combining two or more component indicators - e.g., a

composite indicator of 'good' or 'bad' air quality combines a series of air quality indicators. **Determinant/derived indicators** provide a more collective or integrative way to describe a concern 'determined' or 'derived' from other, more specific component and composite indicators. For example, a determinant indicator of human health is determined or derived, in part, from more specific indicators such as malnutrition and access to clean water.

The general criteria used to select an indicator are *simplicity, policy relevance, analytical soundness,* and *measurability* (Levett 1998; OECD 2002).[570] Indicators should also be *directionally safe* - i.e., the intent of the indicator is clear and of direct importance to the property being measured (Spangenberg and Bonniot 1998).

To be useful in the policy realm, indicators need to capture the state of a system, track changes over time, and monitor the forces/pressures that can affect the state of a system. Thus, linking specific indicators to pressing policy issues creates a useful political tool that can indicate how a prevailing condition might respond, or is responding to, a new policy initiative.

While the decision to use a particular type of indicator is somewhat arbitrary, it is influenced by the policy instruments and character of the programs to be investigated. For example, detailed component indicators might be necessary to measure 'good' or 'bad' air quality. On the other hand, an indicator such as total waste generated does not necessarily require sub-specification. Thus, the choice of a particular kind of indicator is dictated by practicality and policy relevance, and also the ease or difficulty of measuring any one of the three types of indicators - i.e., *component, composite,* or *determinant/derived.*

In a report to the Prime Minster of Canada, Hodge et al. (1995) state that the main objective of developing a system to monitor and assess progress towards sustainable development is to enhance the decision-making process. The provision of good quality information lies at the center of such an initiative. More specifically, Hodge et al. (1995) argue that the following goals apply to the creation of a (proactive) sustainable development indicator system:

— "*to contribute to improved decision-making and reduced risk by providing early warning signals for required policy and behavioural changes;*
— *to ensure accountability;*
— *to encourage initiative by recognizing success when it is achieved;*
— *to facilitate continuous learning and adjustment on the part of all stakeholders; and*
— *to identify knowledge gaps and suggest priorities for filling these gaps.*" (Hodge et al. 1999, p. 1)

There has been much discussion on the process of developing indicators (Bossel 1999; Innes 1990; Meadows 1998). In addition to creating indicators that are policy relevant, Innes (1990) provides a convincing case that indicators should be developed through a

[570] See Meadows (1998), Moldan et al. (1997), and Hardi and Zdan (1997) for an extended list of criteria used to develop and select indicators.

combination of expert and non-expert knowledge, combining shared social values and knowledge with robust technical data. Thus, stakeholder involvement is critical. "*Influential indicators reflect socially shared meanings and policy purposes as well as respected technical methodology*" (ibid, p. 4). While the measurement of social values can be difficult to quantify, a failure to bring both quantitative and qualitative forms of measurement together can seriously undermine the effectiveness of research focusing on sustainable development (Palys 1997).

A major problem that can undermine efforts to develop indicators is the inherent *subjectivity* that is present in the selection of indicators and the evaluation of the data they present (Bossel 1999). Overcoming this problem is difficult; however, using indicator systems that adopt systematic and reproducible processes is clearly important. Another problem with indicator development is the availability of information. This leads to a situation where indicators measure "*what is measurable, rather than what is important*" (Meadows 1998, p. 4). Meadows (1998) also discusses problems of *overaggregation* (whereby too many factors are pulled together), the *falsification* of data, and *overconfidence* in the output from indicators.

One of the most comprehensive sets of principles created to assess progress towards sustainable development was prepared by the International Institute for Sustainable Development (IISD) (Hardi and Zdan 1997). Known as the *Bellagio Principles*, this list covers all of the key issues discussed above and provides clear descriptions of how to measure and assess progress toward sustainable development (Box 5.1).

Box 5.1: The Bellagio Principles

1. **GUIDING VISION AND GOALS**

   Assessment of progress toward sustainable development should:

   — be guided by a clear vision of sustainable development and goals that define that vision

2. **HOLISTIC PERSPECTIVE**

   Assessment of progress toward sustainable development should:

   — include review of the whole system as well as its parts

   — consider the well-being of social, ecological, and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts

   — consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, in monetary and non-monetary terms

3. **ESSENTIAL ELEMENTS**

   Assessment of progress toward sustainable development should:

   — consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate

   — consider the ecological conditions on which life depends

   — consider economic development and other, non-market activities that contribute to human/social

Box 5.1: The Bellagio Principles

well-being

4. ADEQUATE SCOPE

Assessment of progress toward sustainable development should:

— adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision-making

— define the space of study large enough to include not only local but also long distance impacts on people and ecosystems

— build on historic and current conditions to anticipate future conditions - where we want to go, where we could go

5. PRACTICAL FOCUS

Assessment of progress toward sustainable development should be based on:

— an explicit set of categories or an organizing framework that links vision and goals to indicators and assessment criteria

— a limited number of key issues for analysis

— a limited number of indicators or indicator combinations to provide a clearer signal of progress

— standardizing measurement wherever possible to permit comparison

— comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate

6. OPENNESS

Assessment of progress toward sustainable development should:

— make the methods and data that are used accessible to all

— make explicit all judgments, assumptions, and uncertainties in data and interpretations

7. EFFECTIVE COMMUNICATION

Assessment of progress toward sustainable development should:

— be designed to address the needs of the audience and set of users

— draw from indicators and other tools that are stimulating and serve to engage decision-makers

— aim, from the outset, for simplicity in structure and use of clear and plain language

8. BROAD PARTICIPATION

Assessment of progress toward sustainable development should:

— obtain broad representation of key grass-roots, professional, technical and social groups, including youth, women, and indigenous people - to ensure recognition of diverse and changing values

— ensure the participation of decision-makers to secure a firm link to adopted policies and resulting action

9. ONGOING ASSESSMENT

Assessment of progress toward sustainable development should:

— develop a capacity for repeated measurement to determine trends

— be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently

— adjust goals, frameworks, and indicators as new insights are gained to promote development of

Box 5.1: The Bellagio Principles

collective learning and feedback to decision-making

10. INSTITUTIONAL CAPACITY

Continuity of assessing progress toward sustainable development should be assured by:

— clearly assigning responsibility and providing ongoing support in the decision-making process

— providing institutional capacity for data collection, maintenance, and documentation

— supporting development of local assessment capacity

Source: (Hardi and Zdan 1997, pp. 2-4).

5.3 The Influence of Indicators on Policy Agendas

Indicators can have a powerful influence on the future direction of political agendas. The question of how indicators, or scientific assessments, impact policy choice is addressed by Clark et al. (2002). They argue that instead of having an immediate impact, influential assessments tend to "*exert substantial indirect influence on long term issue development*" (ibid, p. 6). This raises the question of how indicators can be used to influence 'agenda setting' rather than immediate policy action. Clark et al. (2002, p. 7) argue that "[t]*he most influential assessments* [or sets of indicators] *are those that are simultaneously perceived by a broad array of actors to possess three attributes: saliency, credibility and legitimacy. ...*

...

- ***Saliency*** *reflects whether an actor perceives the assessment to be addressing questions relevant to their policy or behavioral choices;*
- ***Credibility*** *reflects whether an actor perceives the assessment's arguments to meet standards of scientific plausibility and technical adequacy; and*
- ***Legitimacy*** *reflects whether an actor perceives the assessment as unbiased and meeting standards of political fairness.*"

Given that agency budgets are often constrained, an argument can be made that indicators that meet the above attributes will be more likely to influence an agency's agenda. Thus, designing a set of indicators using these three attributes makes sense from a political perspective if the objective is to stimulate change.

A challenge that Clark et al. (2002) recognize, however, is that any attempt to enhance one attribute tends to weaken one of the others. Further, the *embeddedness* of an assessment or set of indicators within an agency can also affect its ability to influence an agenda.[571] For example, if an agency is solely responsible for developing and producing a set of indicators (i.e., the indicators are *strongly embedded* in the organization), the

[571] Bauler (2004) makes the argument that institutional embeddedness is a precondition to legitimacy, credibility, and salience. He suggests that if indicators are embedded within (or belong to) an agency, they are more likely to succeed in influencing the direction of policy-making since they can relate directly to projects/initiatives and influence the decisions of actors. The corollary to embeddedness, however, is that the institutionalization of data and indicators can make it difficult for agencies to adjust to new circumstances and changing public values (Innes 1990).

agency might be seen as responding to political influence and the indicators may lose legitimacy. However, if an agency has a reputation for producing high quality data and/or develops the indicators through a consultation process, the reverse might be true. In this case the indicators might have a high level of legitimacy *and* saliency. Thus, policy relevance and utility to users are vital attributes that indicators must possess if they are to establish an environment for change.

5.4 Indicator Development during the 21st Century

The creation of indicators of sustainable development can be placed at the end of a long history of indicator development that emerged during the twentieth century (Hodge 1995; 1997; Hodge et al. 1999; Innes 1990) - see Table 5.1.

Table 5.1: Timeline of Indicator Development

Decade Indicator Work Began	Type of Indicators
1940s - 1950s	Economic
1960s	Social; Quality of Life
1970s	Environmental and Natural Resource; Health Information Systems; [Health and Safety]
1980s	Healthy Communities
1990s - 2000s	Sustainable Development

Source: Adapted from Hodge (1995; 1997).

In the U.S., early work on indicators focused on social and economic measures, beginning with the publication of a Presidential Committee report in 1933 on *Recent Social Trends* and the release of the first set of National Income Product Accounts (NIPA) in 1934 (which included the well-known measure of gross domestic product) (Flynn et al. 2002) - see Table 5.2. As the environmental movement began to emerge during the 1960s/1970s,[572] these indicators were supplemented with the environmental and worker health and safety measures that generally accompanied new legislation. At this point in time, the development of indicators tended to remain within the disciplinary

[572] While the focus here is on social indicators, it should be noted that the roots of the environmental movement in the U.S. can be traced back to the turn of the 20th century to the presidency of Theodore Roosevelt (the 26th president of the United States, 1901 - 1909). President Roosevelt is often credited as being both a politician and a conservationist. In 1906, he signed the Antiquities Act that gave the President the power to declare "*landmarks, historic and prehistoric structures, and other objects of historic or scientific interest*" as national monuments. Between 1906 and 1978, twelve presidents invoked the Antiquities Act to establish 38 'historic and prehistoric' and 61 'natural' monuments. During Roosevelt's presidency the national forest reserves increased from 46 to 150 million acres and the number of national parks increased from five to sixteen. Sources: National Park Service, *American Antiquities Act of 1906*, http://www.cr.nps.gov/local-law/anti1906.htm (accessed on 04/09/06); and John, J. S. (1996) *The 1890 Census and the Roosevelt Presidency*, http://xroads.virginia.edu/~CAP/NPS/nps3.html (accessed on 04/09/06). See the top-down model of environmentalism described in Section 3.1.

confines of economics and social and environmental sciences, with limited integration between them (Flynn et al. 2002).

With the emergence of sustainable development during the 1970s/1980s came the need for more holistic indicators that were capable of measuring progress at a system - rather than a domain/sector - level (Hodge 1997; Hodge et al. 1999). The Brundtland report, *Our Common Future*, laid the foundation for these indicators by arguing that economic measures alone are an inadequate measure of social well-being (WCED 1987). It called for the creation of an overarching framework to integrate economic, environmental, and social concerns relating to human development. This call was later reinforced at the 1992 Rio Conference by *Agenda 21*, which recognized the need to provide 'information for decision-making.'[573] The intent of Agenda 21 was to encourage governments, as well as international governmental and non-governmental organizations, to develop a series of indicators for sustainable development that would form the building blocks for decision-making at all levels. Emphasis was placed on *harmonizing* the indicators across geographic levels and on creating a set of indicators at the international level that would be made widely available and kept up to date.[574]

While the U.S. has yet to adopt an official set of national sustainable development indicators, a recent report by the Government Accountability Office (GAO 2004) reveals a Congressional interest in establishing better information systems for decision-making. The report documents existing 'topical indicators systems' - originally designed to measure "*specific or related sets of issues, such as health, education, public safety, employment, or transportation*" (ibid, p. 5) - and looks at the idea of creating a *comprehensive key indicator system*. The basic premise would be to aggregate important information found in existing topical indicator systems to provide a coherent set of information relating to economic, social and cultural, and environmental concerns.

From the rich history of indicator development, a wide variety of indexes/indicator frameworks relating to sustainable development have emerged over the past decade. The box on the right of Figure 5.1 presents a number of ways in which these indexes/indicator frameworks can be categorized. The pyramid on the left depicts the hierarchical nature of indicators and indexes. As we move up the hierarchy, the scale and complexity of the underlying data set is reduced through a process of compression and screening until single indexes are reached (Spreng and Wils 1996). Of course, each time data is manipulated into a more manageable form the problem of 'unavoidable subjectivity' arises (Bossel 1999). The typology of indicator frameworks presented in Figure 5.1 is used in the following section to help structure a review of existing indicator initiatives.

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[573] The task of creating national indicators of sustainable development was recently reaffirmed in the Johannesburg Plan of Implementation adopted at the UN World Summit on Sustainable Development in 2002.

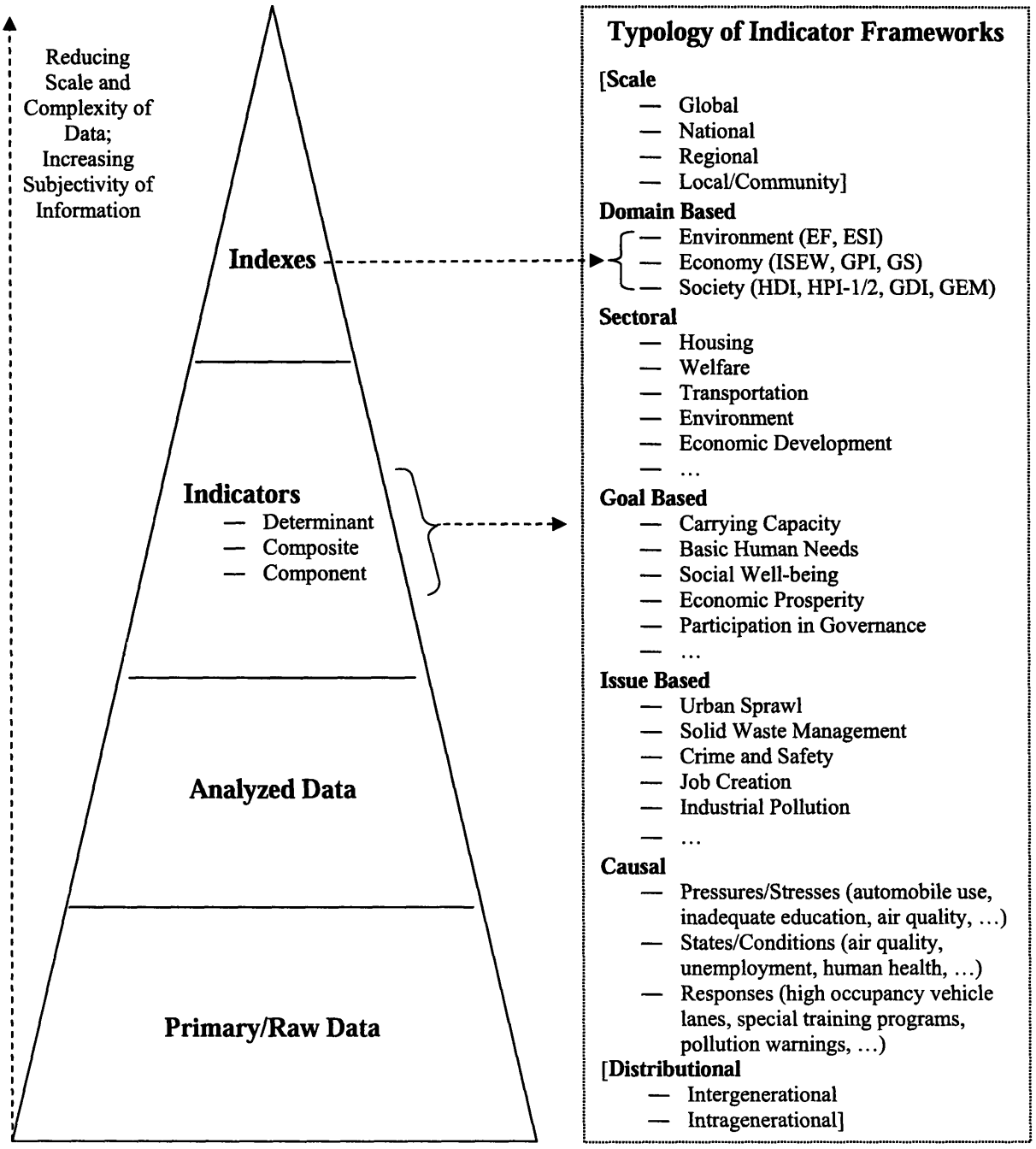
[574] Section 5.6 looks specifically at the work of the OECD and UN and presents the latest set of indicators produced by the UN Commission on Sustainable Development (UNCSD).

Table 5.2: Key Factors Influencing Indicator Development in the U.S. during the 20th Century

Economic	Social	Environmental	Sustainable Development
1934 - *National Income and Product Accounts (NIPA)*, Department of Commerce	**1933** - *Recent Social Trends in the United States*, President's Research Committee on Social Trends		
1946 - Employment Act			
1947 - *The Economic Report of the President to the Congress*, Council of Economic Advisors			
		1963 - Clean Air Act	
		1965 - Water Quality Act	
1970 - *Red Book*, Federal Reserve	**1970** - Occupational and Safety Health Act (OSH Act)	**1970** - NEPA (National Environmental Policy Act)	
	1970 - *Toward a Social Report*, Department of Health, Education and Welfare	**1972** - Stockholm Conference	
		1973 - The Endangered Species Act (ESA)	
	1976 - The Toxic Substances Control Act (TSCA)	**1976** - The Resource Conservation and Recovery Act (RCRA)	
1983 - *Beige Book*, Federal Reserve		**1980** - The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	**1987** *Our Common Future* - World Commission on Environment and Development
	1996 - The Food Quality Protection Act (FQPA)		**1992** - UN Conference on Environment and Development
			1992 - *Agenda 21*
			1998 - *Sustainable Development in the United States: An Experimental Set of Indicators*, SDI Group (updated in 2001)
			2002 - UN World Summit on Sustainable Development
			2004 - *Informing Our Nation: Improving How to Understand and Assess the USA's Position and Progress*, GAO

Note: Table includes key *publications*, conferences, and U.S. legislation.

Source: Adapted from Flynn et al. (2002).



Source: Adapted from Spreng and Wils (1996).

Source: Adapted from Maclaren (1996).

Figure 5.1: Typology of Frameworks for Indexes/Indicators of Sustainable Development

5.5 Indexes and Indicator Frameworks of Sustainable Development

The most comprehensive list of indicator initiatives relating to sustainable development can be found in the International Institute for Sustainable Development's (IISD's) *Compendium of Sustainable Development Indicator Initiatives.*[575] The compendium lists over 600 initiatives that range in scale from international to community-focused indicator projects.

This section focuses on national-level indicator initiatives since the final objective is to develop a set of indicators that can be used to assess the sustainability of U.S. surface transportation (see Section 6.4).

Using the typology presented in Figure 5.1, Box 5.2 displays a wide range of (mostly) national-level indicator initiatives designed to measure progress towards sustainable development. The list is somewhat hierarchical, with *indexes* shown first followed by *holistic indicator frameworks.* The next three groups - *partial sets of indicators, causal indicator frameworks,* and *issue based indicators* - cover certain topics/issues in more detail than is practical in the holistic indicator frameworks. In the next category - *project based/distributional indicators* - the project listed is not a national-level initiative, but has been included as a good example of how indicators could be developed to measure intragenerational entitlements and intergenerational options. The final category lists a number of *national indicator frameworks* developed to measure sustainable development.

[575] See the International Institute for Sustainable Development (IISD), *Compendium of Sustainable Development Indicator Initiatives,* http://www.iisd.org/measure/compendium/ (accessed on 04/09/06). For a list of U.S. focused indicator initiatives, see the Key National Indicators Initiative (led by the U.S. Government Accountability Office and the National Academies), *Comprehensive Indicator Efforts,* http://www.keyindicators.org/Comprehensive_Indicator_Efforts.html (accessed on 04/09/06), and the Sustainable Development Indicators (SDI) project, http://www.sdi.gov/ (accessed on 04/09/06). Also see Murcott (1997) for a useful list of indicators of sustainable development.

Box 5.2: Sustainable Development Indicator Initiatives

INDEXES

Environmental

— Environmental Sustainability Index (ESI) - (Esty et al. 2005)
— Living Planet Index (LPI) - (WWF 2004) [576]

Social

— Human Development Index (HDI) - (UNDP 2004)
— Human Poverty Index for developing countries (HPI-1) and selected OECD countries (HPI-2) - (UNDP 2004)
— Gender-related Development Index (GDI) - (UNDP 2004)
— Gender Empowerment Measure (GEM) - (UNDP 2004)
— Subjective Well-Being (SWB) - (Diener and Suh 2000; Diener et al. 1997)

Economic [577]

— Index of Sustainable Economic Welfare (ISEW) - (Daly and Cobb 1994)
— The Genuine Progress Indicator (GPI) - (Venetoulis and Cobb 2004)
— Genuine Savings (GS) - (Dietz and Neumayer 2004; World Bank 2001)

HOLISTIC INDICATOR FRAMEWORKS

— UN Commission on Sustainable Development, Theme Indicator Framework - (UNCSD 2005)
— Millennium Development Goals (MDGs) - (UNDESA 2004)
— World Bank Key World Development Indicators - (World Bank 2004)
— WRI EarthTrends Database - (WRI 2004)
— World Resources 2002 - 2004 Report - (UNDP et al. 2004)
— Vital Signs 2003 - (Worldwatch Institute 2003)
— Sustainability Impact Assessment (SIA) - (EC 2004b)
— Calvert-Henderson Quality of Life Indicators - (Henderson et al. 2000)
— Indicators and Information Systems for Sustainable Development - (Meadows 1998)
— Pathways to Sustainable Industrial Transformations - (Ashford et al. 2002)

PARTIAL SETS OF INDICATORS

Environment

— EU Environment Related Indicators 2004 - (EC 2004a)

Social

— LABORSTA Internet - (ILO 2005)

CAUSAL INDICATOR FRAMEWORKS

Environmental

— Stress-Response Environmental Statistical System - (Rapport and Friend 1979)
— Pressure-State-Response (PSR) - (OECD 1993; 2003)
— Driving Force-State-Response (DSR) - (UNDSD 1996; UNEP and DPCSD 1995)
— Driving Force, Pressure, State, Impact, Response (DPSIR) - (European Commission and EUROSTAT 1999)

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[576] The Living Planet Index (LPI) might also be considered as an 'indicator' since it tracks the total increase/reduction in the population of 1,100 different types of vertebrate species.

[577] While ISEW, GPI, and GS are expressed in monetary terms (and ISEW/GPI are called 'indicators'), they are considered under the 'index' heading since only part of their calculation is based upon real market prices (OECD 2002). The remainder is synthesized through a number of reasoned adjustments that reflect assumptions about whether a certain category of spending or investment enhances or degrades well-being/total capital stock.

Box 5.2: Sustainable Development Indicator Initiatives

ISSUE BASED INDICATORS

- Ecological Footprint (EF) - (Wackernagel and Rees 1995; 1997)
- Eco-Efficiency - (Factor 10 Club 1995; 1997; Moser 1999; Reijnders 1998; Schmidheiny 1992; Von Weiszacker et al. 1997)
- Urban Sprawl - (Ewing et al. 2002)
- Four Capital Model (Natural, Human-made, Human, and Social Capital) - (World Bank 1997)

PROJECT BASED/DISTRIBUTIONAL INDICATORS

- Sustainable Development Indicators for Fraser River Basin, British Columbia (Gustavson et al. 1999)

SELECTED NATIONAL INDICATOR FRAMEWORKS

- Canada: Sustainability Indicators Initiative - (NRTEE 2003)
- UK: Headline Indicators of Sustainable Development - (DEFRA 2004)
- UK and Devolved Administrations: UK Framework Indicators - (DEFRA 2005a)
- U.S.: Sustainable Development in the United States: An Experimental Set of Indicators - (SDI Group 2001)
- U.S. EPA: Green Communities Indicators (EPA 2005a; 2005b)

5.5.1 Partial Sets of Indicators

As discussed in Section 5.4, the development of indicators began within the disciplinary confines of economics and social and environmental sciences. Therefore, much of the early indicator work led to the creation of partial sets of indicators designed to explore subsets of larger systems. Since the concept of sustainable development grew from the environmental movement (see Chapter 3), environmental concerns have a prominent role in most partial sets of indicators focusing on sustainable development - regardless of their disciplinary base.

While there is value in partial sets of indicators, they suffer from two potential drawbacks (Simon 2003). First, partial sets of indicators can lead to partial solutions to problems. If a set of indicators measures emissions from mobile sources, for instance, solutions to poor air quality might focus on improving vehicle technology (e.g., through more stringent emission regulations) or changing travel behaviour (e.g., through congestion charging). Both responses are likely to result in different outcomes which - while reducing emissions - may or may not support progress towards sustainable development. For example, more efficient vehicles are not likely to reduce congestion levels and congestion charging schemes might unfairly impact lower income groups. In addition, since only air quality is being measured, other related concerns such as urban sprawl or resource consumption (related to the manufacture of vehicles) might not be considered, thereby missing opportunities to co-optimize (or integrate) solutions.

The latter point highlights the second weakness of partial sets of indicators. If a series of independent sets of indicators fails to reveal important links between environmental,

social, and economic concerns, more holistic indicator frameworks are needed to capture the dynamics of the larger system.

5.5.2 Indexes/Holistic Indicators

The need for a simple measure of whether human activities are progressing towards sustainable development has led to the creation of a number of sustainable development-related indexes. It is possible to categorize these indexes by environmental, social, and economic concerns (Box 5.2). However, this categorization only identifies the domain in which the index tends to be used. It does not provide any information on the indicators used to calculate the index, which might integrate a variety of environmental, social, and economic measures.

With the growing interest in preserving the integrity of the environment, many indexes focus on providing a measure of the *condition* of the environment (along with trends). In contrast, others attempt to measure whether development activities/trends are likely to be sustainable into the *future*. The Living Planet Index (LPI) is a good example of the former (WWF 2004). It measures changes in the population of some 1,100 vertebrate species, providing an indication of the impact of human activity on their habitats. The Environmental Sustainability Index (ESI) provides a good example of the latter type of index (Esty et al. 2005). By combining a wide range of national-level socioeconomic, environmental, and institutional indicators, the ESI calculates the relative likelihood that a nation will be able to maintain or enhance its environmental condition over the next several generations.[578]

If we consider economic welfare, perhaps the most well-known measures of overall societal progress are gross national product (GNP) and gross domestic product (GDP). However, GNP/GDP were originally developed during the 1940s - with the formation of Systems of National Accounts (SNA) throughout the world - to measure *total economic output* (Hodge 1997; Neumayer 2004; Vanoli 2004). Since total economic output does not distinguish between 'good' and 'bad' forms of spending, take foregone opportunities into account (i.e., option values), consider non-market goods and services, or account for unpaid work and leisure activities, it is clearly not an accurate measure of economic welfare (Glasser and Craig 1994). Thus, there have been a number of attempts to adjust (or 'green') the calculation of GNP/GDP to provide a better indication of progress. Two prominent examples are the Index of Sustainable Economic Welfare (ISEW) (Daly and Cobb 1994) and the more recent Genuine Progress Indicator (GPI) (Venetoulis and Cobb 2004). Using the principle of 'weak sustainability' as a guide,[579] the ISEW/GPI first adjusts GNP to account for unequal income distribution using the Gini coefficient. It then

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[578] See Jha and Murthy (2003) for a critique of the 2002 ESI and Appendix H, '*Critiques and Responses*,' of Esty et al. (2005) for a discussion of strengths and weaknesses of the 2005 ESI.

[579] We recall that *weak sustainability* implies that the total stock of natural, human-made, human, and social capital remains constant over time. For this to happen, it is assumed that human-made capital can replace natural capital and human and social capital can be maintained by investment in education, health, and other forms of social services.

adds or subtracts a number of different elements to account for ecological and social benefits or costs.[580]

Over the past decade, the ISEW/GPI has been developed for a number of nations - including Australia, Austria, Chile, Germany, Italy, the Netherlands, Scotland, Sweden, Thailand, the UK, and the U.S. (Neumayer 2004). In each case, the ISEW/GPI appears to increase up until around 1970/1980 (depending on the nation), after which it levels off or declines. Over the same period, GNP continues to increase, thereby widening the gap between perceived and actual human welfare. Max-Neef (1995) referred to these trends as evidence of his '*Threshold Hypothesis*:'

> "*for every society there seems to be a period in which economic growth (as conventionally measured) brings about an improvement in the quality of life, but only up to a point - the threshold point - beyond which, if there is more economic growth, quality of life may begin to deteriorate*" (Max-Neef 1995, p. 117).

While many see the ISEW/GPI as a valuable tool to broaden policy prescriptions beyond a reliance on economic growth (Clarke 2004; Hamilton 1999; Lawn 2003; Patterson and Jollands 2004), others point to its methodological problems and question whether there is in fact a growing gap between ISEW/GPI and GNP (Neumayer 2000). Levett (1998, p. 297) even goes so far to say that "*as soon as we try to modify GDP to bring it closer to some conception of welfare ... we are back to subjectivity in deciding which things need to be added to and subtracted from GDP, and how they should be measured and weighted.*" An alternative to ISEW/GPI that is not as vulnerable to these types of criticisms is the measure of Genuine Savings (GS).

The notion of Genuine Savings (GS) was developed by Hamilton (1994; 2000) while working in the World Bank's Environment Department (Hamilton et al. 1997). GS (also referred to as *Adjusted Net Savings*) is an annual measurement of *changes* in national wealth, where 'national wealth' is defined as the total amount of natural, human-made, and human capital (Bolt et al. 2002). Thus, GS does not account for changes in social capital, which one could argue that the ISEW/GPI attempts to consider through measures such as 'defensive expenditures' and the cost of divorces, crime, and lost leisure time (Venetoulis and Cobb 2004). Interestingly, the World Bank (1997) has argued that social capital is the 'missing link' in the creation of a more accurate measure of sustainable development. However, difficulty in finding a suitable indicator for social capital has resulted in it not being included in the GS calculation.

A positive GS value indicates that the total stock of capital is increasing.[581] A zero GS value indicates no change, and a negative value means that total national wealth is in decline. Thus, a negative GS provides a signal that a nation's activities are (potentially)

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[580] For more information on the GPI for the U.S., see Appendix A.

[581] Hueting and Reijnders (2004) list a number of conditions that must hold for a positive GS to signal a weak form of sustainable development. Possibly one of the most important conditions is that GS ≥ 0 for the entire time series and not just for the year of the analysis. Another important condition is that technology can only substitute *non-renewable* resources and cannot replace nature (Hueting and Reijnders 1998).

unsustainable. Here, 'unsustainable' is defined in relation to the Hartwick-Solow 'weak sustainability' principle. A simple formula that clearly describes the GS is as follows (Dietz and Neumayer 2004, p. 227):

Genuine Savings = net investment in produced capital
- net depreciation of natural capital
+ investment in human capital

In general, neo-classical economists appear more comfortable with GS than ISEW/GPI since it is based on the already-familiar system of national accounts and avoids the more subjective elements included in the ISEW/GPI. In addition, Bolt et al. (2002, p. 4) argue that "*adjusted net savings* [or GS] *seeks to offer policymakers who have committed their countries to a 'sustainable' pathway a badly needed, first-approximation indicator to track their progress in this endeavor.*"

Those who reject the GS as a suitable measure of sustainable development also reject the ISEW/GPI on the grounds that it violates the principle of strong sustainability. We recall that for strong sustainability to be achieved there can be no depreciation in the stock of natural capital. Thus, human-made capital cannot replace natural capital, since the former relies upon the latter, and, more importantly, it is simply not possible for human-made capital to replace the life support systems of the planet (Hueting and Reijnders 1998). Strong sustainability also implies that non-renewable resources cannot be depleted. If such a constraint were applied to modern production systems it would most likely force a drastic re-conceptualization of what is meant by 'manufacturing' and 'industrialization.' Therefore, its advocates have weakened this constraint somewhat to allow for systems that *minimize* the use of finite terrestrial resources (i.e., low entropy matter and energy) as part of a 'steady-state economy' (Daly 1991).

In a recent article, Hueting and Reijnders (2004) recognize that it is 'theoretically' possible to increase production and consumption and maintain natural capital. However, such a scenario would require the creation of technologies that are

(i) "*sufficiently clean,*
(ii) *do not deplete renewable natural resources,*
(iii) *find substitutes for nonrenewable resources,*
(iv) *leave the soil intact,*
(v) *leave sufficient space for the survival of plant and animal species and*
(vi) *are cheaper in real terms than current available technologies, because if they are more expensive in real terms, growth will be checked*" (Hueting and Reijnders 2004, p. 252).

Given the stringency of these requirements, they conclude that "[m]*eeting all these six conditions is scarcely conceivable for the whole spectrum of human activities*" (ibid, p. 252).

A holistic indicator that can be used to measure strong sustainability is the notion of an *Ecological Footprint* (EF).[582] Developed by Wackernagel and Rees (1995; 1997), the metric attempts to translate human activity into the corresponding ecological area required to sustain that activity (Wackernagel 2001; Wackernagel et al. 2004). More specifically, an ecological footprint "*represent*[s] *the biologically productive area required to produce the food and wood people consume, to supply space for infrastructure, and to absorb the greenhouse gas carbon dioxide (CO_2) emitted from burning fossil fuels*" (Wackernagel et al. 2002). Thus, EF is based upon the idea of environmental carrying capacity - i.e., the total rate at which renewable resources can be produced (or regenerated) and waste (such as CO_2) can be absorbed in sinks.

The problem with using EF as a measure of sustainable development is that it does not consider the interactions between the various system components, thereby ignoring important processes that can dramatically affect carrying capacity (Becker 1997; Hueting and Reijnders 2004). In addition, van den Bergh and Verbruggen (1999) provide a valuable critique of EF from a public policy perspective. They argue that EF fails to reveal the underlying causes of environmental overshoot or provide adequate policy solutions to problems. Further, EF ignores international/regional trade, thereby making an implicit assumption that national/regional self-reliance is a desired objective.

A final index worth mentioning is the Human Development Index (HDI), discussed in Section 2.1.3. The HDI and the four additional indexes that measure forms of equality are a good counterweight to the above indexes, which focus more on environmental and economic concerns.

In general, the socially-oriented indexes tend to ignore environmental and economic sustainability and focus more on issues such as human well-being - e.g., the HDI does not consider environmental factors (Neumayer 2004). In contrast, indexes located under the *economic* and *environmental* sub-headings tend to monitor development trends by measuring total stocks of one or more forms of capital, and place less emphasis on (*current*) human well-being (ibid).[583] Genuine Savings (GS) perhaps provides the best example of a measure that indicates whether sufficient investment is being made to ensure that *future* generations will have the same level of national wealth as the current generation.

For each of the indexes discussed above it is possible to find arguments that either support or discredit the measurement. On the one hand, proponents argue that the informative power of indexes outweighs any potential methodological or subjectivity problems embedded in their calculation. The political support given to GDP as *the*

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[582] A similar type of holistic indicator not discussed here is maximum suitable yield (MSY). MSY provides a measure of the maximum long-term average yield that can be taken from a renewable resource (such as a fishery or forest). If the maximum yield is exceeded, the ability for the resource to renew itself through natural growth/replenishment is affected, reducing its ability to 'carry' human activities.

[583] The term 'well-being' could be replaced with 'welfare' or 'utility,' which can be defined "*as the satisfaction of human preferences*" (Neumayer 2004, p. 1).

measure of progress (and human welfare) is often cited as an example of the need to present countermeasures that measure real progress towards sustainable development.

On the other hand, opponents of indexes argue that the subjective selection of indicators (from one or more domains of sustainable development) that are adjusted and aggregated into a single value makes the final output difficult to use in a meaningful way (Becker 1997). Further, combining indicators that measure both short- and long-term concerns and processes hides difficult decisions associated with intergenerational equity.

> "*There is undeniably a serious conflict between the wishes regarding production in the short term and the wishes not to jeopardise the living conditions of future generations. By adding elements reflecting these conflicting goals together in a sustainability indicator, the danger arises that inevitable choices are concealed. This hampers an open decision-making process in the course of which the inevitable sacrifice of either less sustainability or—more likely—less production in the short run is not hidden*" (Hueting and Reijnders 2004, p. 254).

It seems clear that while all the indexes relating to sustainable development have some form of shortcoming, they serve a valuable role in raising public awareness about unsustainable development patterns. However, since indexes do not reveal the *processes* that are driving unsustainable trends, it would seem unwise to base a decision-making process solely upon them.

5.5.3 Holistic Indicator Frameworks

One way to address the concerns with indexes and holistic indicators is to disaggregate the issue(s) being measured into a framework of indicators. If carefully designed, such indicator frameworks can monitor the drivers that are affecting a system and also reveal links that exist between key indicators. It appears that the approach taken in the creation of an indicator framework depends upon the scope of what is being measured.

In the early 1990s, the OECD led the development of the Pressure-State-Response (PSR) framework (discussed in detail below) that has since become the cornerstone of numerous indicator initiatives focusing on environmental concerns (OECD 1991; 1993). Using the PSR model as a base, the UN launched an ambitious project to create an indicator framework that extended the OECD model to include social, economic, and institutional concerns (UNDSD 2001b). However, following a number of national trials, it proved too difficult to establish robust causal links between the 'pressures' that were affecting the 'state' of social and economic factors. To address this problem the UN adopted an approach that aligned the selection of indicators with national decision-making processes using a theme/sub-theme framework. The history behind the development of both of these frameworks is discussed in detail in the following section.

The above examples highlight an important characteristic of holistic indicator frameworks - *policy relevance*. The strength of these frameworks is that they can monitor critical trends relating to sustainable development and guide policy decisions to ensure,

for instance, that thresholds or limits are not exceeded or human welfare is improved (Levett 1998). In addition, an indicator framework can be used to measure the effectiveness of policy interventions across a wide range of issues beyond the direct concern(s) being addressed. This provides the opportunity for decision-makers to track any unintended consequences of their actions.

A potential drawback of indicator frameworks, however, is the ease at which they can degenerate "*into a collection of long 'laundry lists' of variables or into compendiums of historical statistical data*" (Gustavson et al. 1999, p. 118). Another problem is the inherent complexity of deciding how to address an array of related problems that span geographic, political, and sectoral boundaries. Notwithstanding these concerns, indicator frameworks have tended to avoid the level of controversy generated by indexes and holistic indicators (Simon 2003), and have been endorsed by a number of international organizations and national governments as a suitable decision-support tool for sustainable development. For these reasons, the following sections take a closer look at the OECD and UN frameworks to obtain a better understanding of how the indicator sets are developed. While Box 5.2 lists a wide variety of indicator frameworks, the OECD and UN frameworks were selected as they have been widely used as the basis for many other indicator initiatives (OECD 2002). In addition, the UN framework aligns well with the conceptualization of sustainable development discussed throughout Chapter 3.

5.6 A Closer Look at the OECD and UNCSD Indicator Frameworks

The catalyst behind much of the research into indicators for sustainable development can be traced back to the OECD and the 1992 UN Conference on Environment and Development.

In 1989, the OECD Council called for the integration of environmental and economic decision-making that was reaffirmed by the G-7 summits in Paris (1989) and Houston (1990) (OECD 1997; 2003). Two years later, the 'Council Recommendation on Environmental Indicators and Information' was approved by OECD governments and asked for the development of "*core sets of reliable, readable, measurable and policy-relevant environmental indicators*" (OECD 2003, p. 20). In 1993, the OECD released its *Core Set of Indicators for Environmental Reviews* (OECD 1993) along with the Pressure-State-Response (PSR) framework, which has since formed the conceptual foundation of many indicator initiatives. It is important to stress that this *international* initiative focused on the *environmental* aspects of sustainable development to the exclusion of social and economic factors. However, this omission was later addressed during an OECD Council meeting in 2001, where ministers called for the development of "*indicators to measure progress across all three dimensions of sustainable development*" (OECD 2003, p. 20).

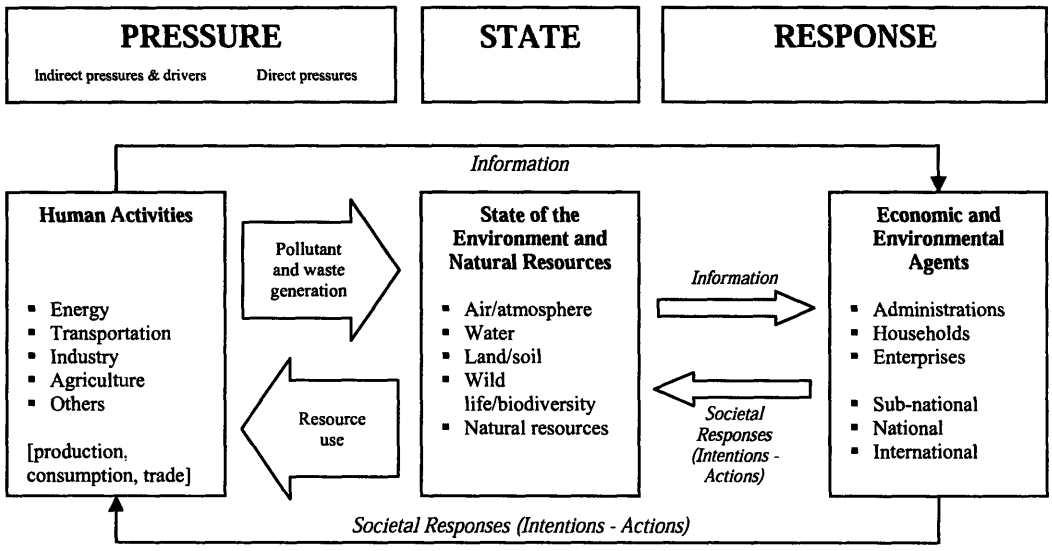
Building upon earlier stress-response frameworks that consider both *natural* (e.g., storms, earthquakes, volcanic activity, etc.) and *human* activity (Rapport and Friend 1979), the OECD developed the PSR framework. The purpose of the PSR framework was to

highlight *cause-effect* relationships to enable decision-makers and the public to understand how their actions could affect the state of the environment and help them craft responses to reduce environmental harm (Figure 5.2).

Environmental 'pressure' is defined in terms of human activity and is measured using indicators that reflect *flows/rates* such as production, consumption, and trade. Indicators of environmental pressure typically track emissions or resource usage. However, indicators that measure other types of human pressure, such as changing land use patterns, are also considered.

The 'state' (or position)[584] of the environment reflects how environmental pressures are changing the quality of the environment and the quantity (or availability) of natural resources. The indicators are designed to measure environmental *stocks* - i.e., the amount of pollution in the atmosphere, the area of contaminated land, etc.

The 'response' element of the PSR framework measures the actions taken by society (individually and collectively) to remediate existing environmental damage (to improve the 'state') or change human activities (i.e., reduce the 'pressures') that are seen to degrade the state of the environment. The types of indicators that are used to measure societal response vary significantly, but they generally relate to abatement and control measures. Examples include pollution abatement rates, fishing quotas, protected areas as a percentage of national territory, percentage of the vehicle fleet fitted with catalytic converters, environment-related taxes and subsidies, pricing structures, and waste recycling rates.



Sources: OECD (1993, p. 10) and OECD (2003, p. 21).

Figure 5.2: The OECD Press-State-Response (PSR) Model

[584] See the discussion of Positional Analysis (PA) in Section 4.2.1.4.

A general critique of indicator frameworks based upon the PSR model is that they only consider human pressures on the environment and ignore the impacts of natural processes (Berger and Hodge 1998). In addition, Spangenberg and Bonniot (1998, p. 6) argue that the PSR model "*reflects a kind of political 'end-of-the-pipe-thinking' and thus cannot meet the requirements of proactive environmental policies.*" This means that the PSR model tends to focus our attention on what can be measured - i.e., the state of the environment. Therefore, political (short-term) attention is directed away from addressing the complex (long-term) problem of understanding which pressures might be affecting the state of the environment. In addition, unless social and ecological factors are integrated in the analysis of pressures, the final solutions are likely to be inadequate.

Running in parallel with the OECD's efforts to develop environmental indicators was the UN initiative to develop indicators of sustainable development. In response to *Agenda 21*, the UN Commission for Sustainable Development (UNCSD) formed a 'Work Programme on Indicators of Sustainable Development' (1995-2000).[585] During the early phase of the program, the UN focused on extending the OECD PSR framework of environmental indicators to include social, economic, and institutional dimensions.[586] In addition, it linked indicators to the relevant chapters in *Agenda 21* (Table 5.3). At the fourth session of the UNCSD in 1996, a preliminary list of 134 indicators (each accompanied by a methodology sheet) was released (UNDSD 1996). The indicators were structured according to the UN's Driving Force-State-Response (DSR) framework.[587]

Table 5.3: Generic UN Driving Force-State-Response (DSR) Framework for Sustainable Development Indicators[588]

Sustainable Development Dimension	Chapter of Agenda 21	Driving Force Indicators	State Indicators	Response Indicators
Social				
Economic				
Environmental				
Institutional				

The UN DSR framework used the term 'driving force' instead of 'pressure' to represent "*human activities, processes, and patterns that impact on sustainable development either positively or negatively*" (UNDSD 2001b, p. 19). The term 'state' referred to the broader

[585] Source: United Nations Division for Sustainable Development, Department of Economic and Social Affairs, *Indicators of Sustainable Development*, http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm (accessed on 04/09/06).

[586] We recall from Chapter 3 that the fourth component of sustainable development is national governance that ensures peace and development. Thus, the 'institutional' dimension can be seen as a proxy for measuring national governance.

[587] The original working list of 134 indicators presented at the fourth session of the UNCSD - displayed using the UN DSR Framework - can be accessed from the UN web site, *Paper No. 15: Indicators of Sustainable Development - Framework and Methodologies (18 April-3 May 1996), Working List of Indicators of Sustainable Development*, http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/english/worklist.htm (accessed on 04/09/06).

[588] Source: UNDSD (2001b, p. 20).

condition of sustainable development and 'response' to the government and social actions aimed at transitioning human activities away from unsustainable development.[589]

During a three-year trial period (1996-1999), 22 countries attempted to apply and develop the UN's set of indicators to their home nation (UNDSD 1999). The main conclusion from these trial runs was that the UN DSR framework works for environmental indicators, but is not suitable for the social, economic, and institutional dimensions of sustainable development. The complexity associated with trying to establish causal links between pressures affecting the state of the economy or social conditions meant that it was not possible to develop a robust causal model. Further, gaps in the indicator set were identified and the sheer number of indicators was too great. Based upon this information it would seem unwise for the OECD to attempt to extend its PSR model beyond environmental considerations to include economic and social dimensions of sustainable development, as per the 2001 Ministers directive. This raises the question of what type of framework should be used.

In response to the inherent problems with the DSR model, the UN Expert Group on Indicators of Sustainable Development recommended that the indicator set be refocused towards policy-oriented themes of sustainable development.[590] The rationale for this change was that the indicators would be more useful if they aligned with national decision-making and performance measurements (UNDSD 2001b). Following a series of consultations and workshops, the UNCSD adopted a *theme/sub-theme framework* that consisted of 15 themes and 38 sub-themes (Table 5.4). In this new framework, the original 134 indicators are reduced to 58. While the UN DSR framework has effectively been discontinued, Table 5.4 shows how each of the indicators in the UNCSD theme/sub-theme framework could be labeled using the DSR framework. In addition, the numbers in brackets relate to the relevant chapter(s) of *Agenda 21.*

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[589] The European Commission recently endorsed a Driving Force-Pressure-State-Impact-Response (DPSIR) framework as being the most appropriate way to structure *environmental* information (EC and EUROSTAT 1999). As a result, many member states of the European Union, the Statistical Office of the European Communities (EUROSTAT), the European Environment Agency (EEA), and international organizations such as the OECD (which pioneered the PSR model), have adopted the DPSIR framework. The DPSIR model deals only with environmental indicators and is built upon the PSR/DSR frameworks. The logic of the DPSIR model is that human social and economic activities ('driving forces') exert a direct 'pressure' (e.g., emissions, waste, etc.) on the environment and, as a consequence, the 'state' of the environment (e.g., air, water, and soil quality, average global temperature, etc.) changes (Smeets and Weterings 1999). A change in the state of the environment can lead to anthropic 'impacts' (e.g., negative impacts on human health, the economy, etc.) that require societal 'responses.' These responses can be designed to change the driving forces, pressures, state, and/or impacts. For more information see: Statistical Office of the European Commission (EUROSTAT), *Towards Environmental Pressure Indicators for the EU (TEPI)*, http://www.e-m-a-i-l.nu/tepi/ (accessed on 04/09/06), and European Environment Agency, Information for Improving Europe's Environment, *Conceptual Framework: How we reason*, http://org.eea.eu.int/documents/brochure/brochure_reason.html (accessed on 04/09/06). For an application of the DPSIR framework, see the Ukraine's *State of the Environment*, http://nature.org.ua/nr98/englv/indicators/ (accessed on 04/09/06).

[590] Source: United Nations Department of Economic and Social Affairs, *Fifth Expert Group Meeting on Indicators of Sustainable Development*, Report of the Meeting, 7-8 April 1999, New York, http://www.un.org/esa/sustdev/natlinfo/indicators/5expmtg.htm (accessed on 04/09/06).

Table 5.4: UNCSD Theme/Sub-Theme Framework Indicators of Sustainable Development[591]

SOCIAL					
Theme	**Sub-theme**	**Indicator**	**DF**	**S**	**R**
Equity	Poverty (3)	Percent of Population Living below Poverty Line		X	
		Gini Index of Income Inequality		X	
		Unemployment Rate	X		
	Gender Equality (24)	Ratio of Average Female Wage to Male Wage		X	
Health (6)	Nutritional Status	Nutritional Status of Children		X	
	Mortality	Mortality Rate under 5 Years Old		X	
		Life Expectancy at Birth		X	
	Sanitation	Percent of Population with Adequate Sewage Disposal Facilities		X	
	Drinking Water	Population with Access to Safe Drinking Water		X	
	Healthcare Delivery	Percent of Population with Access to Primary Health Care Facilities			X
		Immunization against Infectious Childhood Diseases			X
		Contraceptive Prevalence Rate			X
Education (36)	Education Level	Children Reaching Grade 5 of Primary Education	X		
		Adult Secondary Education Achievement Level	X		
	Literacy	Adult Literacy Rate	X		
Housing (7)	Living Conditions	Floor Area per Person		X	
Security	Crime (36, 24)	Number of Recorded Crimes per 100,000 Population		X	
Population (5)	Population Change	Population Growth Rate	X		
		Population of Urban Formal and Informal Settlements		X	
Environmental					
Theme	**Sub-theme**	**Indicator**	**DF**	**S**	**R**
Atmosphere (9)	Climate Change	Emissions of Greenhouse Gases	X		
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances	X		
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas		X	
Land (10)	Agriculture (14)	Arable and Permanent Crop Land Area		X	
		Use of Fertilizers	X		
		Use of Agricultural Pesticides	X		
	Forests (11)	Forest Area as a Percentage of Land Area		X	
		Wood Harvesting Intensity	X		
	Desertification (12)	Land Affected by Desertification		X	

[591] Sources: UN (2001, p. 288) and the UN Department of Economic and Social Affairs, Division for Sustainable Development, *The CSD Theme Indicator Framework*, http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm (accessed on 04/09/06).

	Urbanization (7)	Area of Urban Formal and Informal Settlements		X	
Oceans, Seas, and Coasts (17)	Coastal Zone	Algae Concentration in Coastal Waters		X	
		Percentage of Total Population Living in Coastal Areas	X		
	Fisheries	Annual Catch by Major Species	X		
Fresh Water (18)	Water Quantity	Annual Withdrawal of Ground and Surface Water as a Percentage of Total Available Water	X		
	Water Quality	BOD (biochemical oxygen demand) in Water Bodies		X	
		Concentration of Faecal Coliform in Freshwater		X	
Biodiversity (15)	Ecosystem	Area of Selected Key Ecosystems		X	
		Protected Area as a Percent of Total Area			X
	Species	Abundance of Selected Key Species		X	
Economic					
Theme	**Sub-theme**	**Indicator**	**DF**	**S**	**R**
Economic Structure (2)	Economic Performance	GDP per Capita	X		
		Investment Share in GDP	X		
	Trade	Balance of Trade in Goods and Services		X	
	Financial Status (33)	Debt to GNP Ratio		X	
		Total ODA Given or Received as a Percentage of GNP	X		
Consumption and Production Patterns (4)	Material Consumption	Intensity of Material Use		X	
	Energy Use	Annual Energy Consumption per Capita	X		
		Share of Consumption of Renewable Energy Resources		X	
		Intensity of Energy Use		X	
	Waste Generation and Management (19-22)	Generation of Industrial and Municipal Solid Waste	X		
		Generation of Hazardous Waste	X		
		Management of Radioactive Waste	X		
		Waste Recycling and Reuse			X
	Transportation	Distance Traveled per Capita by Mode of Transport		X	
Institutional					
Theme	**Sub-theme**	**Indicator**	**DF**	**S**	**R**
Institutional Framework (38, 39)	Strategic Implementation of Sustainable Development (8)	National Sustainable Development Strategy			X
	International Cooperation	Implementation of Ratified Global Agreements			X
	Information Access (40)	Number of Internet Subscribers per 1000 Inhabitants		X	
Institutional Capacity (37)	Communication Infrastructure (40)	Main Telephone Lines per 1000 Inhabitants		X	
	Science and Technology (35)	Expenditure on Research and Development as a Percent of GDP			X

	Disaster Preparedness and Response	Economic and Human Loss Due to Natural Disasters	X		

Key: **DF** = Driving Force; **S** = State; and **R** = Response. The numbers in brackets refer to the relevant chapter(s) of Agenda 21.

The development of the theme/sub-theme framework was driven by four main considerations: future risks; correlation between themes; sustainability goals; and basic societal needs (PriceWaterhouseCoopers 1999). However, its development was somewhat constrained by the need to limit the number of indicators and the problem of identifying validated and widely accepted national indicators (UNDSD 2001a). For these reasons the framework could not include all aspects of sustainable development, leading to the exclusion of issues such as resource extraction (mining), tourism, groundwater quality, and biotechnology (UNDSD 2000). Thus, the intent of the theme/sub-theme framework is to reflect the core themes of sustainable development while remaining practical from a policy perspective. The hope is that nations will develop their own versions of the framework, commensurate with their priorities, conditions, and ability to maintain a national indicator system. If all nations use the UN framework as a basis, there is likely to be some uniformity between national indicator systems that will help facilitate international comparisons.

There is evidence to suggest that important documents such as the Rio Declaration and the UNCSD theme/sub-theme indicator framework have already led to a certain level of uniformity between national sets of indicators of sustainable development. In a comparative study of *shortlists* of indicators of sustainable development created for the UK, Sweden, and the U.S., Hens and de Wit (2003) show that 6 indicators are common to all three indicator sets and 13 indicators are common to at least two of the sets (Table 5.5). Of the 19 common indicators identified, 14 are either similar or identical to those included in the UNCSD indicator framework. These indicators are highlighted in bold in Table 5.5 (in both columns).

Hens and de Wit (2003) argue that the 19 indicators shown in Table 5.5 constitute the foundation of an international list of core indicators of sustainable development. While using a 'comparative' approach to develop such a list has merit, there remains an important need to guide the development of national sets of indicators to ensure that they include all of the fundamental elements of sustainable development. Given the strong influence of the UNCSD indicator framework, a more useful approach would be to continually revise this framework so that it reflects those indicators that are most widely used to measure sustainable development. This approach has the benefit of reinforcing an internationally recognized framework that already contains many of the critical elements of sustainable development.

Table 5.5: Agreement between the 'Shortlists' of Indicators of Sustainable Development for the UK, Sweden (S), and the U.S.

	Indicators in all three shortlists	Indicators in two of the three shortlists
Fair agreement on measurement	1. **Domestic product (GDP; GDP/capita; GDP/hour worked)** 2. **Greenhouse gas emissions** 3. **Crime rate**	1. **Debt as % of GDP (S, U.S.)** 2. **Expenditure on R&D as % of GDP (S, U.S.)** 3. % of households in problem housing (UK, U.S.) 4. % of rivers in good or fair quality (UK, U.S.) 5. **Population by age group (S, U.S.)** 6. **Waste (S, UK)**
Significant variation in measurement	4. **Employment (proportion of men/women of working age who are employed)** 5. **Qualifications at age 19** 6. **Life expectancy**	7. Share of GDP spent on health, education, welfare, and social security (S, UK) 8. **Energy consumption by GDP (S, U.S.)** 9. **Material consumption (S, U.S.)** 10. Consumption expenditure (S, U.S.) 11. Days when air quality is moderate (UK, U.S.) 12. **Protected areas (S, U.S.)** 13. **Level of education (S, U.S.)**

Note: The **bold text** highlights those indicators that are similar or identical to indicators included in the UNCSD indicator framework (Table 5.4).

Source: Adapted from Hens and de Wit (2003, p. 450).

The following section documents how the UNCSD indicator framework can be revised by [1] identifying those indicators that are used by other frameworks/indexes and eliminating those which are redundant;[592] and [2] expanding the framework to include important indicators/indexes that are either used elsewhere or are seen to support the conceptualization of sustainable development advocated in this research.

5.7 The Hall-Revised UNCSD Indicator Framework

Even though the UNCSD theme/sub-theme indicator framework presents a comprehensive view of sustainable development, there are a number of important topics, indicators, and indexes that have been omitted. This section presents a series of amendments to the UNCSD indicator framework (hereafter called the '*Hall-revised UNCSD framework*') that incorporate ideas presented in Chapters 2, 3, and 4. In addition, the Hall-revised UNCSD framework is compared with a variety of international-/national-/regional-level indicator frameworks/indexes to identify the frequency with which indicators are used and to highlight which indicators are not included in the framework.

Before discussing some of the critical amendments, it is important to recognize that the original UNCSD framework contains a mixture of component, composite, and

[592] While only one indicator was removed from the original UNCSD indicator framework, the revised framework highlights the number of times that a specific indicator is used elsewhere. Therefore, it is possible to eliminate those indicators that have not been used extensively.

determinant/derived indicators. These indicators do not follow any particular causal model; however, each indicator can be labeled as a driving force, state, or response (see Table 5.4).[593] Alongside the indicators in the UNCSD framework is the Gini *index* of income inequality. The eclectic combination of different types of indicators and an index in a single framework may appear to be comparing 'apples, oranges, and onions' and at first might seem somewhat unwieldy. However, since sustainable development is a multidimensional concept, it requires a multidimensional approach to its measurement. A final point worth mentioning is that the purpose of the UNCSD framework is to *harmonize* national-level indicator initiatives. Therefore, revising the UNCSD framework makes sense since it is a starting point from which governments can develop their own systems of sustainable development indicators.

The following text describes two main approaches used in the development of the Hall-revised UNCSD framework.

The first approach compared the structure of the original UNCSD framework with the five major dimensions of sustainable development discussed in Chapter 3. These components are: [1] peace and security; [2] economic development; [3] social development; [4] national governance that ensures peace and development; and [5] a concern for the environment. The comparison revealed that while environmental, social, and economic issues have adequate treatment in the UNCSD framework, peace and security is not covered. Further, the indicators covering institutional issues provide only limited information on whether national governance supports development. There is no measurement of whether national governance supports peace.

The omission of peace and security from the original UNCSD framework is surprising since one of the founding principles of the UN is to "*maintain international peace and security.*"[594] To address this omission, the category *Peace and Security* has been added to the Hall-revised UNCSD framework (Table 5.6). The themes, sub-themes, and indicators presented under this new category were sourced from a number of leading indicator frameworks presented in Appendix A. In addition, the theme of *Governance* has been added to the Institutional category. The sub-themes of *Corruption, Democracy, Civil Liberties, Rule of Law,* and *Government Effectiveness* were sourced from the ESI (Esty et al. 2005) and WRI *EarthTrends* database (WRI 2004). However, the principal sources of these indicators are also referenced in Table 5.6.

The second approach to creating the Hall-revised UNCSD framework was iterative. As new indicators/indexes were identified as suitable candidates for the revised framework, they were checked against a number of leading international-/national-/regional-level indicator initiatives before being adopted. The result is that virtually all of the indicators/indexes added to the original UNCSD framework have already been validated,

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[593] The indicators included in the Hall-revised UNCSD framework could also be labeled in this manner. However, it is questionable whether this would provide any valuable insights since the framework is not structured to indicate causal links.

[594] Source: Charter of the United Nations, Chapter I, *Purposes and Principles*, Article 1, http://www.unhchr.ch/html/menu3/b/ch-chp1.htm (accessed on 04/09/06).

tested, or, at a minimum, discussed in the indicator literature. Each time an indicator/index in the initiative being studied was identical or similar to those included in the original and Hall-revised UNCSD indicator frameworks, it was marked with one of two symbols shown below.

✓ **Indicator is identical or similar to those included in the original UNCSD indicator framework**

✓★ **Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework**

The results from the comparison are documented in Appendix A.

While the analysis methodology is simple, the decision of whether to include a new indicator/index in the Hall-revised UNCSD framework is more complex. In some instances an indicator/index has been included since the issue it measures is seen to be of critical importance to sustainable development. This was the rationale behind the creation of a new category for *Peace and Security* and a new theme of *Governance* (discussed above). In other cases an indicator/index has been included either because it provides a useful contrast to an existing measure (e.g., the GPI is a useful counterweight to GDP), or because it is a well established measure (such as the HDI) that was omitted from the original UNCSD framework.

The value of the comparative analysis is that it highlights which indicators consistently appear in a wide variety of indicator initiatives. Appendix A presents the results from the comparisons in a visual manner, making it easy to identify the sources of existing and new indicators/indexes and to reproduce the Hall-revised UNCSD framework.

The following subsections provide a category by category summary of some of the important additions made to the original UNCSD framework.

5.7.1 Changes to the Social Category

There are two significant kinds of amendments that have been made to the social category of the UNCSD framework: [1] the inclusion of a number of indexes; and [2] the creation of a set of indicators under an 'Employment' theme.

The indexes that have been added to the UNCSD framework fall into two types - *human-* and *issue-focused.* Five of the six *human-focused* indexes that have been added are published annually in the UN Human Development Reports. These five indexes are designed to measure overall human development (HDI), poverty in developed (HPI-1) and selected OECD countries (HPI-2), and gender equality (GDI and GEM). While all of the indexes are (partially) based upon some form of direct or indirect economic indicator, they have been located under the social category since their primary focus is to track social concerns.

Section 2.1.3 makes the argument that the UN indexes of human development provide a reasonable measurement of how well nations are meeting the (psychological and physiological) needs of their people and reveal the level of inequality that exists between *and* within nations. For these reasons, and the fact that the indexes will allow nations to compare how they are doing in relation to others, the indexes have been included in the Hall-revised framework.

A sixth (more subjective) index has been added to the group of UN indexes to measure human *well-being*. Listed under a *Happiness* theme, and *Satisfaction with Life* sub-theme, the metric of subjective well-being (SWB) has been introduced to measure well-being (or happiness) in a way that is not based upon economic or material gain. For a discussion of the psychological and environmental (i.e., waste) problems associated with using income and material wealth as a proxy for well-being see Section 2.1.4. While there is currently no robust measure of well-being, the topic is gaining support both in academic and political circles. For example, the 2005 UK Strategy for Sustainable Development makes a strong commitment to identifying a suitable way of measuring human well-being.

> "*We are ... committed to investigating the concept of well being, how it might be integrated into our policies, and how we might monitor whether we are genuinely making a difference to people's lives*" (DEFRA 2005a, p. 12)

An *issue-focused* index that has been added to the UNCSD framework measures urban sprawl. This index was included since it provides a valuable way to track the development of urban form and its associated impact on quality of life.

Another important amendment to the social category is the creation of a set of indicators under an *Employment* theme. The reason for focusing specifically on employment is that it is an area where modest improvements are likely to have a direct impact on an individual's quality of life and ability to meet his/her needs. In addition, the importance of creating meaningful and well paid employment is a recurring theme throughout Chapters 2 and 3.

In Section 3.3.3.1, the argument is made that if the 1994 Declaration of Philadelphia and the 1972 Stockholm Declaration are considered together, they present a set of principles that are designed to enhance both aspects of the human environment - where we work and where we live. The Declaration of Philadelphia specifically calls for the expansion of the international economy to improve human welfare and create more jobs, and for the protection of workers in all occupations. While there have been many national efforts to protect workers (such as the 1976 U.S. Occupational Health and Safety Act), occupational health and safety has remained an 'underemphasized element' of social and economic development (see Section 3.3.6). To account for this oversight, the first sub-theme, 'Health and Safety,' is included to measure the direction in which rates of occupational injury and disease are moving.

In Section 2.3, Peter Drucker's (1994) idea of the 'knowledge worker' is introduced as an increasingly important element of national competitiveness. As developed nations

continue to transition towards a post-industrial, or service, economy, it is likely that opportunities for new comparative advantage will lie with the knowledge (and innovative capacity) held by the national workforce. Therefore, it seems wise for nations to monitor whether their industrial sector is facilitating *Skill Enhancement*, which is measured here using years of schooling required for a job and the level of work time devoted to continuing professional education. Skill enhancement is also likely to play an important role in any 'innovation-driven strategy' for competitiveness (see Section 4.2.4) (Charles and Lehner 1998).

Related to the level of knowledge required for employment are the sub-themes of *Job Satisfaction* and *Job Security*. Ranking jobs (using psychometric measures) by the level of satisfaction a worker receives is one way in which the current monetary focus of employment can be directed towards other potentially more meaningful outcomes. Also, the level of job security felt by employees is an equally important measure that is likely to be affected by rapid technological change and globalization - two powerful forces driving the modern era of development.

Section 2.5 provides a detailed discussion of the implications of rapid technological change and globalization, including how they are likely to affect employment. What is perhaps most striking is the ability of these drivers to simultaneously improve and undermine employment on a global scale. The important question, however, is whether the total level of global employment (and average income) is increasing. The final set of indicators included under the *Employment* theme are designed to assess whether the average wage (i.e., *Purchasing Power*) is improving and gauge the status of employment within a nation.

The measurement of purchasing power is important since without an adequate level of income it becomes difficult for an individual to meet his/her basic needs. A failure at this level is likely to make the achievement of higher psychological needs more difficult. Indeed, one might argue that the greatest erosion to happiness and social capital is the fact that people are not able to make an adequate living. This assertion seems to be supported by research comparing SWB and income (Diener and Suh 2000). Therefore, increasing purchasing power (obtained via employment) can be described as a necessary condition for enhanced well-being. But increasing wealth is not a panacea. As discussed in Section 2.1.4, there is a threshold (between $5,000 to $10,000 per capita PPP) after which only minor increases in life expectancy (World Bank 1993) and SWB (Inglehart 2002; Inglehart and Klingemann 2000) are observed with increasing GDP per capita. Max-Neef (1995) referred to this phenomenon as the 'Threshold Hypothesis.'

To obtain a more holistic picture of the status of employment within a nation, two additional sub-themes - *Number of Jobs* and *Underemployment* - have been added to the existing measure of *Unemployment*. It is important to recognize that the measurement of the total number of jobs is broader than just those people employed in the formal sector. It also includes contingent/temporary, informal, and unpaid work. Further, the number of jobs held by an individual is likely to be a useful indicator of the availability of well paid employment. Finally, the *Underemployment* indicator is included to measure whether an

individual's skills are being put to best use. For example, if a large proportion of people with advanced degrees are working in a job category where such a level of education is not required, this represents a waste of human capital and of the resources required to educate these individuals.

A final point worth mentioning is that the five forms of capital - *natural*, *human-made*, *human*, *social*, and *financial* (Goodwin 2003) - have been included in the Hall-revised UNCSD framework. Human and social capital are located in the Social category, human-made and financial capital are located in the Economic category, and natural capital is located in the Environmental category. While there is no clear consensus on how these forms of capital should be measured, they are included in the table since they represent important areas where future work is required.

5.7.2 Changes to the Environmental Category

As the indicators included in the original Environment category were already quite comprehensive, only minor additions were deemed necessary.

First, the Living Planet Index (LPI) has been included as a useful way of monitoring the stock of terrestrial species. Second, a theme of *Waste* was included to ensure that it is not overlooked when thinking about the environment. Third, the theme of *Natural Capital* has been included to encourage the development of indicators that monitor the stocks and flows of non-renewable and renewable resources, and assess whether levels of pollution are within or exceed the assimilative capacity of the environment. Establishing the maximum sustainable yields for renewable resources and the maximum rates (and accumulation levels) of pollution (based upon the carrying capacity of natural sinks) is believed to be of critical importance. Hence, the theme of *Natural Capital* is basically a call for the natural processes that support the economy to be properly accounted for and protected. Finally, the theme *Sustainability of Human Activity* has been included, which contains the Environmental Sustainability Index (ESI) and the Ecological Footprint measure. Both of these provide a macro-level perspective of whether human activity is exceeding environmental carrying capacity.

5.7.3 Changes to the Economic Category

A number of additions were made to the Economic category. As mentioned previously, the Genuine Progress Indicator (GPI) has been included as a counterweight to the GDP. An alternative indicator that could have been included is the World Bank's (2001, pp. 180-183) Genuine Savings (GS) measure. While some argue that the "*GS is preferable on theoretical and empirical grounds ... and ... is more apt to guide policy*" (Dietz and Neumayer 2004, p. 228), the GPI has been included instead since it attempts to provide a more multidimensional valuation of economic welfare. The GPI also revises GNP and is, therefore, comparable to GDP, whereas GS presents a savings rate.

The *Trade* sub-theme has been expanded to consider the average level of tariffs imposed upon agricultural products, textiles, and clothing. This indicator is included to gauge whether a nation is supporting the idea of free trade.

Under the *Material Consumption* sub-theme, two new indicators have been included to measure how much is consumed by society and the level of polluting goods and raw materials that are transferred between nations. The latter measure should provide an indication of whether a nation is a net importer or exporter of polluting goods and raw materials.

A new sub-theme that is closely related to the issue of consumption is *Advertising* (see Section 2.1.4 for a discussion of 'producer created demand'). This new indicator measures advertising spending that encourages unnecessary/excessive consumption of goods. While it is relatively straightforward to measure advertising spent on consumer goods and services, it is likely to be more difficult to determine which type of advertising is leading to unnecessary/excessive consumption. However, failing to try and develop a suitable way to measure the latter type of advertising spending ignores an issue that has important environmental and social implications.

The first new theme in the Economic category has been created to measure national *Competitiveness*. The metrics selected for this theme, however, are not the usual type of indicators that one might expect. The first sub-theme, *Lower Cost (inherent)*, measures the cost savings that can be attributed to enhanced capital, labor, and labor-capital interface[595] productiveness. Here productiveness should not be confused with productivity.[596] *Productivity* is found by dividing an output by a factor of input - i.e., it is the amount of output per unit of input. *Productiveness* is a measure of the quality of being productive or the capacity for producing. For example, a more productive machine is capable of faster output and a more productive worker is capable of more creative or faster work if his/her skills have been enhanced. Therefore, labor productivity can be enhanced by the use of more productive capital (i.e., a smarter machine) or more productive workers. As a result, it is important to measure the productiveness of labor, capital, and the labor-capital interface since this provides a more accurate measure of where a company's/nation's competitiveness lies - i.e., in its capital, labor, the interface between the two, or a mixture of two or more of these elements. The problem with the conventional measurement of labor productivity (which divides output by a labor factor input, such as number of hours worked or wages paid, etc.) is that it fails to identify who/what is responsible for the production/competitiveness.

The second sub-theme, *Lower Cost (derived from environmental and social factors)*, is a measure of the cost savings that can be attributed not to production efficiencies, but

[595] The labor-capital interface is the match between a particular technology and a person for a given production scenario. For example, ergonomically designed workstations are a better match than poorly designed ones.

[596] The reference in Table 5.5 to the UK Government's indicators of sustainable development (DEFRA 2005b) has been included since the UK set of indicators is the only one to consider labor productivity. While we are only interested in productiveness here, the reference is included for its significance.

rather to improvements in environmental, social, and/or employment factors that yield positive financial benefits in terms of reduced costs or even positive social benefits such as more satisfied workers. Using the current situation as a baseline, new initiatives/programs can be assessed by how much future expenditure they save. A 'lower cost' analysis takes a broad view of the problem being addressed. For example, the use of a new process/initiative that reduces accidents and lowers pollution levels is likely to avoid health costs associated with injured or ill workers/bystanders and lower any potential environmental clean up/remediation costs.

The final sub-theme, *Performance*, measures how the performance of an industry sector or product has improved over time. This indicator provides information on the rate of innovation, which is a central aspect of competitiveness.

The last theme in the Economic category is for the measurement of *Capital*. The sub-themes look specifically at *Human-made/Built Capital* and *Financial Capital*.

5.7.4 Changes to the Institutional Category

The one change made to the Institutional category has been the inclusion of the *Governance* theme, discussed previously. The sub-themes chosen were selected from a number of different sources and are believed to provide a broad indication of whether national governance is likely to support development. The issue of whether national governance supports peace is addressed in the *Peace and Security* category.

5.7.5 New Category - Peace and Security

The new category of *Peace and Security* contains two main themes - *Peace* and *Investment in Peace and Security*.

The four indicators under the *Peace* theme measure the number of violent conflicts occurring around the world (and within specific nations), national investment in peace keeping missions, the number of completed peace keeping missions, and the number of ratified treaties or conventions relating to weapon systems. These indicators will provide a general indication of the level of conflict occurring around the world and the commitment of national governments to address these problems.

The indicators under the theme *Investment in Peace and Security* measure government expenditure in the areas of defense/security, public health, and education. The rationale for measuring these three core areas is to highlight national priorities relating to the security, health, and well-being of the nation.

5.7.6 What is not Included?

The easiest way to identify what is not included in the Hall-revised UNCSD framework is to look at those indicators in Appendix A that have not been marked. In many cases the indicators that have been excluded provide a more detailed exploration of an issue already considered. However, there are several areas that are not covered. For example, there is no measurement of the level of food and agricultural/aquacultural production (WRI 2004; Worldwatch Institute 2003), maternal health is not considered (UNDESA 2005), eco-efficiency is excluded (Ashford et al. 2002), groundwater quality is still omitted (UNDSD 2000), and the effects of specific industries such as tourism and biotechnology are not accounted for. While it is clearly possible to extend the list of indicators, it is believed that the Hall-revised UNCSD framework covers the key issues included in the conceptualization of sustainable development that is articulated in this chapter.

Table 5.6: Hall-Revised UNCSD Framework of Indicators of Sustainable Development (UNCSD 2005) [597]

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Equity	Poverty (3)	Percent of Population Living below Poverty Line	(EC 2004b; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b; SDI Group 2001)
		Gini Index of Income Inequality	(EC 2004b; Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004)	(EPA 2005b; SDI Group 2001)
		Human Poverty Index for Developing Countries (HPI-1)	(UNDP 2004)	
		Human Poverty Index for Selected OECD Countries (HPI-2)	(UNDP 2004)	
	Gender Equality (24)	~~Ratio of Average Female Wage to Male Wage~~		
		Gender-Related Development Index (GDI)	(UNDP 2004)	
		Gender Empowerment Measure (GEM)	(UNDESA 2005; UNDP 2004)	
Human Development		**Human Development Index (HDI)**	(UNDP 2004)	
Health (6)	Nutritional Status	Nutritional Status of Children	(Esty et al. 2005; EC 2004b; UNDESA 2004; 2005; UNDP 2004; World Bank 2004)	
	Mortality	Mortality Rate under 5 Years Old	(Esty et al. 2005; EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2005a; 2005b)
		Life Expectancy at Birth	(EC 2004b; Henderson et al. 2000; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; SDI Group 2001)
	Sanitation	Percent of Population with Adequate Sewage Disposal Facilities	(OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	
	Drinking Water	Population with Access to Safe Drinking Water ***[also see 'Fresh Water/Water Quality' theme/sub-theme under the 'Environmental' category for related indicators]***	(Esty et al. 2005; UNDESA 2004; 2005; UNDP 2004; World Bank 2004)	
	Healthcare Delivery	Percent of Population with Access to Primary Health Care Facilities		(SDI Group 2001)
		Immunization against Infectious Childhood Diseases		
		Contraceptive Prevalence Rate	(UNDESA 2004; 2005)	

[597] The original version of the UNCSD indicator framework can be accessed from the UN Department of Economic and Social Affairs, Division for Sustainable Development, *The CSD Theme Indicator Framework*, http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm (accessed on 04/09/06). **Note: The bold text in this table indicates changes that have been made by the author. The text in normal font is the original UNCSD indicator framework, and indicators that have been cut from the original framework have been marked through with a line.**

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
	Safety	**Accident Rates (by activity and sector)** ***[also see 'Employment/Health and Safety' theme/sub-theme (below) for worker health and safety indicator]***		(DEFRA 2005b)
Education (36)	Education Level	Children Reaching Grade 5 of Primary Education	(EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; WRI 2004)	(NRTEE 2003; SDI Group 2001)
		Adult Secondary Education Achievement Level	(EC 2004b; Henderson et al. 2000; UNDP 2004; UNDP et al. 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
	Literacy	Adult Literacy Rate	(EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004)	(SDI Group 2001)
Housing (7)	Living Conditions	Floor Area per Person	(Henderson et al. 2000)	
		Proportion of Households with Access to Secure Tenure (slum/homeless population as a percent of urban population)	(Henderson et al. 2000; 2005) (UNDESA 2005)	(DEFRA 2005b; EPA 2005b)
	Urbanization (Neighborhood/ Community)	**Urban Sprawl (index combining residential density; neighborhood mix of homes, jobs, and services; strength of activity centers and downtowns; and accessibility of the street network)** ***[also see 'Land/Urbanization' theme/sub-theme under the 'Environmental' category for an additional urbanization indicator]***	(Ewing et al. 2002)	
Security	Crime (36, 24)	Number of Recorded Crimes per 100,000 Population		(DEFRA 2004; 2005a; 2005b; EPA 2005b; SDI Group 2001)
Population (5)	Population Change	Population Growth Rate	(Esty et al. 2005; Henderson et al. 2000; OECD 2003; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
		Population of Urban Formal and Informal Settlements	(WRI 2004)	
Employment	**Health and Safety**	**Rates of Occupational Injuries and Disease for Job Type**	(Ashford et al. 2002; Henderson et al. 2000; ILO 2005)	
	Skill Enhancement and Creativity of Job	**Years of Schooling Required for Job Type**	(Ashford 2005; Ashford et al. 2002)	
		Percent of Work Time Devoted to Continuing Professional Education (CPE) for Job Type ***[also see 'Competitiveness/Inherent Cost' theme/ sub-theme under the 'Economic' category for a related indicator]***	(Ashford 2005; Ashford et al. 2002; Henderson et al. 2000)	

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
	Job Satisfaction	**Level of Satisfaction with Job Type (measured using psychometrics)**	(Ashford et al. 2002)	
	Job Security	**Average Time in Job Type before Involuntary Redundancy**	(Ashford 2005; Ashford et al. 2002)	
		Does Labor Law Allow for Immediate Dismissal? (employment at will)	(Ashford 2005; Ashford et al. 2002)	
	Purchasing Power	**Average Wage (by Job Type)/Consumer Product Index**	(Ashford 2005; Ashford et al. 2002; Henderson et al. 2000; ILO 2005)	
	Number of Jobs	**Total Number Employed (including contingent/temporary, informal sector, and unpaid employment)**	(Ashford et al. 2002; EC 2004b; Henderson et al. 2000; ILO 2005)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
		Numbers of Jobs Held by Individual	(Ashford et al. 2002; EC 2004b; Henderson et al. 2000; ILO 2005)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
	Underemployment	**Level of Underemployment (measured using compensation, hours, and extent to which existing skills and/or experience are utilized)**	(Ashford 2005; Henderson et al. 2000)	
	Unemployment	Unemployment Rate [*moved from 'Equity/Poverty' theme/sub-theme*]	(Henderson et al. 2000; ILO 2005; UNDESA 2004; 2005; UNDP 2004; WRI 2004)	(DEFRA 2005a; 2005b; SDI Group 2001)
Happiness	**Satisfaction with Life**	**Subjective Well-Being (SWB)**	(Diener and Suh 2000; Diener et al. 1997; Meadows 1998)	(DEFRA 2005a)
Capital	**Human Capital**	**Population Demographics (could be extended to include measures of health and education)**	(EC 2004b; Meadows 1998; World Bank 1997)	
	Social Capital	**Qualitative Measures of Social Integration, Knowledge, Trust, and Honesty in Society**	(Meadows 1998; World Bank 1997)	(SDI Group 2001)

The numbers in brackets refer to the relevant chapters in Agenda 21.

Environmental				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Atmosphere (9)	Climate Change	Emissions of Greenhouse Gases **[by sector and source - e.g., Methane (CH_4), Nitrous Oxide (N_2O), Carbon Tetra-Chloride (CCl_4), Methyl Chloroform (CH_3CCl_3), CFC-11 (CCl_3F), CFC-12 (CCl_2F_2), and CFC-113 ($C2Cl_3F_3$)]**	(Esty et al. 2005; EC 2004a; EC 2004b; Henderson et al. 2000; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances	(OECD 2003; UNDESA 2004; 2005)	(SDI Group 2001)
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas **[e.g., Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Carbon Monoxide (CO), Non-methane Volatile Organic Compounds (VOCs), and Ozone]**	(Esty et al. 2005; EC 2004a; 2004b; Henderson et al. 2000; OECD 2003; WRI 2004)	(DEFRA 2004; 2005b; EPA 2005a; NRTEE 2003; SDI Group 2001)
Land (10)	Agriculture (14)	Arable and Permanent Crop Land Area	(WRI 2004)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
		Use of Fertilizers	(Esty et al. 2005; EC 2004b; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b)
		Use of Agricultural Pesticides	(Esty et al. 2005; OECD 2003; WRI 2004)	(SDI Group 2001)
	Forests (11)	Forest Area as a Percentage of Land Area	(Esty et al. 2005; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(NRTEE 2003; SDI Group 2001)
		Wood Harvesting Intensity	(OECD 2003; WRI 2004)	(SDI Group 2001)
	Desertification (12)	Land Affected by Desertification	(OECD 2003)	
	Urbanization (7)	Area of Urban Formal and Informal Settlements	(Esty et al. 2005; OECD 2003)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
Oceans, Seas, and Coasts (17)	Coastal Zone	Algae Concentration in Coastal Waters		
		Percentage of Total Population Living in Coastal Areas		
	Fisheries	Annual Catch by Major Species	(Esty et al. 2005; EC 2004a; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005a; 2005b; SDI Group 2001)
Fresh Water (18)	Water Quantity	Annual Withdrawal of Ground and Surface Water as a Percentage of Total Available Water	(Esty et al. 2005; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
	Water Quality	BOD in Water Bodies	(Esty et al. 2005; EC 2004b; Henderson et al. 2000; OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; NRTEE 2003; SDI Group 2001)

Environmental				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
		Concentration of Faecal Coliform in Freshwater		(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
Biodiversity (15)	Ecosystem	Area of Selected Key Ecosystems	(EC 2004b; Meadows 1998; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; NRTEE 2003)
		Protected Area as a Percent of Total Area	(OECD 2003; UNDESA 2004; 2005; WRI 2004)	
	Species	Abundance of Selected Key Species	(Esty et al. 2005; EC 2004a; 2004b; OECD 2003; UNDP et al. 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
		Living Planet Index (LPI)	(WWF 2004)	
Waste	**Waste Generation and Management**	**[*see 'Consumption and Production Patterns/Waste Generation and Management' theme/sub-theme for indicators*]**		
Natural Capital	**Non-renewable/ Renewable Resources**	**Non-renewable/Renewable Resource Stocks and Flows**	(EC 2004b; Meadows 1998; World Bank 1997)	
	Assimilative Capacity	**Assimilative Capacity of the Natural Environment**	(EC 2004b; Meadows 1998; World Bank 1997)	
Sustainability of Human Activity		**Environmental Sustainability Index (ESI)**	(Esty et al. 2005)	
		Ecological Footprint	(Esty et al. 2005; Meadows 1998; Wackernagel 2001; Wackernagel et al. 2002; WWF 2004)	

The numbers in brackets refer to the relevant chapters in Agenda 21.

Economic				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Economic Structure (2)	Economic	GDP per Capita **($ and PPP$)**	(Henderson et al. 2000; OECD 2003; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; SDI Group 2001)
		Genuine Progress Indicator (GPI) per Capita ($ and PPP$)	(Venetoulis and Cobb 2004)	
	Performance	Investment Share in GDP		(DEFRA 2004; 2005b)
	Trade	Balance of Trade in Goods and Services	(UNDP et al. 2004; World Bank 2004; WRI 2004)	
		Average Tariffs Imposed on Agricultural Products, Textiles, and Clothing	(Esty et al. 2005) (UNDESA 2004; 2005)	
	Financial Status (33)	Debt to GNP Ratio	(UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	
		Total ODA Given or Received as a Percent of GNP	(Esty et al. 2005; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2005b)
Consumption and Production Patterns (4)	Material Consumption	Intensity of Material Use	(OECD 2003)	(DEFRA 2005a; 2005b; SDI Group 2001)
		Annual per Capita Consumption (or Throughput) of Passenger Cars, Gasoline and Diesel, Electricity, Meat, Fish, Paper, Coffee, etc.	(WRI 2004) (Meadows 1998)	
		Import[/Export] of Polluting Goods and Raw Materials as Percentage of Total Imports[/Exports] of Goods and Services	(Esty et al. 2005)	
	Energy Use	Annual Energy Consumption per Capita **[and by economic sector]**	(Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004)	(EPA 2005a; SDI Group 2001)
		Share of Consumption of Renewable Energy Resources	(Esty et al. 2005; EC 2004a; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; EPA 2005a)
		Intensity of Energy Use **[energy use per unit of GDP]**	(Esty et al. 2005; EC 2004a; Henderson et al. 2000; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; WRI 2004)	(SDI Group 2001)
	Waste Generation and Management (19-22)	Generation of Industrial and Municipal Solid Waste	(OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; SDI Group 2001)
		Generation of Hazardous Waste	(Esty et al. 2005; OECD 2003)	(DEFRA 2005a; 2005b; SDI Group 2001)
		Management of Radioactive Waste		

Economic				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
		Waste Recycling and Reuse	(Esty et al. 2005; OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
	Transportation	Distance Traveled per Capita by Mode of Transport	(EC 2004a)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b; SDI Group 2001)
		Distance Traveled per Category of Freight by Mode of Transport (Ton-miles)		
	Advertising	**Advertising Spending (encouraging unnecessary/excessive throughput)**	(Worldwatch Institute 2003)	
Competitiveness (market share)	**Lower Cost (inherent)**	**Cost Savings Attributed to Enhanced Capital, Labor, and Labor-Capital Interface Productiveness**	(Ashford 2005; Ashford et al. 2002)	(DEFRA 2005b)
	Lower Cost (derived from environmental or social factors)	**Cost Savings Attributed to Environmental, Health, and Employment Factors**	(Ashford 2005; Ashford et al. 2002)	
	Performance	**Rate of Increase in Performance by Industry Sector/Product Type**	(Ashford 2005; Ashford et al. 2002)	
Capital	**Human-made/Built Capital**	**Physical Stock of Productive Capacity of an Economy**	(EC 2004b; Henderson et al. 2000; Meadows 1998; World Bank 1997)	(SDI Group 2001)
	Financial Capital	**Available Financial Capital**		

The numbers in brackets refer to the relevant chapters in Agenda 21.

Institutional				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Institutional Framework (38, 39)	Strategic Implementation of Sustainable Development (8)	National Sustainable Development Strategy		
	International Cooperation	Implementation of Ratified Global Agreements	(Esty et al. 2005; UNDP et al. 2004; WRI 2004)	
	Information Access (40)	Number of Internet Subscribers per 1000 Inhabitants	(Esty et al. 2005; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(SDI Group 2001)
Institutional Capacity (37)	Communication Infrastructure (40)	Main Telephone Lines **[and Cellular Subscribers]** per 1000 Inhabitants	(UNDESA 2004; 2005; World Bank 2004)	
	Science and Technology (35)	Expenditure on Research and Development as a Percent of GDP	(World Bank 2004)	(DEFRA 2004; SDI Group 2001)
	Disaster Preparedness and Response	Economic and Human Loss due to Natural Disasters	(Esty et al. 2005)	
Governance	**Corruption**	**Corruption Perceptions Index**	(Esty et al. 2005; Kaufmann et al. 2003; UNDP et al. 2004; WRI 2004)	
	Democracy	**Polity Index of Democracy**	(Esty et al. 2005; Marshall et al. 2005; UNDP et al. 2004; WRI 2004)	
	Civil Liberties	**Level of Civil Liberties**	(Esty et al. 2005; Freedom House 2004; UNDP et al. 2004; WRI 2004)	
	Rule of Law	**Perceptions of the Incidence of Crime**	(Esty et al. 2005; Kaufmann et al. 2003)	
		Effectiveness and Predictability of the Judiciary	(Esty et al. 2005; Kaufmann et al. 2003)	
		Enforceability of Contracts	(Esty et al. 2005; Kaufmann et al. 2003)	
	Government Effectiveness	**Quality of Public Service Provision**	(Esty et al. 2005; Kaufmann et al. 2003)	
		Quality of the Bureaucracy	(Esty et al. 2005; Kaufmann et al. 2003)	
		Competence of Civil Servants	(Esty et al. 2005; Kaufmann et al. 2003)	
		Independence of the Civil Service from Political Pressures	(Esty et al. 2005; Kaufmann et al. 2003)	
		Credibility of the Government's Commitment to Policies	(Esty et al. 2005; Kaufmann et al. 2003)	

The numbers in brackets refer to the relevant chapters in Agenda 21.

Peace and Security				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Peace	**Conflicts**	**Number of Violent Conflicts**	(Henderson et al. 2000; Worldwatch Institute 2003)	
	Peace Keeping Efforts	**Peace Keeping Expenditures and Number of Completed and Ongoing Peace Keeping Missions**	(Henderson et al. 2000; Worldwatch Institute 2003)	
	Treaties	**Ratification of Treaties or Conventions Relating to the Use of Nuclear, Biological, Chemical, and other Weapon Systems**	(Henderson et al. 2000)	
Investment in Peace and Security	**Government Expenditure**	**Government Expenditure on Military/Security, Public Health, and Education (expressed in GDP and Percent of GDP)**	(Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004)

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6 Sustainable Transportation

The purpose of this chapter is to [1] introduce important transportation terminology and system representations (Section 6.1), [2] review the concept of sustainable transportation (Section 6.2), [3] present a decision-support framework that encourages the creation of transportation policies/programs that support sustainable development (Section 6.3), and [4] present a set of national-level sustainable transportation indicators developed using the Hall-revised UNCSD indicator framework (Section 6.4).

6.1 The Transportation System: Terminology and System Representations

This section introduces terminology that is often used to describe a transportation system and presents several ways in which a transportation system can be represented or visualized. Particular attention is given to the notion of a *system boundary* that is often used to limit the scope of a systems analysis.

It is helpful to begin by considering what is meant by a *system*. Three useful definitions of a *system*, a *complex system*, and an *engineering system* developed by Magee and de Weck (2002, p. 4) are as follows:

— "***System:*** *a set of interacting components having well-defined (although possibly poorly understood) behavior or purpose; the concept is subjective in that what is a system to one person may not appear to be a system to another.*"

— "***Complex System:*** *a system with numerous components and interconnections, interactions or interdependencies that are difficult to describe, understand, predict, manage, design, and/or change.*"

— "***Engineering System:*** *a system designed by humans having some purpose; large scale and complex engineering systems ... will have a management or social dimension as well as a technical one.*"[598]

Magee and de Weck's (2002) description of an *engineering system* can be linked to the idea of a *socio-technical system*, first conceived in Norway in the mid 1950s (Emery and Trist 1960). In its simplest form, the concept of a socio-technical system refers to the *joint operation* of social and technological systems to achieve a desired goal (Davis and Taylor 1972). Thus, when humans are required actors in a process (or system), the desired outcome is achieved through the actions of a social system as well as a technical system. The main difference between the definitions is the specific reference to *large scale* and *complex* systems in the definition of an engineering system. The transportation system is a good example of an engineering system.

[598] Magee and de Weck's (2002) definition of an engineering system highlights the importance of *management* and *social* dimensions, which play an essential role in system innovation/transformation.

6.1.1 System Purpose

The purpose of the transportation system is to enable people or freight to move between origins and destinations. The demand for transportation is by and large a derived demand from social activities (SACTRA 1999). For example, the demand for freight transportation arises from the need to move goods and materials between buyers and sellers. The demand for passenger transportation is more complex, however, and can arise from four broad groups of activity (SACTRA 1999). First are the trips that individuals undertake to access employment or educational/training facilities. In economic terms, these trips supply labor to production. Second are the consumption-related trips where people travel to access shops, leisure, or healthcare facilities, or travel to reach a tourist destination. In this group, the demand for transportation is derived from a need/desire to purchase goods (e.g., food, clothes, etc.) or receive a service or experience at the destination. Third are the trips that arise from the human need to remain connected with family and friends. Finally, there are the trips that people make for the sheer pleasure of traveling (e.g., riding a motorcycle along an open highway).

In general, transportation is considered to be an *intermediate good* that exists to serve the needs/desires of the user/customer. The one exception to this rule is the last group of activities mentioned above where the act of traveling satisfies a specific human need (such as the need for autonomy) and can be treated as a *good* in itself. Travel that falls into this category is characterized as excess travel (Mokhtarian and Salomon 2001; Root 2003). Whereas in conventional transportation planning travel demand is derived from an individual's need to access a destination in the shortest and most cost effective manner, excess travel is travel beyond that which can be explained using this rationalistic model. Therefore, transportation planning must not only consider travel between origins and destinations, but also travel where the final destination is not as important as the act of traveling itself.[599]

6.1.2 Integrated Network of Sub-systems

A *transportation system* is an *integrated network* of highways, roads, railways, walkways, bike paths, canals and rivers, and air corridors which facilitate the movement of different modes of transportation (including bicycles, electric vehicles, motorbikes, automobiles, trucks, trains, boats, and aircraft). The entire transportation system is made up of *sub-systems* that can be defined by infrastructure type, transportation mode, or by the sub-system's purpose (e.g., movement of passengers, freight, etc.). These sub-systems (or sub-networks) interact to make an intermodal and integrated system. The intermodal nature of the transportation system makes it *flexible* - i.e., there are many options for the same trip. This flexibility means that the system is able to provide mobility following a shock to the system or the even the temporary loss of a sub-system (such was the case in the days following the 9/11 terrorists attacks when air traffic was grounded).

[599] In practice, excess travel is likely to represent only a small percentage of total travel.

Surface transportation systems (including underground systems) are *related* to each other in the sense that they occupy geographical space and they connect together at key interchanges (some of which are *intermodal*). The air transportation system connects to the surface transportation system at airports (or nodes); otherwise, this system operates above the earth's surface.

6.1.3 An Open, Large Scale System

A transportation system can be described as an *open system* - i.e., it interacts with its environment.[600] The *environment* within which the transportation system operates can be defined in terms of people (i.e., society - where the government, stakeholders, and users/customers play a critical role), physical components, the economy, and the natural environment. The transportation system is *large* in that it spreads across nations and provides access to almost every corner of the world.

The scale of the transportation system gives it a certain amount of *permanence* - i.e., the system is likely to exist for a long period of time. However, while changes to the *physical* system (such as highways, railway lines, etc.) might take decades, *adaptive change* of the management and operation of the system can be rapid. For example, if we look at airways and the response of air traffic controllers to the 9/11 terrorists attacks mentioned above, the air traffic control system was able to react in a timely manner and land 4,456 aircraft within 3 hours, avoiding major accidents (Bond 2001). Thus, the system was able to adapt quickly to a new operating environment. The application of intelligent transportation systems (ITS) is likely to improve the rate at which the management and operation of the transportation system can adapt in real time to changing circumstances (Sussman 2000; 2005).

6.1.4 Movement and System Inputs and Outputs

It is possible to distinguish between movement that takes place within *natural* and *social systems* (Gudmundsson and Hojer 1996). In natural systems, movement occurs through the forces of nature, such as gravity and solar radiation; in social systems, movement is the result of human actions as well as natural forces. In both types of system, "[m]*ovement takes place within a system of origins and destinations*" (ibid, p. 274). Since we are primarily interested in the transportation system, our focus will be on movement within social systems.[601]

In a transportation system, it is possible to identify three general types of movement that are associated with system *inputs* and *outputs* (Figure 6.1). First is the movement of *people* and *freight* (including oil and gas transported via pipelines), which enter the

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[600] Conversely, a *closed system* has no interaction with its environment.

[601] The Brundtland report refers to sustainable physical and social systems where social systems do not include any physical artifacts (i.e., technology) (WCED 1987). In this section, the phrase 'social system' is used in a much broader sense to incorporate the physical systems that support social interactions (see the related discussion in Section 6.2.4).

system at an origin and leave the system at a final destination. This type of movement is the means by which fundamental human needs such as connectedness, autonomy, and sustenance are satisfied (see Section 6.2.4.3).

Second is the movement of *energy* and *matter*, which enter the system as fuel, construction material, and products (such as vehicles, equipment, etc.) and leave the system as emissions, waste, or material that is recycled/down-cycled for other products or purposes. The quantity and type of energy and matter that is supplied to the system is *derived* from the demand for passenger and freight transportation services. The continual improvements in the efficiency of transportation technology - including the introduction of information and communication technology (ICT) and travel demand techniques (see below) - are likely to weaken the connection between transportation demand and the energy and matter that is required to meet that demand.

Finally there is the movement of *information*, which can enhance the management, operation, and performance of the transportation system (e.g., through ITS)[602] or alleviate the need for people to travel (e.g., through ICT such as teleworking).

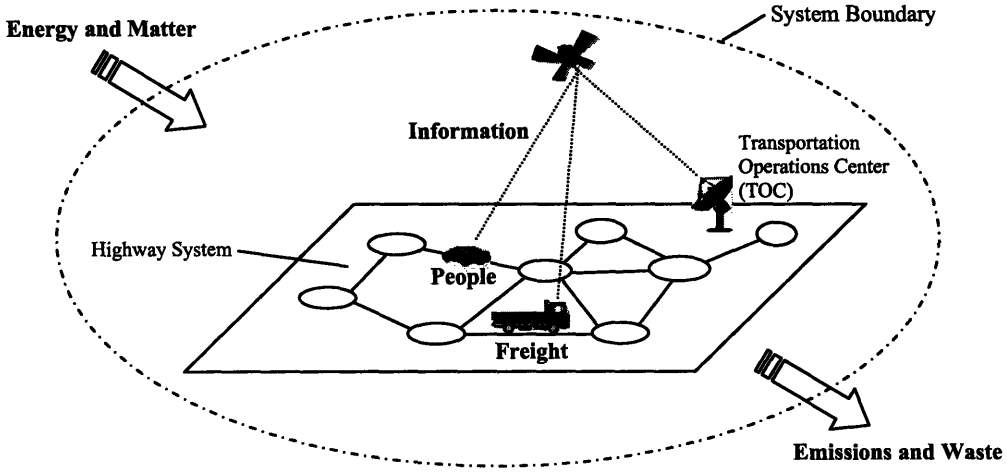

Figure 6.1: Input and Outputs to and from the Transportation System

[602] In the last 30 years, Transportation Operations Centers (TOCs) have become a central feature of virtually all Intelligent Transportation Systems (ITS) - Figure 6.1. The role of a TOC is to use information technology to integrate the space and time characteristics of the transportation network to manage and monitor network traffic flows, provide information on the state of the network to its users, and facilitate vehicle fleet management (e.g., buses and trucks). Traffic flow information obtained by measuring devices, video equipment, and/or voice communication systems (wireless cellular or radio), is mobilized, accumulated, and recombined at the TOC to provide transportation network operators with up-to-date system information. An ITS architecture that uses highly automated data recording devices (analog to digital) offers the potential to provide robust and reliable information to the TOC in a digital format. The advantage of such an ITS architecture is that it provides 'mobility' to the traffic information, establishes a 'stable' relationship between reality and the representation of the system, and the digital format in which data is transferred/stored allows the TOC to add value to the information by permitting numerous 'combinations' of data (Latour, 1987, p. 226).

All three types of movement are highly interconnected and can affect human well-being in different ways. For example, while the mobility and accessibility provided by the automobile might satisfy our psychological need for *connectedness*, the associated emissions (from the combustion of fuel/energy) can lower our physiological health. Further, the impacts of these emissions not only affect the driver (Peters et al. 2004), but also the community at large (Gorham 2002a), which means that the distributional impacts of the transportation system must be considered with care. Finally, we should recognize that the transportation system is highly interconnected with other types of social systems and the environment. For example, energy, economic, telecommunication, manufacturing, and healthcare systems all support and depend upon the transportation system. Hence, transportation can be thought of as the glue that holds life's activities together.

6.1.5 System Complexity

A transportation system is a complex system, constructed of millions of parts that interconnect. While there are a range of ways in which the complexity of a system can be characterized (Lloyd 2002; Perrow 1999; Sussman 2002),[603] there are four types of complexity that seem particularly relevant to a transportation system (Dodder et al. 2004; Sussman 2000):

1. *Internal complexity* - the number and type of sub-systems and system components and their interconnections describe the level of internal complexity;
2. *Behavioral complexity* - the interaction between sub-systems and system components is likely to result in 'emergent' properties that make the behavior of a system difficult or impossible to predict;[604]
3. *Evaluative complexity* - differences of opinion between decision-makers and stakeholders of what constitutes a 'good' design or level of service/performance leads to evaluative complexity; and
4. *Nested complexity* - the influence that a complex organizational and policymaking system (i.e., the institutional sphere) has on complex physical sub-systems is described as nested complexity. Here, the physical sub-systems are seen to be *embedded* within the institutional sphere (Figure 6.2).

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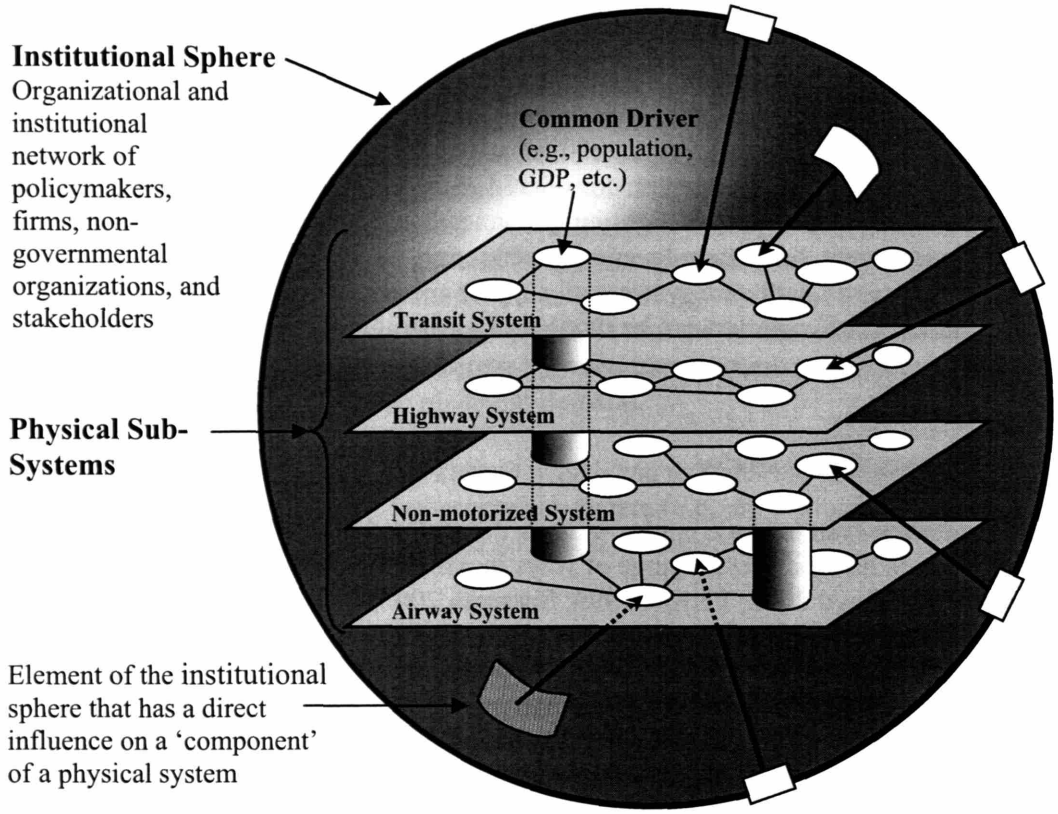
[603] Perrow (1999) describes systems as *tightly-* or *loosely-coupled.* A group of tightly-coupled systems are dependent upon one another. A change in one system will affect all of the other systems. In contrast, loosely-coupled systems are relatively independent and are not significantly affected by exogenous changes. Perrow (1999) makes a further distinction by describing the interactions within systems as *linear* or *complex.* Linear interactions tend to be well laid out and predictable, whereas complex interactions are difficult to predict and result in unexpected outcomes. For example, a railway network can be described as a tightly-coupled, linear system. The interactions between components of the system are well understood and operational and management decisions are well informed by system feedback. In contrast, a nuclear power plant is a tightly-coupled, complex system. The interactions between its components are numerous and complex, making it difficult to provide adequate and accurate system information/feedback. The result is that a failure in a system component can be hidden from system operators, resulting in unexpected system outcomes.

[604] A transportation system is likely to have *emergent properties* that will be of particular interest to system engineers/planners. In general, the system is studied or assessed in terms of *performance measures* such as the number of traffic accidents, the rate of traffic flow, the level of air pollution, etc.



Source: Adapted from Dodder et al. (2004, p. 5).

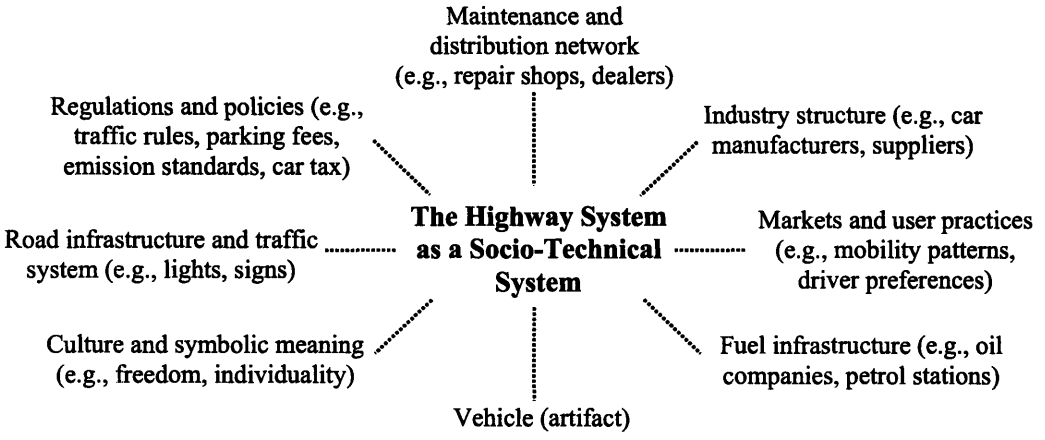
Figure 6.2: Nested Complexity and Layers of the Physical System

6.1.6 System Representation

The manner in which the transportation system is conceptualized and represented is likely to influence the analysis of the system. This section presents a variety of transportation system representations and highlights the importance of system boundaries since these dictate what is included and excluded from decision-making processes.

Dodder et al. (2004) describe and analyze the transportation system using the CLIOS (Complex, Large-scale, Integrated, Open Systems) framework. The CLIOS framework consists of three main phases: [1] system representation; [2] design and evaluation of system improvements; and [3] implementation of system changes. Figure 6.2 presents two aspects of the representation phase: the *layering* of physical systems and the *nesting* of these systems within the institutional sphere. The 'common drivers' shown on the diagram indicate where the sub-systems interconnect. Income per capita is a good example of a common driver since a change in income is likely to affect all modes of transportation in different ways. A third aspect of the system representation (not shown in Figure 6.2) is the expansion of system components to explore areas of interest (such as congestion or air quality) in more detail.

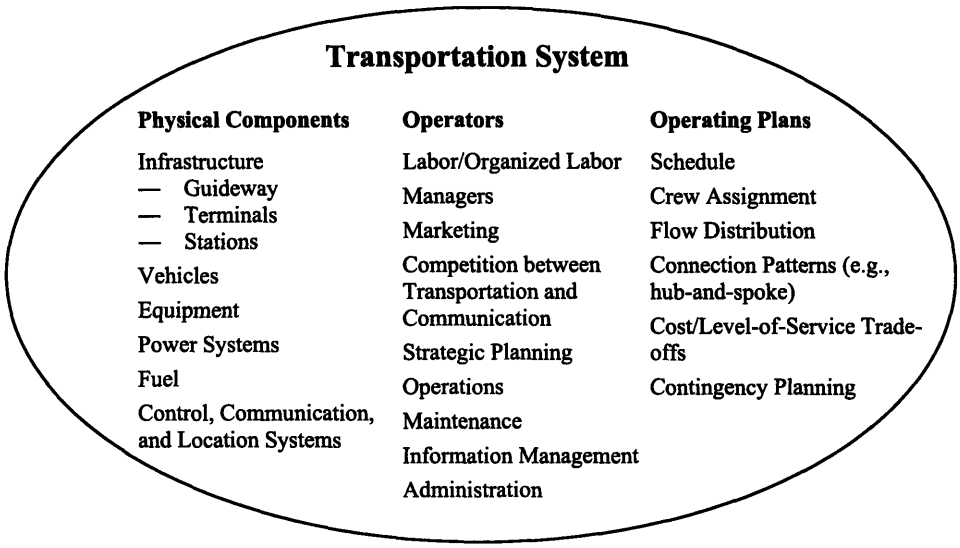
In Figure 6.2, the highway system is represented as a physical sub-system that is embedded within an institutional sphere. Thus, the physical and social systems are conceived as separate entities that are interconnected by lines of responsibility, ownership, and/or interests. An alternative view of the highway system is presented by Geels (2004) (Figure 6.3). Geels (2004) views the highway system as a socio-technical system and does not make an obvious distinction between physical and social elements. Further, he combines the internal components of the highway system (e.g., road infrastructure) with external and psycho-sociological factors such as regulations and policies and symbolic meaning.



Source: Adapted from Geels (2004, p. 20).

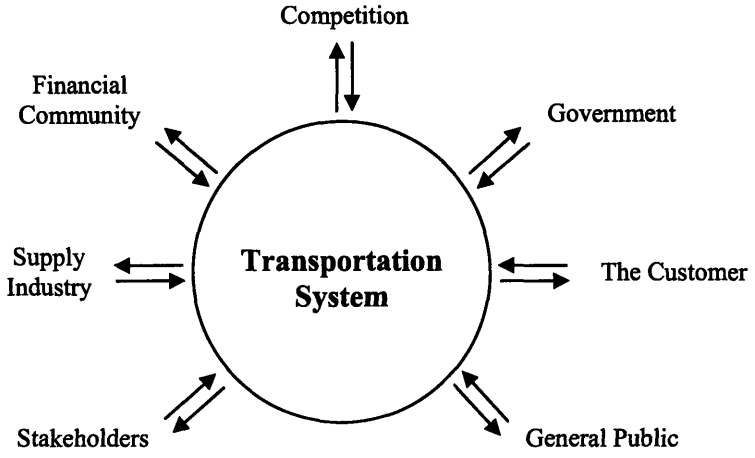
Figure 6.3: Socio-Technical System for the Highway System

In contrast to Geels's (2004) system representation, Sussman (2000) makes a clear distinction between the components that are internal (Figure 6.4) and external (Figure 6.5) to the transportation system.



Source: See Sussman (2000, pp. 11-25).

Figure 6.4: Internal Components of the Transportation System

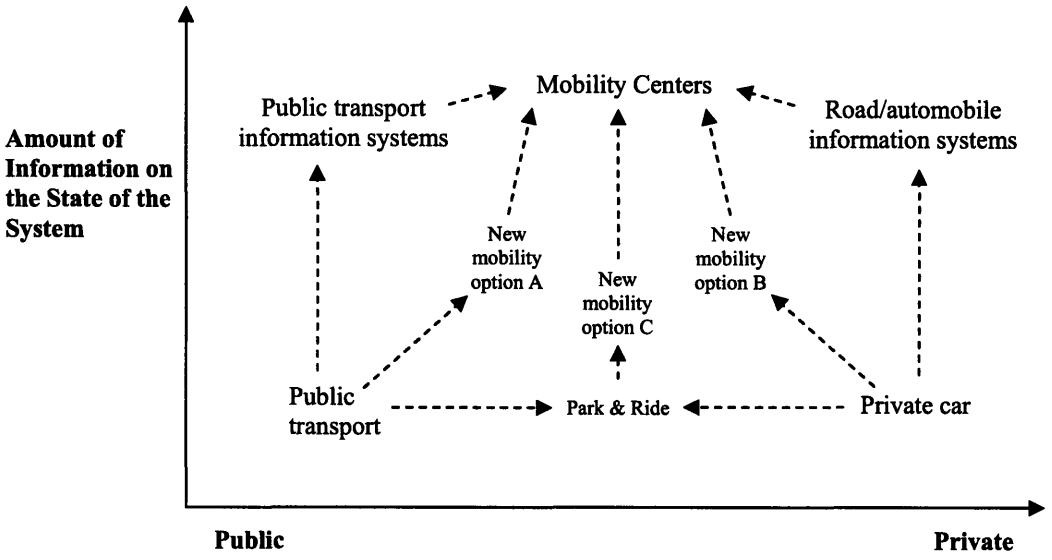


Source: Sussman (2000, p. 27).

Figure 6.5: External Components of the Transportation System

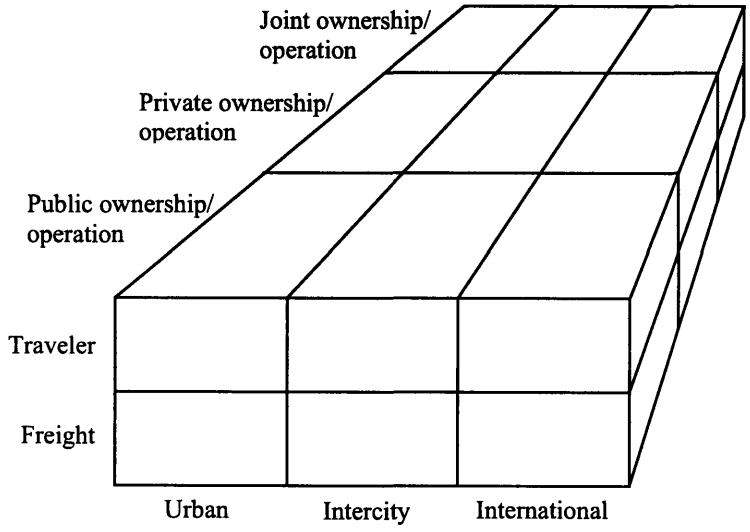
Instead of thinking about the transportation system as consisting of interconnected sub-systems or internal/external components, it is possible to consider the system using a completely different framework. Figure 6.6 combines the ownership of transportation systems with the level of information required to describe the state of the system. This diagram can be used to explore how the gap between public and private modes of transportation can be bridged through new forms of mobility. While this type of system representation does not provide information on the connectivity or layout of a system, it does allow the analyst/decision-maker to consider a wide range of mobility options in an *organizational context.* Similarly, Figure 6.7 characterizes the transportation system using ownership and operation, but makes an explicit distinction between passenger and

freight transportation and the scale of the system. Both Figures 6.6 and 6.7 present different ways to understand the social (or organizational) and physical aspects of a transportation system and draw different boundaries around the system.



Source: Hoogma et al. (2002, p. 131).

Figure 6.6: Bridging the Gap between Public and Private Modes of Transportation through the Use of Information Technology

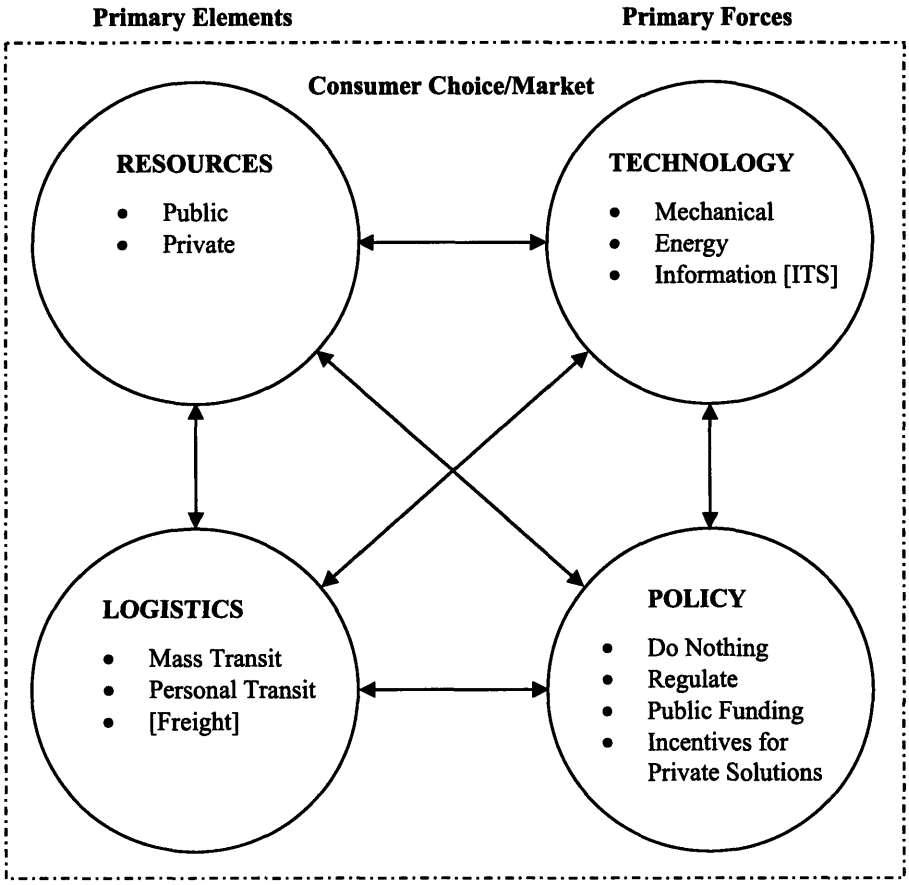


Source: Sussman (2000, p. 8).

Figure 6.7: Transportation Systems Characterization

If our interest lies more in transportation policy development, it is likely that our system representation will include components that are pertinent to the policy process. For

example, Freund (2005) views transportation policy as existing within an interconnected framework of the primary elements (i.e., public/private financial resources and passenger[/freight] logistics) and primary forces (i.e., technology and policy) of transportation (Figure 6.8). This representation of the transportation system implies that the system is dynamic - i.e., a change in one component is likely to lead to changes in the others.



Source: Freund (2005, p. 2).

Figure 6.8: Basic Elements of the Transportation Policy Process

Another way to view the transportation system is to use a hierarchy (Figure 6.9). "*A system hierarchy ... provides order and function to the operation of the individual components* [of a system] *in the context of more global system goals. How this system hierarchy is defined affects how one views problems and conducts planning*" (Meyer and Miller 2001, p. 91).

The benefit of using a hierarchy to describe a system is that it enables the analyst/decision-maker to consider how changes in one system might affect other systems. When considering sustainable development, understanding how policies aimed at the transportation system might impact land use and the livability of communities, for

instance, is important. Conversely, understanding how changes to other systems (such as the energy/power system) might impact the transportation system is of equal interest.

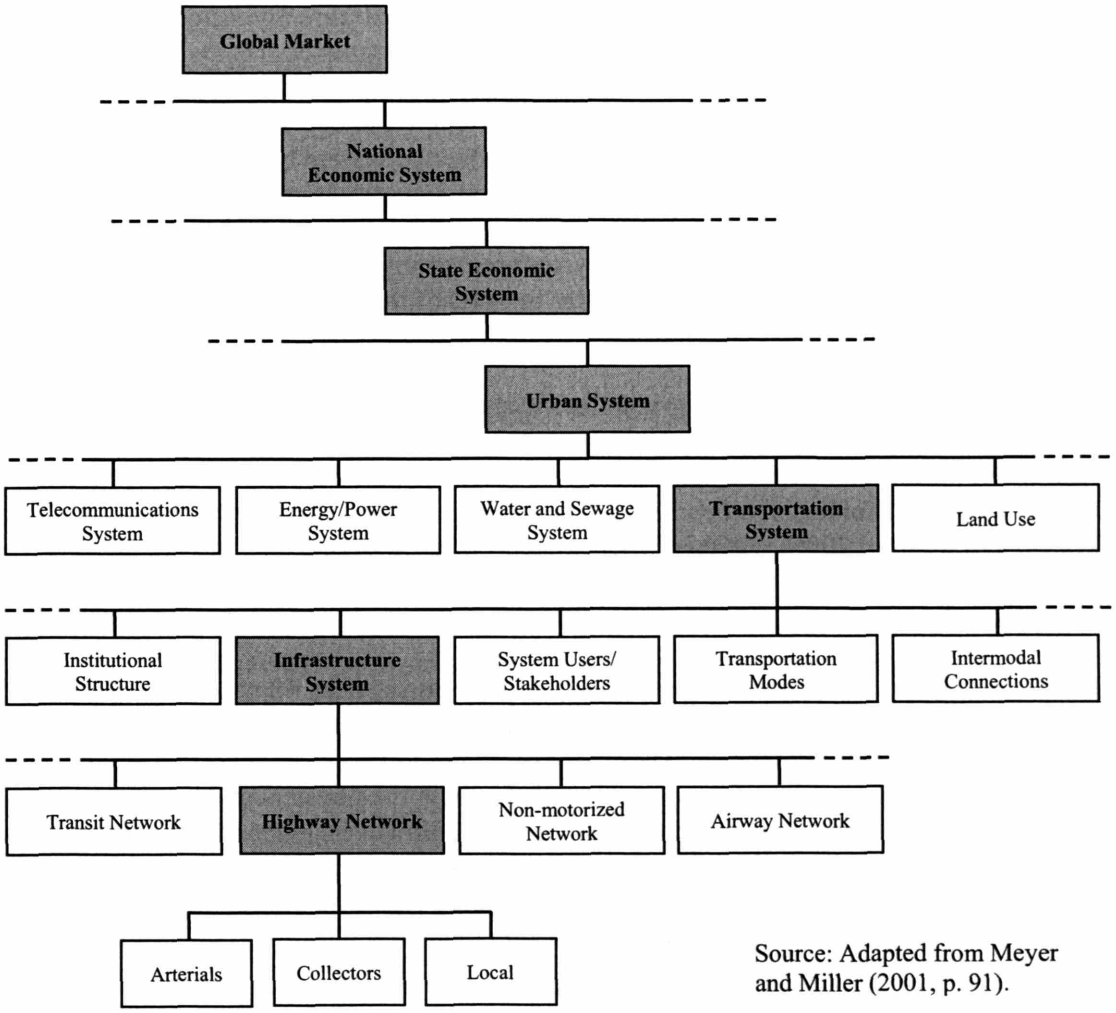


Figure 6.9: Transportation in a Systems Hierarchy

Figures 6.1 to 6.9 provide a good indication of the various ways in which a transportation system can be represented and understood. It is clear that each type of representation provides certain advantages and disadvantages. For example, a detailed focus on physical sub-systems can enhance our understanding of mobility patterns, but provides limited information on the political element of the systems. Likewise, a system hierarchy presents a useful way to identify the relationship of critical components; however, one might question whether it is possible to make such a clear distinction between the levels shown in the hierarchy. In addition, while both a system hierarchy and the CLIOS representation rely upon hierarchies to separate elements of the system, they conceptualize the system in quite different ways.

6.1.7 Conclusion

This section was written to introduce some useful system terminology and to highlight the inherent complexity of a transportation system. A key argument is that the transportation system's conceptualization and boundary will directly influence the analysis of the system. Indeed, one might argue that *the system boundary is only defined once the research question has been asked.* If the question is whether a transportation system is sustainable, further information will be required to define exactly what is meant by the concept of sustainable transportation to enable the system boundary to be drawn. An interesting observation of the system representations shown in the previous section is that none of them include the natural environment. While it might not be possible to include environmental factors in certain system representations (such as organizational diagrams), a failure to recognize the broader impacts of the transportation system when possible is an important oversight.

While there is no 'correct' way to view the transportation system, it is important to include all of the relevant social/organizational, economic, environmental, and technical factors (as perceived by the stakeholders) in the analysis. This fact raises the importance of engaging stakeholders at an early stage in the representation and modeling of the system (Mostashari 2005). Further, it seems appropriate to represent the system using a variety of techniques to inform the analysts, stakeholders, and the decision-makers of how changes to the system might affect both the system itself and other related systems.

Finally, while the discussion refers to the 'transportation system,' it should be recognized that the phrases *transportation enterprise*,[605] *transportation sector*, *CLIOS*, *socio-technical system*, and *engineering system* are often used interchangeably to describe the transportation system. Since this research includes both the physical and social aspects of transportation, all of these phrases seem appropriate. However, given that this research is primarily interested in whether the U.S. surface transportation legislation supports sustainable development, the phrases transportation system, sector, and enterprise are used in the subsequent text since these terms are commonly used in U.S. DOT policy documents.

6.2 Sustainable Transportation

> "*There can be no sustainable development without sustainable transportation. It is an essential component not only because transportation is a prerequisite to development in general but also because transportation, especially our use of motorized vehicles, contributes substantially to a wide range of environmental problems, including energy waste, global warming, degradation of air and water, noise, ecosystem loss and fragmentation, and desecration of the landscape. Our*

[605] A *transportation enterprise* is defined as "*all people, organizations and infrastructure involved with transportation investment, labor, management, operations and uses. It includes private companies, public agencies, citizen groups and individuals*" (U.S. DOT 2000, p. i).

nation's environmental quality will be sustainable only if we pursue transportation in a sustainable way" (Benfield and Replogle 2002, p. 647).

The transportation system is often envisioned as the engine of development. It is seen as the backbone of the twentieth century's economic and social progress and is the means by which humans access goods and services and connect to communities. Yet, the transportation system is also a major contributor to environmental degradation and community disruption. One might also argue that the falling costs and increasing efficiency of the transportation system has enabled the emergence of the 'throughput society' (see Section 2.1.4). The ease with which materials and goods can be moved across and between nations has transformed the structure of national economies, which are becoming increasingly interconnected. This process is further enhanced by the emergence of information and communication technology (ICT) throughout the world. The complexity unleashed by the integration of regional and national economies means that tracing *who* is responsible for negative externalities - i.e., resource extraction firms, manufacturers, consumers, government, etc. - is not a simple question to ask or answer. One is immediately faced with concerns of national and consumer sovereignty and hard questions about what is the *right* or *just* solution to a problem.

The objective of this section is to explore the rich and emerging field of sustainable transportation. It begins by looking at how the roots of the concept can be traced to the 1972 Stockholm and 1992 Rio conferences (Section 6.2.1). This is followed by a review of the evolution of the definitions and principles of sustainable transportation since the early 1990s (Section 6.2.2). A conclusion from this review is that the prevailing focus on 'sustainable transportation' might be too narrow and constraining. It implies that the transportation system can be made sustainable in its own right, possibly without considering other sectors. By exploring the interconnections between the transportation system and the economy (Section 6.2.3), a broader perspective is introduced that considers the transportation system through the lens of sustainable development. Using Gudmundsson and Hojer's (1996) set of principles for sustainable development as a guide, the sustainability of the transportation sector is discussed in the context of: [1] the preservation of natural capital for future generations; [2] the preservation of the [quasi-]option value of human and man-made capital for future generations; [3] improving quality of life; and [4] the need to ensure a fair distribution of life-quality (see the four sub-sections in Section 6.2.4).

Viewing the transportation system in the context of sustainable development presents some difficult challenges. Given the high level of complexity, it is no wonder that many transportation planners and decision-makers view the concept of sustainable development as an unattainable or vague policy objective. The purpose of this chapter is to challenge these perceptions.

6.2.1 Transportation and Its Relationship to the Concern for Sustainable Development

An operating assumption of this research is that the concept of sustainable transportation is directly linked to, and must be conceptualized within, the broad framework of sustainable development. This section looks at the role transportation has played in the formation of the concern for sustainable development. Following this discussion is a review of the principles/ideas contained within the 1972 Stockholm and 1992 Rio conferences that have become central to the concept of sustainable transportation.

In Chapter 3, the emergence of sustainable development is explored by tracking its four key environmental drivers and five core elements which surfaced during the second half of the twentieth century. A closer look at the environmental divers of the concern for sustainable development reveals that the transportation system has played - and continues to play - a significant role in fueling these indicators of unsustainable development.

First, the transportation system is responsible for a wide range of impacts that affect *ecosystem integrity and biological diversity and indirectly affect human health and well-being* - the first environmental driver of the concern for sustainable development. The growing field of 'road ecology' provides a good example of the concerns that researchers (across a wide range of disciplines) have with the physical, chemical, and noise impacts of the road network and traffic on vegetation, wildlife, aquatic systems, etc. (BFR 1999; Forman et al. 2003; Rajvanshi et al. 2001; Spellerberg 2002). As transportation systems continue to expand in many urban and rural areas across the world, their environmental impacts are likely to remain an important driver of the need for sustainable development.

Second, the transportation system relies upon *non-renewable resources and energy supplies* to build/maintain infrastructure, manufacture transportation vehicles/equipment, and power the system - the second environmental driver of the concern for sustainable development. Since the 1960s the U.S. transportation sector has consumed approximately one-fifth of the steel, one-tenth of the aluminum and copper, one-third of the zinc, and half of the lead produced annually within national borders (Geiser 2001).[606] In Europe, the production of transportation vehicles/equipment and infrastructure account for 20 to 40 percent of the total consumption of major materials, including aggregates, cement, steel, and aluminum (Hille 1997). With no obvious renewable substitutes for these engineering materials available - at least on the scale required to construct/maintain

[606] It should be recognized that in the U.S. approximately 95 percent of all motor vehicles enter the recycling infrastructure, of which 82-84 percent of the weight of these vehicles is recycled [or down-cycled] (Dana 2003). While some argue that these figures are too high (Paul 2003), the level at which vehicle materials are being reused is nevertheless impressive considering the fact that there is no comprehensive regulation requiring this level of recycling. In the Netherlands, however, the regulatory landscape is quite different. Dutch law currently requires that 85 percent of all vehicle materials be recycled, which will be increased to 95 percent - the European target set for 2015 - in 2007 (de Jong et al. 2003). While it is currently possible to recycle metals such as iron, aluminium, and copper with relative ease, as more sophisticated alloys, laminates, and blends become available the recycling of these materials is likely to present a significant technical challenge (Hille 1997).

typical highway, airport, and railway systems - it is likely that a recycling and conservation ethic will become increasingly important as raw materials and landfill space become scarce (and highly priced).[607]

With regards to non-renewable energy supplies, the transportation sector's reliance on oil is a major indicator of its long-term unsustainability (Brown 1981; Greene 1996; Sperling and Shaheen 1995). The sector currently accounts for about 25 percent of the total commercial energy consumed worldwide and around 57 percent of the total oil consumed (IEA 2004b; 2004c; UNDESA 2001). In OECD countries the transportation sector accounts for some 54 percent of the primary oil demand, and petroleum-based fuel (e.g., gasoline, diesel, residual fuel oil, and jet fuel) accounts for 97 percent of the transportation sector's energy use (IEA 2002). In developing nations the transportation sector's share of oil demand is lower - around 33 percent - since oil is still used for electricity generation (ibid). While the solution to this energy-reliance problem is seen to lie in the transition from an oil to a hydrogen- and solar-based economy (Geller 2002; Scheer 2004; Sperling and Cannon 2004), the timeframe and processes by which this transition can occur are highly uncertain and subject to national priorities and circumstances. Thus, the transportation sector's reliance on non-renewable resources and energy supplies is likely to continue for many decades, maintaining the sector's prominent role in unsustainable resource use.

Third, *toxic chemicals* released during the manufacture and disposal of transportation vehicles/equipment and through the incomplete combustion of fossil fuels can *directly affect human health and the health of other species* - the third environmental driver of the concern for sustainable development. In 1976 the manufacture and use of Polychlorinated Biphenyls (PCBs) in electrical and hydraulic equipment was banned in the U.S. with the passage of the Toxic Substances Control Act (TSCA) due to concerns over its toxicity and persistence.[608] While almost three decades have passed since its ban, aging transportation equipment - including many vessels[609] and PCB capacitors and transformers[610] - still present a potential threat to human health and the health of other species. The challenge facing the owners of transportation vehicles/equipment containing PCBs is how to dispose of these items in a cost-effective and safe manner. Another example of this problem is the disposal of asbestos brake linings, which primarily affects automobile mechanics in the U.S.[611]

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[607] In an effort to reduce the demand for minerals in the UK, an aggregates levy and landfill taxes are being used to encourage mineral recycling and the adoption of a whole life cycle approach to minerals management (Reid 2002; NCBS 2002).

[608] See the Environmental Protection Agency (EPA), *Polychlorinated Biphenyls (PCBs)*, http://www.epa.gov/opptintr/pcb/ (accessed on 04/09/06).

[609] See the statement of the Maritime Administrator, William Schubert, on the *Disposal of Obsolete Government Vessels* to the Subcommittee on Surface Transportation and Merchant Marine (U.S. Senate) on July 7, 2003, http://marad.dot.gov/Headlines/speeches/2003/7july03.htm (accessed on 04/09/06).

[610] See the Federal Aviation Administration, *Hazardous Waste Disposition*, http://fast.faa.gov/toolsets/Environment/hazmat2.htm (accessed on 04/09/06).

[611] See the discussion in Forman et al. (2003, pp. 201-223) on the effects of chemical pollution from roads and vehicular sources.

With regards to the combustion of fossil fuels, local and regional air pollutants from motor vehicles - e.g., primary pollutants such as carbon monoxide (CO), volatile organic compounds (VOCs), sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulates (PM), and lead, and secondary pollutants such as ozone - have long been associated with respiratory and other human health problems (Christiani and Woodin 1999; Gorham 2002a; Onursal and Gautam 1997; Whitelegg 1997).[612] Indeed, a recent study in the New England Journal of Medicine confirmed the link between the exposure of humans (when in vehicles, on public transportation, or on motorcycles or bicycles) to air pollution from traffic and the onset of heart attacks (Peters et al. 2004). In addition, the Environmental Protection Agency (EPA) estimates that as much as half of all cancers linked to outdoor sources of air toxins (such as benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and diesel particulate matter) can be attributed to mobile sources (i.e., automobiles, trucks, and buses).[613] Therefore, the transportation system has been and continues to be a major contributor to the concern that toxic chemicals are affecting the health of humans and other species.

Finally, *ozone depleting substances and greenhouse gases* released from motor vehicles and transportation equipment play a major role in the *disruption of the global climate* - the fourth environmental driver of the concern for sustainable development. Before their phase-out following the establishment of the Montreal Protocol in 1987, ozone-depleting chlorofluorocarbons (CFCs) used in vehicle air conditioners were a major contributor to the thinning of the ozone layer. Interestingly, the gases that replaced CFCs in air conditioners and other products such as tires (e.g., hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)) are now being assessed for their global warming potential and also face being phased-out (Barrault et al. 2003; Schwarz and Harnisch 2003).[614] In 2002, the transportation sector in North America was responsible for 30 percent of the region's total energy-related CO_2 emissions; in Europe the figure was around 26 percent; and in the Pacific region CO_2 emissions attributed to transportation were around 22 percent (IEA 2004a). Between the period of 1990 and 2002, these shares remained relatively stable or increased slightly (ibid). In developed nations, the transportation sector is the second largest emitter of CO_2 behind the energy sector (ibid). Thus, while it seems that the transportation sector's impact on the ozone layer is under control, its impact on global climate change shows no signs of decreasing in the near future. If we consider the growing energy demands of transportation systems in developing nations (EIA 2004), the sector as a whole is likely to be a leading contributor to climate change for the foreseeable future.

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[612] See the Environmental Protection Agency (EPA), Air and Radiation, *Why be Concerned?*, http://www.epa.gov/air/concerns.html (accessed on 04/09/06).

[613] See the Environmental Protection Agency (EPA), *Mobile Source Air Toxics*, http://www.epa.gov/otaq/toxics.htm (accessed on 04/09/06).

[614] See the U.S. Energy Information Administration (EIA), *Emissions of Greenhouse Gases in the United States 2003, Hydrofluorcarbons, Perfluorocarbons, and Sulfur Hexafluoride*, http://www.eia.doe.gov/oiaf/1605/gg04rpt/index.html (accessed on 04/09/06), and an article by EuropaWorld, *Climate change: Commission tackles fluorinated gases*, http://www.europaworld.org/week140/climatechange15803.htm (accessed on 04/09/06).

The above discussion highlights the paradox that lies at the heart of modern industrialization processes. While the development of transportation systems affords society the freedom of mobility and accessibility with all of the opportunities and possibilities for self-fulfillment that come with this, these benefits appear to be offered at an ever-increasing price. The growing interest in sustainable transportation indicates that society is no longer satisfied with the 'Faustian' pack it formed with transportation experts, industry, and government (McKenzie 2003; Whitelegg 1997). While many urban areas struggle to maintain their accustomed levels of transportation service as more people and freight enter existing transportation systems, the costs of providing this service (e.g., congestion, pollution, accidents, land degradation, etc.) are rising.[615] Hence, society and industry are not receiving the benefits they expects for the costs that they are bearing and have a right to ask what can be done to address these problems.

The first international conference that called prevailing industrialization processes into question was held in Stockholm in 1972 (see Section 3.3.3.1). While transportation was not directly addressed at the conference - which focused on the deteriorating condition of the *human environment* - the Stockholm Declaration does articulate several principles that are relevant to sustainable transportation. These principles are shown in Table 6.1 next to the corresponding environmental driver of the concern for sustainable development. Since global climate change had yet to be formally recognized at an international level, none of the Stockholm principles addressed this concern.

[615] It is important to recognize that the transportation system has a capacity constraint that makes it somewhat unique from other large scale engineering systems - such as the telecommunication system. While the field of intelligent transportation systems (ITS) treats vehicles as packets of information that can be ordered or managed in a more efficient way, there is an upper bound to the physical system at which the flow will be maximized. In telecommunication systems, once the existing network is congested, extra capacity can be added as required with minimal external impacts. In a transportation system, the addition of extra capacity eventually leads to diminishing marginal returns as factors such as environmental conditions and noise undermine improvements in mobility. In addition, the impact of latent demand can quickly consume any increase in system capacity. Thus, it is likely that creative solutions to current transportation problems will require non-traditional planning avenues to be pursued, whereby transportation services become subservient to broader objectives such as livable communities, smart growth, and new urbanism. Refocusing and integrating transportation and land use planning to reduce the need to make long or short trips for everyday tasks is one approach that is likely, for instance, to reduce the demand for highway expansion. It might also improve health as people find it easier to walk to the local store instead of driving several blocks.

Table 6.1: Stockholm Principles Relevant to Sustainable Transportation

Environmental Driver of the Concern for Sustainable Development	Principles from the Stockholm Declaration[616] Directly Relevant to the Transportation Sector	Comments
1. The disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being.	**Principle 15**: *Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. ...*	The idea of protecting the environment and balancing environmental, social, and economic considerations is a primary objective of planning for sustainable transportation.
2. The rapid use of finite resources and energy supplies.	**Principle 13**: *In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and co-ordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population.*	The transportation sector's reliance on non-renewable resources and energy supplies is a major obstacle to its long-term sustainability. The coordination of the sector's resource and energy demands with that of other key sectors is likely to become an important area of debate in the future.
3. The direct impacts of toxic pollution on human health and the health of other species.	**Principle 6**: *The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of all countries against pollution should be supported.*	While not a leading concern in the area of sustainable transportation (as currently defined), the management and prevention of toxic pollution from transportation equipment and vehicles remains an important problem area. Further, the impact of toxic pollution from transportation on communities is of particular relevance to 'environmental justice.'

In 1992, the concept of sustainable transportation began to take shape at the Earth Summit in Rio de Janeiro. Agenda 21 - the action plan of the Rio Declaration - included two chapters that address transportation. Chapter 7, which covered sustainable human settlements, called for a comprehensive approach to urban transportation planning that focused on ways to promote "*efficient and environmentally sound urban transport systems in all countries*" (UN 1993, § 7.52). More specifically, each nation was asked to:

(a) "Integrate land-use and transportation planning to encourage development patterns that reduce transport demand;

(b) Adopt urban-transport programmes favouring high-occupancy public transport in countries, as appropriate;

(c) Encourage non-motorized modes of transport by providing safe cycleways and footways in urban and suburban centres in countries, as appropriate;

[616] See the United Nations *Declaration of the United Nations Conference on the Human Environment*, http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1503 (accessed on 04/09/06).

(d) *Devote particular attention to effective traffic management, efficient operation of public transport and maintenance of transport infrastructure;*
(e) *Promote the exchange of information among countries and representatives of local and metropolitan areas;*
(f) *Re-evaluate the present consumption and production patterns in order to reduce the use of energy and national resources*" (UN 1993, § 7.52).[617]

The last objective is interesting since it raises two important issues with regard to the transportation sector. First, as a leading consumer of non-renewable resources the transportation sector needs to develop ways to minimize its use of finite resources. Second, the transportation sector plays an important role in *facilitating* the consumption of resources by other sectors and society in general. Hence, the manner in which the transportation system is *used* is likely to be of direct relevance to sustainable development. While the former issue is addressed directly in the sustainable transportation literature, the latter issue has not become part of the mainstream view of sustainable transportation (Hall 2002).

The second transportation-related chapter in Agenda 21 is Chapter 9, which focuses on the protection of the atmosphere.[618] As one might expect, the primary concern with the transportation sector in this chapter lies with its contribution to atmospheric emissions (UN 1993, § 9.13). To address this problem, a program area was developed to encourage nations "*to develop and promote cost-effective policies or programmes, as appropriate, to limit, reduce or control ... harmful emissions into the atmosphere and other adverse environmental effects of the transport sector, taking into account development priorities as well as the specific local and national circumstances and safety aspects*" (UN 1993, § 9.14).

In addition, signatory governments to Agenda 21 were asked to "[d]*evelop and promote ... cost-effective, more efficient, less polluting and safer transport systems*," as well as integrate transportation planning in rural and urban areas (UN 1993, § 9.15.a).

While Agenda 21's text on transportation is somewhat limited, there are several broad principles within the Rio Declaration[619] that are particularly relevant to the notion of sustainable transportation.[620] First, the Declaration states that environmental protection must be integrated into the development process and cannot be considered in isolation from it (Principle 4). Hence, the transportation sector must integrate environmental considerations into its planning and decision-making processes. To help achieve this objective, the Declaration endorses three different approaches: [1] to act with *precaution* where future outcomes are uncertain (Principle 15); [2] to develop economic instruments

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[617] These objectives were supported by a call for *public awareness campaigns* and *human resource development* to highlight and support the need for change (UN 1993, § 7.53).
[618] Chapters 7 and 9 of Agenda 21 had an influential role in shaping the President's Council on Sustainable Development's (PCSD's) approach to transportation. Specifically, the PCSD (1996; 1999) considered transportation in the context of sustainable communities and global climate change (see Section 8.3.2.2).
[619] See the United Nations *Rio Declaration on Environment and Development*, http://www.unep.org/Documents/Default.asp?DocumentID=78&ArticleID=1163 (accessed on 04/09/06).
[620] See the related discussion in Section 3.4.4.1.

that *internalize* the costs of negative externalities (Principle 16); and [3] to undertake an *environmental impact assessment* when a proposed activity is likely to have a significant adverse impact on the environment (Principle 17). All three of these approaches are directly applicable to sustainable transportation and many of them are currently used in transportation decision-making throughout the world.

Second, the Rio Declaration states that stakeholder participation is essential when addressing environmental issues (Principle 10). This principle states that "*each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities.*" The provision of information to stakeholders and their involvement in decision-making is directly relevant to transportation concerns for 'environmental justice.'

Finally, the Rio Declaration specifically addresses the international impacts of national activities. While nations have the sovereign right to use their own resources as they see fit, the Rio Declaration states that they also have a "*responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction*" (Principle 2). This principle is directly relevant to the emission of greenhouse gases (e.g., CO2, HFCs, etc.) from transportation motor vehicles and equipment. It is also applicable in situations where transportation-related regional air pollutants cross national jurisdictions. Further, the Rio Declaration states that the transfer of hazardous activities and substances between states should be prevented (Principle 14).[621] Since the transportation system is the mechanism by which hazardous wastes are transferred between nations, one could argue that the *use* of the transportation system could form a central (moral) component of the concept of sustainable transportation (Hall 2002).

At the time of the Rio Conference, national governments and international agencies began to develop their own positions on sustainable transportation. A notable example is the Commission of the European Communities' Green Paper on 'The Impact of Transport on the Environment' (EC 1992).

The Green Paper defined a 'sustainable mobility framework' as one that:

- contains "*the impact of transport on the environment*[;]"
- allows "*transport to continue to fulfil its economic and social functions*[;]"
- contributes "*to social and economic cohesion ... and to the creation of new opportunities for the peripheral regions*[;]"
- safeguards "*the freedom of choice for the user*[;]" and
- identifies, "*in accordance with the principle of subsidiarity, the responsibility which the different actors will have to assume in order to achieve the objective of the strategy*" (EC 1992, p. 55).

[621] See the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, http://www.basel.int/pub/basics.html (accessed on 04/09/06).

In contrast to the more specific definitions discussed in the following section, this framework was criticized for being "*a typical political compromise containing something for everyone but with no clear indications of new policy directions*" (Short 1995, p. 9). While valid, this criticism does not acknowledge the significance of having sustainable transportation as an agenda item for the European Community. The momentum behind much of the work in Europe on sustainable transportation over the past decade has been made possible by early policy documents such as this.[622] In this regard, the Green Paper should be seen as a milestone in Europe's formulation of - and debate on - the concept of sustainable transportation. It had the effect of moving global environmental issues from the periphery to the center of transportation policy and placed 'sustainable mobility' at the top of analysts' agendas (Gudmundsson and Hojer 1996). However, it would be almost a decade until the European Council (2001a) endorsed its internationally-accepted definition of sustainable transportation that is presented in the following section.

The U.S. has followed a different pathway. Since the federal government has not 'officially' endorsed the concept of sustainable transportation, its advocates are somewhat divided among the various environmental, social, and economic dimensions of the concept. The lack of a unifying theme (and long-term direction) under which transportation policies and programs can be developed remains a barrier to more innovative transportation policy even though there have been some notable achievements such as the integration of the Clean Air Act with surface transportation legislation (Lyons 2000; Weiner 1997) (see Section 8.3.2).

In conclusion, this section discusses how the transportation sector is a major contributor to the four environmental drivers of the concern for sustainable development. It also introduces important transportation-relevant text within the Stockholm and Rio Declarations and Agenda 21, which have shaped the foundation of the definitions and principles of sustainable transportation discussed in the next section. Much of the work focusing on the transportation sector at the international level - specifically work driven by the UN - continues to call for, and build upon, the objectives set out in these two UN declarations and Agenda 21 (ECOSOC 2001a; 2001b). An interesting characteristic of this work is that the topic of transportation is treated as a subset of other topics such as human settlements or energy (UNCHS 2001; WEHAB Working Group 2002). The next section views the concept of sustainable transportation as a topic in its own right - i.e., it is the expression of sustainable development within the transportation sector. Hence, transportation becomes the center of attention and issues such as climate change, environmental protection, livable communities, energy efficiency, and economic development become sub-themes within the concept of sustainable transportation.

[622] For a summary of the latest European work on sustainable transportation, see the European Commission, *Transport and Environment*, http://europa.eu.int/comm/environment/air/transport.htm (accessed on 04/09/06).

6.2.2 Definitions and Principles of Sustainable Transportation

The basic principles of sustainable development and sustainable transportation are articulated in this section. Although these principles are relatively clear, there is controversy in their *interpretation* and *application* to real world circumstances. This section shows how the core principles of sustainable development have been integrated into sustainable transportation and questions whether the current (internationally-accepted) view of sustainable transportation is likely to support the larger process of sustainable development.

The most well-known definition of sustainable development is the Brundtland definition (WCED 1987). While this definition recognizes the importance of meeting the needs of current and future generations, these needs can only be satisfied if the natural environment is able to support (or 'carry') the human populace. The core principles by which human activities will be kept within the earth's carrying capacity are most clearly articulated by Herman Daly:

1. "*The main principle is to limit the human scale (throughput) to a level which, if not optimal, is at least within carrying capacity and therefore sustainable. ...The following principles aim at translating this general macro level constraint to micro level rules.*
2. *Technological progress for sustainable development should be efficiency-increasing rather than throughput-increasing. ...*
3. *Renewable resources, in both their source and sink functions, should be exploited on a profit-maximizing sustained yield basis and in general not driven to extinction (regardless of the dictates of present value maximization), since they will become ever more important as nonrenewables run out ... Specifically this means that: (a) harvesting rates should not exceed regeneration rates; and (b) waste emissions should not exceed the renewable assimilative capacity of the environment.*
4. *Nonrenewable resources should be exploited, but at a rate equal to the creation of renewable substitutes"* (Daly 1991, pp. 44-45).

Daly's (1991) first principle should be thought of as *the* fundamental principle of ecological sustainability, which is refined by the third and fourth principles. Costanza and Daly (1992) later added the principle that the use of *replenishable* (i.e., non-living) forms of natural capital (e.g., groundwater and the ozone layer) should not exceed their rates of replenishment or recharge. While Daly's (1991) second principle highlights technological innovation as an important factor in reducing humanity's ecological impact, social, institutional, and organizational innovation are equally important considerations. Indeed, a more balanced (systems) approach that integrates and co-optimizes technological, social, institutional, and organizational innovation is likely to be more effective at satisfying basic needs while making our resources go further.

A weakness of Daly's (1991) definition is that it does not include the importance of sustaining/improving human well-being or the role of government. A useful definition of

- or set of necessary conditions for - sustainable development that attempts to include these elements was developed by William Rees:

> "*Ecological stability requires that*
> — *consumption by the economy of the products and services of nature be compatible with rates of production by the ecosphere.*
> — *the production of wastes by the economy remain within the assimilative capacity of the ecosphere.*
> — *economic activity protect the essential life-support functions of the ecosphere and preserve the biodiversity and resilience of Earth's ecological systems.*
> *Geopolitical security requires that*
> — *society satisfy basic standards of material equity and social justice.*
> — *governance mechanisms be in place to enable an informed citizenry to have an effective participatory role in decision-making.*[623]
> — *people share a positive sense of community cohesion (local and global) and a sense of collective responsibility for the future*" (Rees 1995, p. 356).

While more comprehensive, a general criticism with definitions that treat ecological carrying capacity in such a formulaic manner is that the 'quality' of the environment is not a leading consideration (Gudmundsson and Hojer 1996). For example, consuming renewable resources (such as fish or trees) at rates equal to their natural rate of replenishment does not mean that the resources are flourishing; it means that their population or ecosystem is only just surviving. Nevertheless, establishing ecological limits is vitally important if society is to know whether its activities are damaging the environment upon which its future depends. Including the public and stakeholders in decision-making is one way that the desired level of environmental quality (which is an important component of an individual's quality of life) can be obtained.

Establishing ecological limits (or carrying capacities) implies that human activities must be kept within these limits or the environment will suffer irreparable harm. Daly (1996) uses the term 'steady state' to describe the operation of the human economy within such limits (see Sections 2.4 and 4.2.2). It is important to recognize that the term steady state refers to the steady and maximum aggregate throughput of energy and matter that can be *sustained* by the natural environment. The 'throughput' in a steady state economy (SSE) refers to the transformation of low-entropy (renewable and non-renewable) raw materials into commodities and then into high-entropy wastes. Thus, if the throughput of energy and matter is restricted by imposed resource constraints or ecological limits then society

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[623] The requirement that stakeholders must be involved in decision-making for sustainable development to be achieved is an interesting proposition. However, it should be recognized that stakeholder involvement does not necessarily guarantee that decisions will be made that support the multidimensional concept of sustainable development (see the related discussion on the role of government and stakeholder posture in Section 2.2.2). For example, if stakeholders adopt a utilitarian or communitarian perspective the type of policies that are likely to be supported under each scenario might be quite different. Thus, ensuring that stakeholders have an effective participatory role in decision-making should be accompanied by an analysis of whether or not the positions they adopt are likely to support the objectives of sustainable development.

must seek innovative ways to ensure its needs can be met as it brushes up against these limits.

Within a SSE, the allocation of resources among competing interests is left to the market (Daly 1996). Two factors that are constrained are the rates at which resources are used (an important component of intergenerational equity) and waste is produced. If society ignores these constraints, then it must accept that its actions are likely to change the natural environment and there is no guarantee that the new state will support the quality of life to which society has become accustomed. Global climate change is possibly the most prominent example of how humans are living beyond the Earth's ecological limits.

While a SSE requires that a steady state equilibrium must be achieved at the macro scale to prevent (or halt) global ecological disruption, this need not constrain the dynamic and evolving nature of the economy (Daly 1993). A steady state equilibrium does, however, demand new concepts of development (i.e., satisfaction of human needs) that should not be equated with *growth*.[624] A flourishing economy will be essential to propagate the 'waves of creative destruction' that are a necessary component of society's transformation towards sustainable development. These waves of change will need to be guided by macro resource-use and ecological constraints embedded within voluntary accords, international treaties, or regulation. The transition from an oil-based unsustainable economy to a hydrogen- and solar-based sustainable economy is *the* challenge of the 21st Century.

The core principles of sustainable development - i.e., meeting human needs and improving quality of life; living within the earth's ecological carrying capacity; living off ecological interest rather than consuming natural capital; and protecting future generations (Beatley 1995; Costanza and Daly 1992; Daly 1991; Holdren et al. 1995; Rees 1995; WCED 1987) - have been incorporated to varying degrees in conceptualizations of sustainable transportation.[625]

Following the 1992 Rio Conference, the 1990s witnessed a surge of activity in the emerging field of sustainable transportation. In essence, the concept of sustainable transportation can be described as "*an expression of sustainable development in the transportation sector*" (Zietsman and Rilett 2002, p. 10). One of the earliest international efforts to develop the concept of sustainable transportation was the OECD project on Environmentally Sustainable Transport (EST). During the first phase of the EST project, the OECD developed a qualitative definition of sustainable transportation that was very much inspired by Daly's principles of ecological carrying capacity. The OECD (1996, p. 54) initially defined an environmentally sustainable transport system as one in which

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[624] While neo-classical economic analysis is focused on constant and increasing rates and flows, steady state economics refutes that this approach could ever achieve an ecological steady state (see discussion of ecological economics in Section 4.2.2).

[625] It is important to acknowledge that the focus of this section is on holistic conceptualizations of sustainable transportation (CST 1997; Gudmundsson and Hojer 1996; Litman and Burwell 2003; Nijkamp 1994) rather than more specific views that, for instance, focus on sustainable *urban* transportation (May 2003; Minken et al. 2003; OECD 1995). Since the urban, regional, and system views of sustainable transportation are subsets of the broader concept, this approach is justified.

"[t]*ransportation ... does not endanger public health or ecosystems and meets mobility needs consistent with (a) use of renewable resources at below their rates of regeneration and (b) use of non-renewable resources at below the rates of development of renewable substitutes.*"

In later work, the OECD refined the EST definition by expanding upon its basic principles and relating them to quantified international environmental and health criteria and targets. The revised definition is presented below:

> "[A] *sustainable transport system is one that throughout its full life-cycle operation:*
> — *allows generally accepted objectives for health and environmental quality to be met, for example, those concerning air pollutants and noise proposed by the World Health Organization (WHO);*
> — *is consistent with ecosystem integrity, for example, it does not contribute to exceedances of critical loads and levels as defined by WHO for acidification, eutrophication and ground-level ozone; and*
> — *does not result in worsening of adverse global phenomena such as climate change and stratospheric ozone depletion*" (OECD 2000, p. 35).

This revised EST definition - while comprehensive in relation to human and ecosystem health - does not include other important social and economic criteria of sustainable development.[626]

In parallel with the early stages of the EST project, the OECD held an important conference in Vancouver (24-27 March, 1996) - *Towards Sustainable Transportation* - that pulled together some 400 transportation stakeholders from 25 nations to develop a vision and chart a course for sustainable transportation (OECD 1997). In addition to reaffirming the first EST definition presented above, the conference endorsed the so-called 'Vancouver principles of sustainable transportation' that covered a range of environmental, social, and economic issues (Box 6.1).[627]

The Vancouver principles should be regarded as a first step towards a comprehensive understanding of the principles of sustainable transportation. Indeed, the OECD conference report concludes that "[e]*very effort should be made to encourage and invite further work on the development and wider dissemination of this set of principles*" (OECD 1997, p. 68). In response to the progress made at the Vancouver conference and the call for further work, Environment Canada and Transport Canada - two agencies of the Canadian government - created the Centre for Sustainable Transportation (CST)

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[626] In a paper reviewing the main results of the OECD EST project, Ciad et al. (2002, p. 220) present a slightly revised EST definition that includes a fourth component: "*provides for safe, economically viable, and socially acceptable access to people, places, goods, and services*" (p, 220). Ciad et al.'s (2002) addition to the EST definition and the European Council's revision of the CST definition (discussed below) provide good examples of how definitions of sustainable transportation are seldom fixed and are continually evolving.

[627] A number of the Vancouver principles of sustainable transportation have been incorporated into Table 6.3, which presents a comprehensive list of principles from several sources.

(Yevdokimov 2004). The mission of the CST is to "*work proactively in achieving the sustainable transportation of persons and goods in Canada.*"[628]

Box 6.1: The Vancouver Principles of Sustainable Transportation (OECD 1997, p. 36)

Access: Improve access to people, goods, and services, but reduce demand for the physical movement of people and things.

Decision-making: Make transportation decisions in an open and inclusive manner that considers all impacts and reasonable options.

Urban planning: Limit sprawl, ensure local mixes of land uses, fortify public transport, facilitate walking and bicycling, protect ecosystems, heritage, and recreational facilities, and rationalise goods movement.

Environmental protection: Minimise emissions and reduce waste from transport activity, reduce noise and use of non-renewable resources, particularly fossil fuels, and ensure adequate capacity to respond to spills and other accidents.

Economic viability: Internalise all external costs of transport including subsidies but respect equity concerns, promote appropriate research and development, consider the economic benefits including increased employment that might result from restructuring transportation, and form partnerships involving developed and developing countries for the purpose of creating and implementing new approaches to sustainable transportation.

The CST is one of a number of organizations/initiatives in Canada dedicated to developing sustainable transportation systems. Two other notable bodies are the *Victorian Transport Policy Institute* (VTPI)[629] founded by Todd Litman in 1995 and *Moving the Economy* (MTE) established in 1998 as a joint venture between the City of Toronto, Transportation Options (an NGO), and the Canadian government.[630] While many nations were undertaking sustainable transportation initiatives in parallel with Canada (TRB 1997; UK Round Table on Sustainable Development 1996), Canada's early work has played an influential role in formulating the concept of sustainable transportation.

In 2001, the European Council of Ministers of Transport and Telecommunication from 15 EU member states met in Luxembourg and endorsed what has since become the internationally recognized definition of sustainable transportation (European Council 2001a). The roots of the European Council's definition can be traced back to an earlier version developed by the CST (1997)[631] that was one of the first to cover the triad of

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[628] Source: the Centre for Sustainable Transportation (CST), http://cst.uwinnipeg.ca/about.html (accessed on 04/09/06).

[629] See the Victorian Transport Policy Institute (VTPI), *Sustainable Transportation and TDM, Planning That Balances Economic, Social and Ecological Objectives*, http://www.vtpi.org/tdm/tdm67.htm (accessed on 04/09/06).

[630] See Moving the Economy (MET), http://www.movingtheeconomy.ca/index.html (accessed on 04/09/06).

[631] The Centre for Sustainable Transportation (1997, p. 1) defined a sustainable transportation as follows:

"*A sustainable transportation system is one that:*

— *allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.*

environmental, social, and economic concerns. The European Council definition was included in a *Council Resolution* that called for the *integration* of environmental and sustainable development considerations into transportation policy.

> "*THE COUNCIL ... RECOGNISES, that there is a need for further action in order to attain a sustainable transport system defined as one that*
> — *allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;*
> — *is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;*
> — *limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise*" (European Council 2001a, pp. 15-16).

Today, there is an international consensus that the concept of sustainable transportation can be defined under the *Three E's* of environment, equity, and economy (Hall 2002).[632] A comparison of several important definitions of sustainable transportation reveals that a wide range of issues are considered under each of the three areas (Figure 6.10). In addition to the issues identified in existing definitions, the importance of seeking renewable energy sources to power transportation systems (in the long-term) and the need to ensure the security of these systems have been added.

> — *is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.*
> — *limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.*"

While the CST and European Council definitions are similar, the European Council's version adopts Daly's (1991a) terminology to describe the use of renewable and non-renewable resources. The European Council's definition also highlights the importance of 'balanced regional development' and expands the CST's focus on 'individuals and societies' to include 'companies.'

[632] The term the "Three E's" was first used in the mid 1970s in discussions on the topics of the *Economy*, the *Environment*, and *Energy*. During the 1990s, Energy became an intrinsic part of the Environment and was replaced by *Ethics* (or Equity) as society gradually became aware that a movement towards a sustainable future could not occur without a transformation of individual priorities and values (Kidder 1990). The notion was that the environment and the economy depend on our ethics - our sense of right and wrong - and that incorporating ethics into decisions might begin to alter the past objectives of growth, accumulation, and excess towards new objectives of sustainability, sharing, and restraint.

Environment

	A Sustainable Transportation System ...
Health & Environmental Damage	▪ minimizes activities that cause serious public health concerns and damage to the environment; [a, b, d]
Standards	▪ maintains high environmental quality and human health standards throughout urban and rural areas; [a]
Noise	▪ minimizes the production of noise; [b, c, d, e]
Land Use	▪ minimizes the use of land; [c, e]
Emissions and Waste	▪ limits emissions and waste to levels within the planet's ability to absorb them, and does not aggravate adverse global phenomena including climate change, stratospheric ozone depletion, and the spread of persistent organic pollutants; [b, c, d, e]
Renewable Resources	▪ ensures that renewable resources are managed and used in ways that do not diminish the capacity of ecological systems to continue providing these resources; [a, b, c, d, e]
Non-renewable Resources	▪ ensures that non-renewable resources are used at or below the rate of development of renewable substitutes; [a, b, c, d, e]
Energy	▪ is powered by renewable energy sources; and
Recycling	▪ reuses and recycles its components. [c]

Equity/Society

	A Sustainable Transportation System ...
Access	▪ provides access to goods, resources, and services while reducing the need to travel; [a, c, e]
Safety	▪ operates safely; [a, c, e]
	▪ ensures the secure movement of people and goods;
Intragenerational Equity	▪ promotes equity between societies and groups within the current generation, [c, e] specifically in relation to concerns for environmental justice; and
Intergenerational Equity	▪ promotes equity between generations. [c, e]

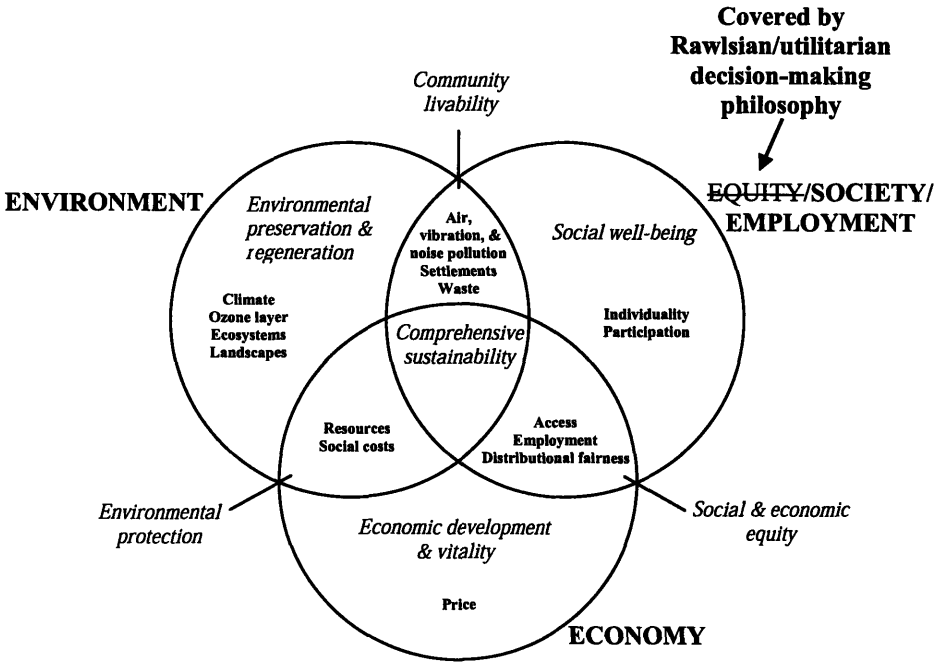
Economy

	A Sustainable Transportation System ...
Affordability	▪ is affordable; [a, c, e]
Efficiency	▪ operates efficiently to support a competitive economy; [a, c, e] and
Social Cost	▪ ensures that users pay the full social and environmental costs for their transportation decisions. [a]

Key: [a] U.K. Round Table on Sustainable Development (1996) *Defining a Sustainable Transport Sector*, London; [b] OECD (1997) *Towards Sustainable Transportation* (the Vancouver Conference), Paris; [c] The Centre for Sustainable Transportation (1997) *Definition and Vision of Sustainable Transportation*, Ontario; [d] OECD (2000) *Environmentally Sustainable Transport (EST)*, Paris; [e] European Council (2001a) Council Resolution on *Integrating Environment and Sustainable Development Into Transport Policy*, Luxembourg.

Figure 6.10: A Comprehensive Definition of Sustainable Transportation

A visual representation of the Three E's of sustainable transportation is shown in Figure 6.11. This approach to visualizing the concept is useful from a policy perspective since it can help policy-makers develop a more structured and integrated response to transportation-related externalities (Table 6.2). However, a potential problem with this type of representation is that it implies that equity considerations can be traded-off against environmental and economic concerns. Making equity one of the three dimensions of sustainable transportation runs counter to the conceptualization of sustainable development formulated in Section 4.1.3.



Sources: Adapted from CST (1997, p. 2) and Brodmann and Spillmann (2000, p. 8).

Figure 6.11: Visualization of the Three E's of Sustainable Transportation

At the heart of the Rawlsian/utilitarian decision-making philosophy (developed in Section 2.2.2) is the principle that every new social arrangement (e.g., a transportation policy) should reduce inequality by making the most disadvantaged members of society relatively better off. Therefore, adopting a framework where equity could be sacrificed for economic or environmental benefit runs against this principle. A better approach would be to replace the equity dimension with a more specific concern for social well-being and employment. Both of these factors are essential components of sustainable development and deserve explicit recognition. Considerations of equity and justice can then occur *within* each of the three dimensions of sustainable transportation.[633]

[633] See Section 6.2.4.4 for a more detailed discussion of equity and transportation.

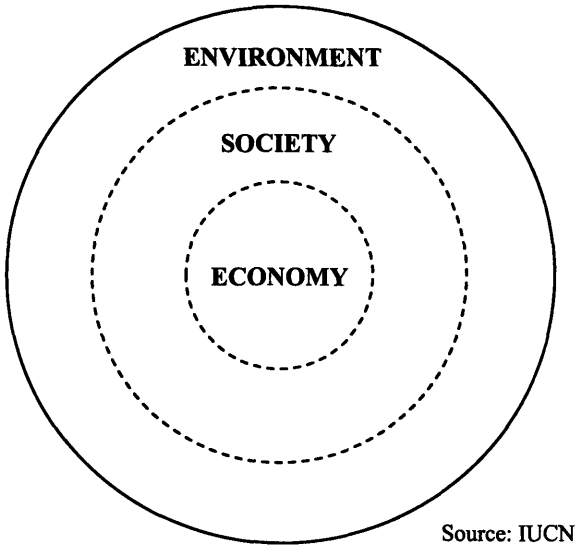
Table 6.2: Negative Externalities Associated with Transportation

Environmental	Social	Economic
Air pollution Consumption of land/urban sprawl Depletion of the ozone layer Disruption of ecosystems and habitats Global climate change Hydrologic impacts Introduction of exotic species Light pollution Noise pollution Release of toxic/hazardous substances Solid wastes Vibration pollution Visual intrusion and aesthetics Water pollution	Accidents Declining community livability/ community partitioning Human (psychological and physiological) health impacts Inequalities associated with negative environmental and health impacts Mobility barriers/inequalities for the disadvantaged Time wastage Visual pollution	Costs of transportation to customers/consumers Costs relating to accidents Depletion of non-renewable resources and energy supplies (*also an environmental and intergenerational equity concern*) Traffic congestion Transportation facility costs Transportation-related health costs

Sources: Black (2005), Button (1993), Maddison et at. (1996), Rothengatter (2003), Spellerberg (2002), TRB (1997), Wachs (2005), Whitelegg (1993; 1997), Whitelegg and Haq (2003), VTPI (2005), and Zietsman and Rilett (2002).

Another problem with Figure 6.11 is that it does not capture the fact that society and the economy depend upon the environment. A more accurate representation that supports the notion of ecological sustainability is shown in Figure 6.12. This figure implies that the economy exists within society (or is a product of social interaction) and that both the society and the economy depend upon the environment. Therefore, if human activity exceeds the carrying capacity of the environment, this outcome *must* affect social well-being and the economy. In Figure 6.11, one could get the (incorrect) impression that the environment only affects certain aspects of society, or that the economy can operate separately from the environment.

Figure 6.12 should be interpreted as integrating ecological thinking into social and economic development (IUCN 2004). Placing the transportation sector within this framework reinforces the importance of keeping the sector within sustainable levels of resource use and pollution. It also reminds us that the economy is created and controlled by society and is a means through which greater ends can be achieved. The transportation system and the economy are similar in this regard.



Source: IUCN (2004, p. 10).

Figure 6.12: A 'Strong' Model of Sustainable Transportation

As one would expect, the principles of sustainable transportation (Table 6.3) are closely correlated with the definitions (Figure 6.10). Indeed, the definitions can be characterized as being built upon the principles. The principles shown in Table 6.3 provide a more operational focus to the idea of sustainable transportation.

A fourth category included in Table 6.3 that is not explicitly identified by current definitions of sustainable transportation is the role of (national, regional, and local) *governance*. In Section 3.1.1 the argument is made that national governance that ensures peace and development is a vital element of sustainable development.[634] Hence, the fourth column in Table 6.3 identifies several core principles that can guide government action to support the objectives of sustainable transportation and sustainable development.

While conceptualizing sustainable transportation using the Three E's is widely accepted, the problem with this approach is that it has the potential to perpetuate the status quo by only focusing on change *within* the transportation sector to the exclusion of change *across* sectors. Transportation is only one sector and it must work in conjunction with other sectors or areas - such as energy, manufacturing, and housing/land use - if system transformations are to be made towards sustainable development.

[634] We recall that the five elements of sustainable development are [1] peace and security; [2] economic development; [3] social development; [4] national governance that secures peace and development; and [5] a concern for the natural environment (Dernbach 1998).

Table 6.3: Principles of Sustainable Transportation

Environment	Equity/Society	Economy	Governance
Adopt - A precautionary and preventative approach to decision-making **Avoid** - Irreversible impacts - Global climate change - Pollution **Encourage** - Remanufacturing/reuse and recycling of transportation vehicles and equipment **Ensure** - The proper disposal of transportation related toxic materials and waste **Protect** - Habitats/ecosystems and operate within their assimilative and regenerative capacities - Biodiversity - Environmental aesthetics	**Enhance** - Safety - Human health - Social well-being/quality of life **Promote** - Equity/distributional fairness - Access and choice - Environmental justice - Individual and community responsibility - Meaningful employment in the transportation sector	**Ensure** - Transportation services are affordable - Transportation is cost-effective - Natural and financial resources are used efficiently - Negative social and environmental costs are internalized - i.e., the polluter pays principle **Support** - Trade and business activity that enhances productiveness and contributes to development	**Encourage** - Technological innovation **Ensure** - Transparency and accountability - Public and stakeholder participation **Establish** - Goals and performance objectives **Support** - Comprehensive and long-term planning - Interagency and international cooperation - The integration and co-optimization of policy

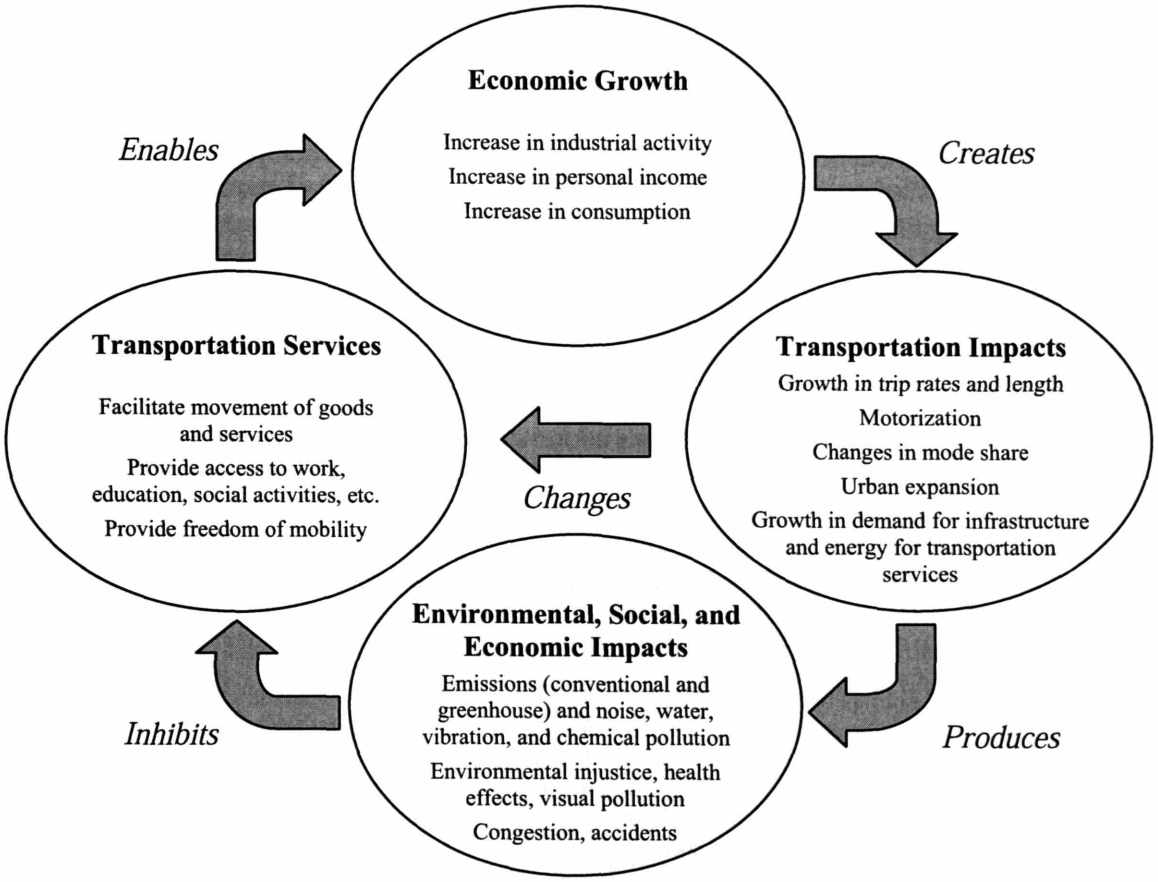
Sources: OECD (1997), Hall (2002), Litman and Burwell (2003), and VTPI (2005).

If the transportation sector is considered in the broader context of sustainable development, one might question whether the sectoral-focus implied by the term 'sustainable transportation' is too narrow and constraining. Indeed, it implies that the transportation system can be made sustainable in its own right, possibly without the need to consider other sectors. This research sets the transportation system in the broader context of sustainable development to avoid being constrained by system-/sector-centric views that tend to be less cognizant of the wider issues. This argument can be explored further by looking at the interconnections between the transportation system and the economy.

6.2.3 The Transportation System and the Economy

Figure 6.13 provides a visual representation of the link between economic growth and transportation services and how these two drivers lead to transportation impacts. The strong correlation between the growth in freight/passenger transportation and the economy (i.e., GDP) since the mid 1940s is often cited as evidence of this link (OECD 2003). However, this correlation does not inform us of whether the increase in

transportation activity is derived from economic growth or whether economic growth is made possible by transportation efficiency gains or system improvements/expansions. Thus, the direction of causality between growth in transportation services and the economy is unclear.



Note: Adapted from Gakenheimer et al. (2002, p. 214) and WBCSD (2004, p. 13).

Figure 6.13: Impacts of Transportation and Economic Growth

The connection between public investment in transportation infrastructure and its effect on economic growth has been the focus of much research since the late 1980s following the publication of Aschauer's (1989) classic (although now highly criticized) paper on this topic.[635] The one directional focus of this body of research is a product of the political need to justify transportation investment decisions as a good use of limited public funds.[636] The general consensus from the research is that investment in

[635] For a comprehensive review of the literature on the impacts of transportation infrastructure investment on economic growth see Bhatta and Drennan (2003), Banister and Berechman (2001), Eberts (1999), ECMT (2001), Lakshmanan and Anderson (2002), OECD (2002), and SACTRA (1999). For a useful discussion of Aschauer's (1989) paper, *Is public expenditure productive?*, see SACTRA (1999) and Lakshmanan and Anderson (2002).

[636] The basic economic argument for transportation investment is that an efficient and extensive network will provide access to labor markets, suppliers, and customers, thereby increasing economic activity

transportation infrastructure does have a small but statistically significant impact on several economic outcomes. However, the specific economic benefits depend upon the scale (i.e., local, regional, or national) and range of observational data included in the analysis and upon the definition of what constitutes transportation investment and economic growth.

In general, there are two categories of economic benefit - i.e., short-run and long-run benefits - that might arise from investments in transportation (Bhatta and Drennan 2003). *Short-run benefits* relate to temporary economic gains that can be attributed to the rise in employment and economic activity associated with a transportation project (such as the construction of a new intersection, railway line, or bicycle path). *Long-run benefits* relate to economic gains that accrue after the completion of a transportation project. These gains can be measured by an *increase* in output, productivity (i.e., output per unit of input), income, property values, employment, real wages, accessibility, quality of life, etc., or by a *decrease* in the costs of production and noncommercial travel time and costs (Bhatta and Drennan 2003; SACTRA 1999).[637]

One of the most comprehensive studies addressing this question of whether transportation investments lead to economic growth was undertaken by the Standing Advisory Commission on Trunk Road Assessment in the UK (SACTRA 1999).[638] The SACTRA

(SACTRA 1999). In this regard, transportation is considered to be a *factor of production* that plays an important role in economic growth. If transportation is treated in this manner, it becomes a cost that businesses seek to minimize. Hence, if a transportation investment is seen to improve the efficiency of the system, a business is likely to support the venture since it will reduce the company's transportation costs (through reduced journey times and vehicle operating costs) and improve competitiveness - i.e., more products/services can be produced per dollar spent on inputs. Using a similar argument, it is likely that an individual would support a transportation project if it reduced his/her travel time, vehicle operating costs, and/or risk of an accident. As the concept of sustainable development and sustainable transportation become more widely understood, it is likely that environmental and social benefits will develop into important considerations in decision-making. Indeed, one might argue that for sustainable transportation to be realized, environmental, social, and economic considerations must receive a more balanced treatment in decision-making than the current predominant focus on economic growth.

[637] Bhatta and Drennan (2003) undertook a review of forty economic studies that assess the impacts of transportation investments on economic growth. Their assessment revealed that *noncommercial* factors such as quality of life, accessibility, and travel time were excluded from all of the studies reviewed due to difficulties associated with their quantification. Another problem they identified was the limited number of studies that compare the *rate of return* on transportation investment with that of investments in areas such as health care or education - i.e., human capital. This lack of information is problematic when trying to decide how to distribute limited public funding.

[638] The SACTRA report was one of the earliest government studies to support the idea of *decoupling* economic growth from growth in freight/passenger transportation. The basic idea of decoupling is to identify ways to encourage economic growth while reducing growth in the negative externalities associated with transportation. If this objective is achieved, it follows that the economy would become healthier since the same economic output could be reached using less transportation. The SACTRA report concluded that the main mechanism through which decoupling could be achieved is through the internalization of external costs associated with transportation. This mechanism would correct market distortions and reduce the real impacts that transportation activity imposes upon society and the environment. At the 2001 European Council meeting in Gothenburg, the heads of state adopted the idea of decoupling in its sustainable transportation strategy. "*A sustainable transport policy should tackle rising volumes of traffic and levels of congestion, noise and pollution and encourage the use of environment-friendly modes of transport as well as the full internalisation of social and environmental costs. Action is needed to bring about a significant*

(1999) report arrived at the following conclusion. "*On the one hand, there are linkages which can help explain how transport has an impact on economic activity. On the other hand, economic activity itself can shape the demand for transport*" (ibid, p. 38). Both of these types of linkages are reflected in Figure 6.13.

An important factor that shapes the relationship between the demand for transportation services and economic growth is the level of development achieved by a nation (OECD 2002). For example, a developing nation may benefit greatly from investment in transportation infrastructure that 'unlocks' natural, human, and manufactured resources that were previously inaccessible.[639] In such a scenario, transportation investment is arguably an important factor of economic growth. Conversely, in developed nations that have well-connected transportation systems, the further expansion of these systems might have a limited impact on economic growth. A more likely scenario is that the high level of GDP per capita in these nations generates demand for more efficient and faster modes of transportation (see discussion below on the relationship between GDP and mobility). Hence, transportation investments are designed to alleviate congestion and respond to a society's mobility and accessibility needs/desires.

While the discussion so far has addressed the positive economic benefits of transportation investments, it is important to consider how the distribution of economic benefits can change the fortunes of firms and individuals in different localities or regions. For example, the creation of a transportation link can expose firms in a local or regional economy to highly competitive rivals outside of their area, effectively disrupting them from the market (SACTRA 1999). In this scenario, transportation investments might undermine the local or regional economy, resulting in unemployment or a radical change in employment opportunities as the economy evolves.

The *two-way* nature of transportation systems effectively exposes small economies to larger and theoretically more competitive markets. In a global economy, the falling costs of transportation and ICT are likely to lead to dramatic - and often unaccommodating -

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***decoupling of transport growth and GDP growth**, in particular by a shift from road to rail, water and public passenger transport*" (European Council 2001b, p. 6, emphasis added). It is interesting to note that the European Council endorses the transfer of freight and passengers from less to more efficient modes of transportation as a way of decoupling transportation from the economy. This strategy is logical given the extensive network of waterways and railways that exist throughout Europe. The decision to adopt decoupling as a strategic European objective is a departure from the previous focus on large-scale transportation infrastructure investments (such as the Trans-European Transport Network or TENs) designed to revitalize the European economy (Bowers 2003). In effect, the European Commission's decision to adopt decoupling as a policy goal means that the SACTRA report and other related studies have been successful in challenging the long-held belief that more transportation infrastructure equals greater economic efficiency.

[639] The role of transportation in *facilitating* the movement of goods and people can lead to both positive and negative impacts. 'Unlocking' natural, human, and manufactured capital by constructing transportation networks between societies and natural resources can lead to enormous social and economic benefit, but at the same time can result in negative impacts such as the loss of biodiversity. The fishbone patterns of roads in tropical rain forests can lead to what conservation biologists call the "*silent forest syndrome*" (Wilson 2002, p. 64). As settlers inhabit land adjacent to roads in these areas, they hunt the larger mammals and palatable birds, creating an environment that looks like a tropical rain forest, but is empty of noise-producing mammals and birds.

changes to the structure of economies throughout the world as comparative advantages become more widely exploited.[640] Therefore, simply developing a highly efficient and extensive transportation system might, for instance, expose communities to market forces that undermine their ability to retain industries and employment. Of course, the reverse scenario is also true, which is why it becomes extremely difficult to identify policies that make transportation more sustainable, support economic development, and enhance the livability and health of communities. One could argue that this is why transportation policy tends to focus on the provision of transportation services while 'recognizing' - instead of directly addressing - the wider issues.

An important conclusion that can be drawn from the above discussion is that economic and transportation system development are closely interrelated. An aspect of this relationship (represented by Figure 6.13) that has yet to be addressed is the effects of economic growth on transportation demand - the other side of the transportation-economy interaction.

Research undertaken by Schafer and Victor (1997; 2000) shows that as GDP per capita increases so too does the distance that people are able to travel since they use their additional income to transition from slower to faster and more expensive modes of transportation (Figure 6.14).[641] The variations in the mobility trajectories between the 11 world regions shown in Figure 6.14 are explained by the historical legacy of infrastructures. While it is highly questionable whether passenger-km (pkm) will reach the hypothetical target point shown in Figure 6.14 - especially with increasing environmental, social, and resource constraints - the macro trends supporting Schafer and Victor's (2000) model suggest that in the near-term global mobility will increase with rising GDP per capita.

It is possible to draw several important insights from Schafer and Victor's (2000) work that are relevant to Figure 6.13. As economic growth occurs in developing countries, demand for raw materials and petroleum is likely to increase as people retire their bicycles (and their shoe leather) in favor of motorbikes and automobiles. In developed

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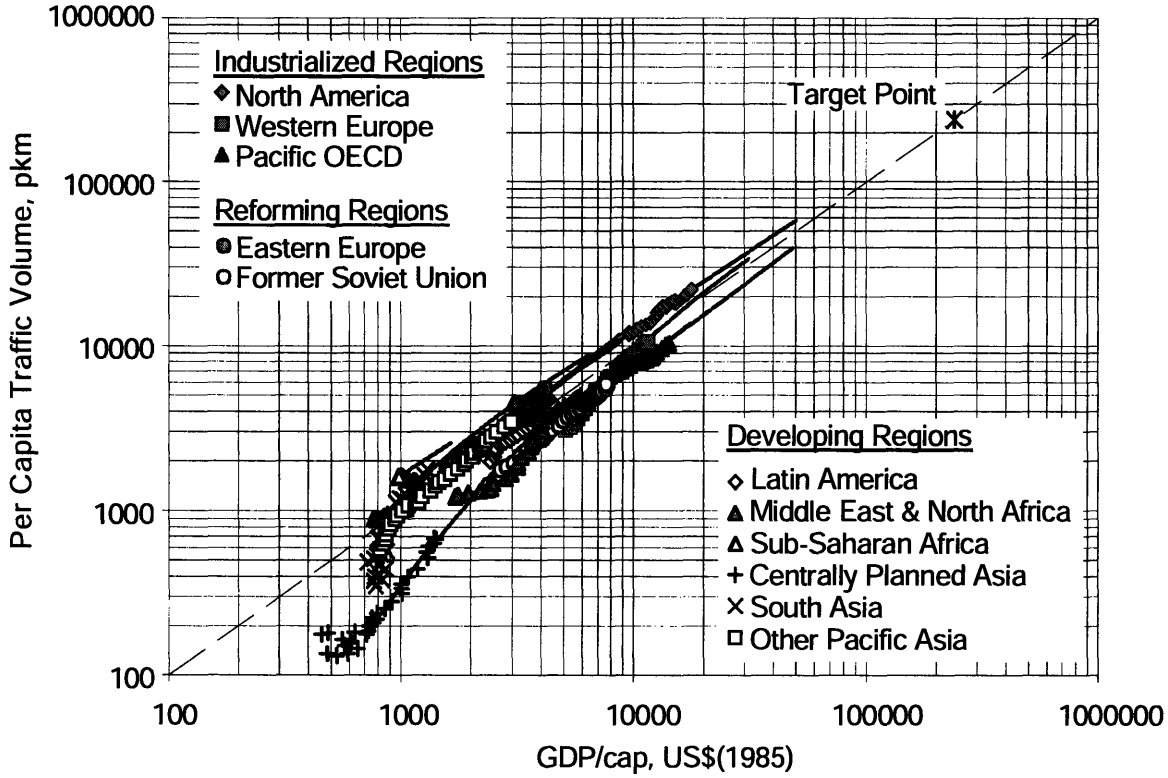
[640] See Glaeser and Kohlhase (2003) for a related and insightful discussion of the implications of declining freight transportation costs on cities and regions. An important conclusion from their research is that the declining costs of freight transportation means that cities no longer need to be located near natural resources or natural transportation hubs and, as a result, are changing their primary functions away from manufacturing and/or shipping towards the provision of services. The higher transportation costs of moving people in cities (due to congestion) means that service firms are locating in more densely populated areas to lower costs for their employees. Hence, there is a complex set of forces that is shaping the cities of the future that are likely to become centers of service provision and resource consumption. As national economies and international transportation systems become increasingly integrated, the origin of the resources consumed in cities will become less important. These trends are worrying from a sustainable development perspective since people can become detached from the impacts of their consuming habits.

[641] Schafer and Victor (2000) base their analysis on historical mobility data for all major motorized travel modes (from 1960 to 1990), projections in economic growth, and the observation that travel money and time budgets are relatively consistent across nations - i.e., an individual spends around ten percent of his/her income on transportation services and travels for an average of 1.1 hours a day. Using this information they were able to predict future mobility trajectories (from 1991 to 2050) for 11 regions of the world.

countries, the gradual saturation of automobile markets means that travelers are likely to transition from automobiles to high-speed rail (HSR) and aircraft. Each of these developments will increase the demand for transportation infrastructure and energy supplies. The transition to faster modes of transportation is likely to impact the level of urban sprawl around cities since commuting distances can increase without a proportional increase in a person's travel time. However, this statement assumes that traffic congestion is not a problem, which is rarely the case in major cities around the world with high motorization rates. Indeed, congestion is a major, growing, and virtually universal problem.



Source: Schafer and Victor (2000, p. 180).

Figure 6.14: Scenario for Mobility and Income for 11 World Regions, 1991 - 2050

The utilization of non-renewable resources and energy supplies to cope with the predicted growth in demand for transportation services promotes unsustainable resource use and is likely to negatively impact public health and the environment at the local/regional/global level. In addition, the increasing noise and land use impacts of transportation combined with growing numbers of accidents and congestion represent a significant burden on society and adversely affect sustainable development. The accumulation of these negative externalities is likely to inhibit the ability of the transportation system to support a vibrant economy (Figure 6.13). Thus, transportation can be described as existing at the interface of economic and environmental interests.

> "*On the one hand, transport is a necessary activity in an economy characterized by product and labour specialisation: it leads to a significant rise in productivity*

of the total capital base of an economy.... On the other hand, transport erodes the stock of natural assets of our world (both stocks of energy and raw materials and the environment at large). Consequently, mobility of persons and commodities plays a conflicting role in the development of any economy" (Nijkamp 1994, p. 262).

Since transportation activity is a product of social needs/desires and market demands, transportation trends and impacts could be considered as an indicator of whether or not human activities are sustainable. For example, urban sprawl is reflected by increasing levels of urban congestion and growing commute lengths. Likewise, the increasing movement of raw materials and freight throughout the world can be thought of as supporting unsustainable consumption habits and inefficient (or flawed) production processes.[642] The consumption of transportation vehicles and equipment also contributes to these problems. Since it is perceived that the transportation sector is unable to directly address certain problems (such as consumption), it is logical for transportation decision-makers to ignore these problem areas. However, increasing system capacity and efficiency to meet demand without questioning whether changes in land use, consumption patterns, human behavior, and/or production processes might alleviate the need for this capacity is a critical oversight that can result in the waste of valuable resources. Thus, if transportation experts work within their disciplinary confines and achieve a truly sustainable transportation system, this system might lead to unsustainable activities in other sectors. For example, a highly efficient transportation system might support the export/import of jobs and increase levels of freight movement and consumption. Thus, the picture is a complex web of positive and negative impacts that depend upon a region's natural, human, manufactured, financial, and social capital as well as its geographic circumstances. This picture is also shaped by rapid technological change and globalization.

The next section presents an alternative view of sustainable transportation where the transportation system is considered within the broader framework of sustainable development - i.e., achieving sustainable development, as opposed to a sustainable transportation system, is the primary objective.

6.2.4 Applying Sustainable Development Principles to the Transportation System: An Alternative Framework to the Three E's

A theoretical and holistic approach to assessing the sustainability of the transportation sector that leans towards the strong model of sustainable development is presented by Gudmundsson and Hojer (1996). Rather than trying to develop a sustainable transportation framework, Gudmundsson and Hojer (1996) qualitatively assess the transportation sector through the broader lens of sustainable development. This approach

[642] Between 1980 and 2003, the tonnage of cargo shipped across the world almost doubled from 3.7 to 6.2 billion tons (UNCTAD 2004, p. 8). In 1980, approximately half (1.9 billion tons) of the cargo shipped was tanker cargo (i.e., oil and fuel) and the remainder was bulk dry cargo (1.8 billion tons). In 2003, tanker cargo accounted for 2.2 billion tons and bulk dry cargo accounted for 4.0 billion tons. The rapid increase in bulk dry cargo is primarily due to the rise of higher-value cargo.

is conceptually different from looking at transportation using the Three E's, which directs attention to the transportation sector and does not explicitly place the sector in the larger global context. Gudmundsson and Hojer's (1996) analysis framework combines the notion of preserving 'capital' for future generations with the need to enhance well-being and equity within current generations. The following text introduces the core ideas and components of Gudmundsson and Hojer's (1996) framework using their original source material and several new references, and discusses how the transportation sector performs when assessed from the perspective of sustainable development.

Embedded within Daly's (1991) principles of ecological carrying capacity and the European Council's (2001a) definition of sustainable transportation is the concept of investing the rents from non-renewable resources into renewable substitutes. This view of development treats non-renewable resources as an endowment that should be invested wisely. However, what constitutes a 'wise' investment appears at the center of debates between and within neo-classical and ecological economists.

Two core principles contained within the full text of the Brundtland report call for the establishment of sustainable *social* as well as *physical* systems (WCED 1987, p. 43). Humans have evolved to be highly dependent on their societies, and thus "*the sustainability of societies is a necessary condition for meeting human needs*" (CST 1997, p. 2). In addition, existing societal factors (such as trust, honesty, and social networks) are important since they determine the present quality of life and because they can be a major component of our legacy to our descendants.

Physical systems relate to both *natural* and *man-made* systems and the mechanisms through which they interact. A stable natural system provides the resources and life support functions that humans and all other species need for survival - these resources and services are often referred to as *natural capital.* A stable man-made system (such as the transportation system) - while it too might provide resources and access to resources for the survival of humans and other species - facilitates societal (including economic) interactions.

One way of conceptualizing sustainable social and physical systems is to use the idea of 'capital.' In the financial and economic realm, *capital* is used to describe accumulated wealth that is held (by an individual, group, or corporation) in the form of money or property (e.g., buildings, factories, equipment, vehicles, etc.). This wealth can be invested or used to produce more wealth. Hawken et al. (2000) make a convincing case that this prevailing economic view of capital is insufficient and the concept needs to be broadened to include four types of capital (or factors of production).[643] These are:

1. **Human Capital (HC)** - the stock of human skills, intelligence, and capabilities that can provide a flow of services;

[643] See the related discussion in Section 5.5.2 on indexes and holistic indicators. The discussion of the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI), and Genuine Savings (GS) is of particular relevance.

2. **Financial Capital (FC)** - the stock of cash, investments, and monetary instruments that can be invested to enhance human or social (see discussion below) capital, produce a product, or simply make more money;
3. **Manufactured (or man-made) Capital (MC)** - the stock of physical assets produced by transforming natural and/or man-made capital using human productive capacities; and
4. **Natural Capital (NC)** - the stock of environmentally-provided assets, i.e., renewable (e.g., living species and ecosystems), replenishable (e.g., groundwater and ozone), and non-renewable (e.g., fossil fuels and minerals) resources.

The first three forms of capital are used by industry to transform natural capital into the products and services that society consumes/uses.

A fifth - and more controversial - form of capital not included in Hawken et al.'s (2000) view of 'natural capitalism' is **social capital (SC)**. The formation of social capital can be understood as an endogenous process whereby society develops a stock of trust, mutual understanding, shared values, and social networks that support social interaction and the coordination of economic activity (Putnam 1995; World Bank 1997).[644] Social capital is used as a proxy to describe variations in different levels of economic development, ceteris paribus (Goodwin 2003). Thus, two communities with similar human, financial, manufactured, and natural resources can perform and adapt to new circumstances in quite different ways due to their social capital.

The idea that the aggregated stock of capital should be maintained for the benefit of future generations is one of the fundamental principles of sustainable development. However, the manner in which this stock of capital is maintained is at the center of debates between advocates of the *weak* and *strong* forms of sustainable development (see Sections 4.1.1 and 4.2.2).[645]

The framework developed by Gudmundsson and Hojer (1996) contains two principles that focus on preserving natural (S_a) and manufactured and human (S_b) capital for *future* generations and two principles that address the issue of increasing quality of life (D_a) and equity (D_b) in the *present* generation (Table 6.4).[646] These four principles are considered

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[644] For an individual-oriented approach to considering social capital see Glaeser et al. (1999).

[645] Under the *weak form* of sustainable development, natural capital (NC) can be reduced as long as manufactured capital (MC) increases to counter any loss in overall wealth. However, under the *strong form* of sustainable development, manufactured and natural capital are seen as complementary and cannot be substituted for one another (Ayres 1978). Thus, society must live off the interest from its natural capital endowment rather than rapidly consuming this capital to satisfy current needs. The *strong form* of sustainable development implies that the reliance on non-renewable resources and energy supplies should be replaced with a reliance on renewable resources and solar energy.

[646] It is important to recognize that Gudmundsson and Hojer's (1996) treatment of natural, human, and manufactured capital is related to the idea of Genuine Savings (GS) - see Section 5.5.2. GS can be defined using the following formula: **Genuine Savings (GS) = Net Investment in Manufactured Capital (MC) - Net Depreciation of Natural Capital (NC) + Investment in Human Capital (HC)**. GS is used to measure changes in *national wealth* over time. A neutral or positive GS value (for the entire time series) indicates that sustainable development is being achieved, whereas *any* negative change in the GS value indicates unsustainable development. Gudmundsson and Hojer (1996) have effectively separated GS into

separately to reflect the different valuation systems that they represent. It is important to recognize that S_a and S_b are concerned with equity *between* generations and D_b focuses on equity *within* the present generation.

Table 6.4: Expanded Set of Principles for Sustainable Development

Sustainability [*focus on future generations*]	**Development** [*focus on present generations*]
S_a - preserving natural resources [NC] for future generations	**D_a** - improving quality of life for individuals
S_b - preserving the [quasi-]option value of human [HC] and man-made [MC] capital for future generations	**D_b** - ensuring a fair distribution of life-quality

Source: Gudmundsson and Hojer (1996, p. 273).

Gudmundsson and Hojer (1996, p. 280) argue that "*sustainable development is a policy goal that would have wide reaching implications for transport policy ... if it was seriously adopted.*" To describe what is meant by this statement, the following subsections look at each of the four principles shown in Table 6.4. The discussion draws upon the conclusions made by Gudmundsson and Hojer (1996) and upon research presented in previous sections and chapters.

6.2.4.1 Preserving Natural Capital for Future Generations (S_a)

The first principle (S_a) relates to the use of non-renewable and renewable resources and energy supplies, the ability of the environment to act as a sink for pollution and wastes, and the preservation of biodiversity. All of these elements are related to the four environmental drivers of the concern for sustainable development discussed previously.

The transportation system's current reliance on non-renewable resources and energy supplies is arguably the leading indicator of its long-term unsustainability. This statement is reinforced by the fact that only a small proportion of resources and energy consumed by the system come from renewable sources. With regard to the sink functions of the environment, the transportation system is a major contributor of pollution and wastes that are putting the assimilative capacity of ecosystems under pressure. Further, the introduction and long-term accumulation of toxic substances in the environment from transportation vehicles and equipment (such as lead and PCBs) present severe health problems for all forms of species. The negative impacts on biodiversity caused by pollution are compounded by the physical intrusion of infrastructure, equipment, and vehicles into ecosystems and the transport of exotic species, bacteria, and disease.

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its constituent parts in their framework - i.e., S_a = **NC** and S_b = **MC** + **HC**. Instead of measuring the investment/depreciation in capital, Gudmundsson and Hojer (1996) are more concerned with the *quantity* and *quality* of capital and the *opportunities* that this capital affords future generations.

The above discussion suggests that the transportation system is currently on an unsustainable pathway. If future generations are to benefit from natural capital, then the transportation sector as well as other major sectors or areas must begin to reduce their reliance on non-renewables, reduce pollution and waste (paying special attention to toxic and persistent substances), and take action to preserve and enhance ecosystems and biodiversity. However, it is not clear whether the responsibility for achieving overall sustainability should be shared equally among sectors or whether the burden should fall on those sectors where radical change is more economically and socially viable.

Gudmundsson and Hojer (1996, p. 278) suggest that since the transportation sector uses natural capital without producing any, "[a]*n institutional solution to the problem could be to introduce compensation from other sectors. However, we see no evidence today of such a trade taking place, and are forced to conclude the failure of transport to satisfy our first principle.*"

Adopting a holistic approach to sustainable development highlights the critical need for governments to create national strategies that, in the case of natural capital, set resource usage and pollution limits. The sectors - or more accurately the firms and agencies within these sectors - must then be held accountable for operating within the parameters (which can either be national or specific to a sector). Figure 6.15 provides a (hypothetical) representation of how the *accumulated* footprints of each sector must stay within the ecological carrying capacity of the Earth's ecosystem in order to achieve a sustainable state. Further, it is important to recognize that there are likely to be a range of distributional issues embedded within the decision to set limits that require careful consideration.

Since the transportation sector is a significant consumer of natural capital, strategies that focus on remanufacturing, reusing, and recycling transportation vehicles and equipment, encourage the adoption of renewable sources of energy, and reduce pollution (including CO_2 emissions) are likely to have a significant positive impact on natural capital. While not necessarily a visionary strategy, simply reducing transportation activities that diminish natural capital is an important first step.

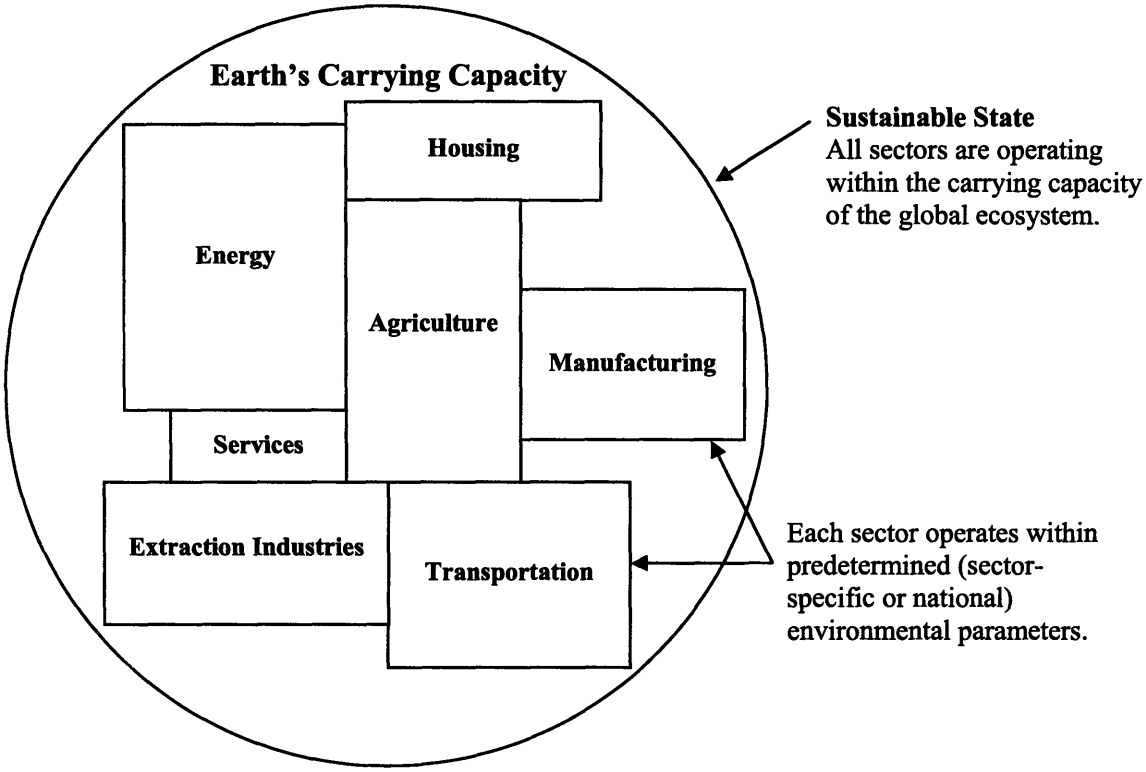

Figure 6.15: Representation of a Steady State Economy where All Sectors are Operating within the Carrying Capacity of the Global Ecosystem

6.2.4.2 Preserving the [Quasi-]Option Value of Human and Manufactured Capital for Future Generations (S_b)

The second principle (S_b) reflects the notion of preserving the option value - or more accurately the *quasi-option value* (see discussion below) - of human and manufactured capital for future generations. Since modern societies are dependent upon the knowledge and technology embedded within these forms of capital,[647] the second principle focuses on preserving this wealth for the benefit of future generations. To put it another way, the accumulated stock of human and manufactured capital should be maintained so that future generations have the *opportunity* to use this capital to reach a level of well-being comparable to that of the present generation.[648]

Before looking at how Gudmundsson and Hojer (1996) apply the notion of '[quasi-]option value' to the transportation system, it is useful to describe the theory behind the concept in the broader context of total economic value (TEV).

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[647] See the related discussion in Section 2.3.

[648] It is important to recognize that only a small proportion (around one-fifth) of the world's population has access to a high level of well-being (Durning 1992; 1994; UN 2003). Therefore, the notion of preserving the opportunity to achieve 'current' levels of well-being for future generations raises serious ethical questions about whether this criterion is sufficient.

In Section 4.2.1 the concept of TEV is introduced as the addition of the *use* and *non-use values* of an environmental good/resource. Within both of these categories are several approaches that can be used and combined to obtain the TEV of a resource (Figure 6.16). The dotted lines on Figure 6.16 highlight the fact that a number of different taxonomies can be used to calculate TEV (Albani and Romano 1998).[649] For example, Randall and Stoll (1983) consider direct use, indirect use, and option value as forms of *use value*, whereas Freeman (1993) only considers direct use value under this category and places the other valuation approaches under *non-use value*. Hence, there is disagreement as to whether indirect use and option value should fall under the *use* or *non-use value* categories.

Bearing in mind the above comments, *use value* is considered here as the direct or indirect value that an individual receives from the actual use of a resource (Bateman and Turner 1993). In economic terms, the *use value* is equal to the market price of a resource (which is ideally set under perfect competition), or if it is a non-market good - such as scenery, wildlife, air, water, or soil quality - the *use value* can be estimated using a variety of valuation techniques (such as contingent valuation, hedonic pricing, travel cost models, etc. - see Section 4.2.1).

Direct use value can be divided into two forms - *consumptive* and *non-consumptive* (Boyle and Bishop 1985). In the former, value is derived from the consumptive use of a resource - e.g., fishing or hunting. In the latter, an individual is still in contact with a resource but value is instead derived from its non-consumptive use - e.g., visiting a scenic park or bird watching. It follows that an individual receives indirect use value by consuming a good or service derived from a resource *without* coming into contact with that resource (Boyle and Bishop 1985; Randall and Stoll 1983). For example, reading an article about an ancient African tribe or watching a wildlife program on TV are both forms of indirect use value.[650]

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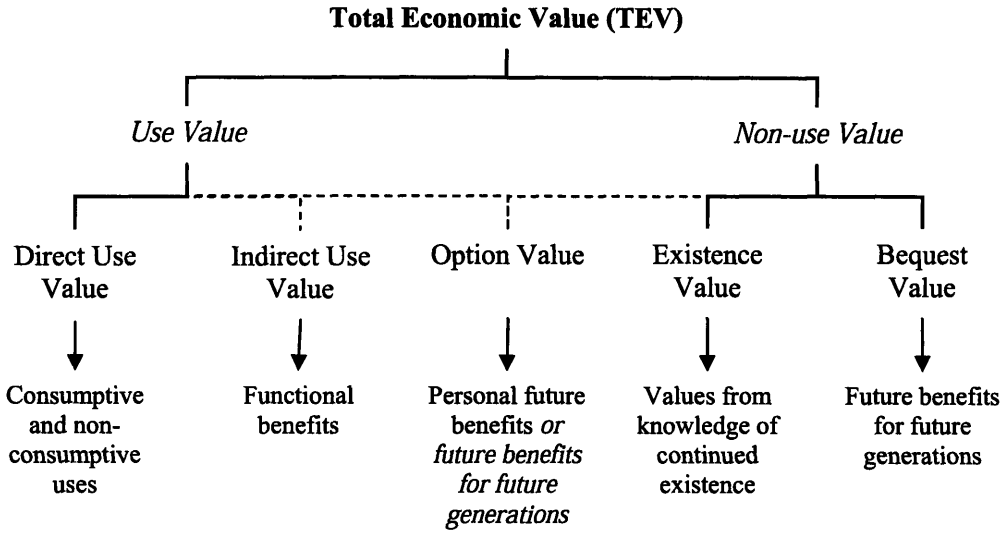
[649] Randall and Stoll (1983) make the following statement on the confusion that exists amongst the valuation techniques used to calculate the TEV of a resource. "*While considerable ingenuity and analytical rigor have been devoted to this reconsideration of resource value concepts, the task is not yet complete and some of the inevitable false starts have left a legacy of confusion. Value concepts have proliferated - use value, option price, option value, expected consumer's surplus, quasi-option value, existence value, preservation value, etc. - but some of these are overlapping in concept, while many others are empirically elusive so that validation of estimates is difficult and often incomplete. Thus, confusion in some quarters is matched by skepticism in others*" (ibid, p. 265).

[650] While indirect use value - or *vicarious use value* (Randall and Stoll 1983) - has been described under *use value*, Randall (1991) later argues that it is difficult to distinguish indirect use value from existence value. Therefore, one might consider indirect use value as a *non-use value*.



Sources: Adapted from Croitoru (2004, p. 3) and Pearce and Moran (1994, p. 20).

Figure 6.16: Calculating Total Economic Value (TEV)

The idea of *non-use value* arose from the realization that the TEV of a resource could not be captured adequately by only considering *use values*. The seminal work by Weisbrod (1964) on option value and Krutilla (1967) on existence and bequest values greatly expanded the scope of how environmental benefits from resources were considered.

An option value (OV) refers to the amount of money that an individual is willing to pay now to have the option of using a resource in the future, in addition to his/her expected consumer surplus (ES) (Randall and Stoll 1983; Weisbrod 1964).[651] To put it another way, it is the premium that an individual is willing to pay to ensure the future availability of a resource (or amenity) (Randall 1991). Therefore, the option price (OP) is the sum of the expected consumer surplus and the option value (i.e., OP = ES + OV).[652]

Existence values are derived from the benefit that an individual receives from knowing that a resource exists, regardless of whether he/she intends to use it (Krutilla 1967).[653] Bequest values differ from existence values in that they arise from an altruistic desire to provide a certain amount of a resource to future generations (ibid). Hence, the bequest value of a resource might be described as the cost associated with prevailing moral choices. Making a clear distinction between existence and bequest values has proved to

[651] By considering the *uncertainty* in the demand for a publicly provided good or service, Weisbrod (1964) argued that there may be some benefit ('option value') to the consumer which exceeds that determined by conventional price-compensating consumer surplus.

[652] For a useful critique of the concept of option value, see Freeman (2003, pp. 247-250).

[653] In the words of Krutilla (1967, pp. 779-780), "[w]*hen the existence of a grand scenic wonder or a unique and fragile ecosystem is involved, its preservation and continued availability are a significant part of the real income of many individuals.* [Therefore,] ... *the area under the demand curve, which represents a maximum willingness to pay, may be significantly less than the minimum which would be required to compensate such individuals were they to be deprived in perpetuity of the opportunity to continue enjoying the natural phenomenon in question.*"

be difficult in practice (Boyle and Bishop 1985), leading to them often being combined under the heading of existence value.

In summary, *non-use value* can arise out of a desire to preserve the option of using a resource in the future, emerge from a sense of environmental stewardship or responsibility, or can be linked with a desire to bequeath certain environmental resources to future generations (Freeman 1993).

An additional type of value not shown in Figure 6.16 - which combines both option and existence values - is quasi-option value. Arrow and Fisher (1974)[654] and Henry (1974) independently offered quasi-option value as the benefit received from *delaying* a decision to use a resource in an irreversible manner until more information becomes available.[655] "*Essentially, the point is that the expected benefits of an irreversible decision should be adjusted to reflect the loss of options it entails*" (Arrow and Fisher 1974, p. 319). For example, delaying a decision to harvest wood from a tropical rain forest might result in the discovery of a new and rare medicinal plant that could make the harvest policy inefficient. Therefore, quasi-option value should be seen as a general approach to valuing "*intertemporal flexibility and environmental preservation under uncertainty*" (Albani and Romano 1998, p. 3). More recently, Pindyck (2000) applied the principle of quasi-option value (although he does not use this term) to the timing of environmental policies. He concludes that the greater the uncertainty of future economic and ecological outcomes when there are irreversibilities, the greater should be the delay in the adoption of a policy.[656] Thus, quasi-option value can be seen as a way to operationalize the precautionary principle.

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[654] By considering the uncertainty associated with the costs and benefits of developing an unspoiled natural area, Arrow and Fisher (1974) assessed whether (or to what extent) development should proceed. They concluded that "*if the development involves some irreversible transformation of the environment, hence a loss in perpetuity of the benefits from preservation, and if information about the costs and benefits of both alternatives realized in one period results in a change in their expected values for the next, the ... net benefits from developing the area are reduced and, broadly speaking, less of the area should be developed*" (ibid, pp. 313-314). Hence, if the future payoffs from a development are uncertain, it would be prudent to invest less today so that at a later date any underinvestment can be remedied as more information becomes available. Alternatively, if new knowledge and/or technology change the future *use value* of the undeveloped resource, the current society or future generations will have the option to use the resource in a more beneficial way.

[655] The 'quasi-option value' approach to development is similar to - but should not be confused with - 'real options analysis' that focuses on determining the value of embedding flexibility into capital-investment decisions (de Neufville 2004; Dixit and Pindyck 1995). The value of a real option is obtained by subtracting the value of a project/decision *with* flexibility from the value of a project/decision *without* flexibility. The main difference between the two approaches is how they are used. Quasi-option value attempts to value the loss of future options caused by the irreversible use of natural capital. In contrast, real options analysis is more closely aligned with the idea of an 'option value' and the notion of paying a premium today to have the right to exercise an investment option in the future. Thus, real options analysis is not concerned with the impact of a project on the future use of a natural resource. Instead, it focuses on determining the optimal investment today given the uncertainty of future demand, price, technology, budgets, etc.

[656] Freeman (2003, p. 250) argues that "[w]*hether quasi-option value exists or whether it is positive or negative for preservation depends on the nature of the uncertainty, the opportunities for gaining information, and the structure of the problem.*" Freeman (2003) suggests that the need to calculate quasi-option value can be alleviated by adopting an 'optimal sequential decision-making strategy' - i.e., a

The above discussion highlights an important distinction between 'option' and 'quasi-option' value. The former is a static concept whereas the latter is an intrinsically dynamic construct.

In the sustainable development framework presented by Gudmundsson and Hojer (1996), the phrase 'option value' is used in reference to the work of Dasgupta (1994).[657] However, this connection is problematic since Dasgupta (1994) really describes 'quasi-option value' (although he too does not use this term). Dasgupta (1994, p. 44) argues that the stock of an environmental resource has an additional value beyond its future use value which is "*the value of extending society's set of future options. ... Future options have an additional worth because, with the passage of time, more information is expected to be forthcoming about the resource's use-value. This additional worth is called an* ***option value.***" Hence, Dasgupta (1994) defines the price of a resource as the sum of its *use value* and *[quasi-]option value*, where the [quasi-]option value accounts for learning or technological change.

While Dasgupta's (1994) use of terminology is confusing, Gudmundsson and Hojer's (1996) basic principle of preserving the [*quasi-*]*option value* of *transportation-related* human and manufactured capital for future generations is of intellectual interest.

Since Gudmundsson and Hojer (1996) define [*quasi-*]*option value* in an intergenerational context, it should be considered as a non-use value. In fact, their formulation is closely related to bequest value - rather than existence value - where the current generation receives some altruistic benefit from preserving human and manufactured capital for the benefit of its descendents. Whereas it is intuitive to think about the quasi-option value associated with preserving natural capital for future generations (e.g., it can be used as an input to production or provide a wide range of life support services), applying this concept to the transportation sector is more complex. The difficulty lies in knowing whether an *inherited* or *preserved* transportation system - which consists of manufactured and human capital - will support the development of, and be of value to, future societies. Thus, within Gudmundsson and Hojer's (1996) assessment framework the transportation system is treated as a resource that can benefit future generations.

In Section 6.2.3, the idea that transportation is a *factor of production* is introduced.[658] If viewed in this manner, one could argue that preserving the transportation system will be of value to future generations. For example, as non-renewable resources become scarce and societies search for substitutes, the value of a well-connected and efficient transportation system is likely to increase. An extensive transportation network will enable societies to access resources from, or provide resources to, remote or far away

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precautionary approach to decision-making - that can maximize the use of information obtained by delaying the irreversible use of natural capital. In essence, the need to calculate the quasi-option value is removed since the optimal decision is revealed by the sequential decision-making process.

[657] For an interesting discussion of the paper Dasgupta (1994) delivered at the 'First Annual International Conference on Environmentally Sustainable Development' (September 30 - October 1, 1993), see Steer (1994) and Dresner (2002, pp. 78-81).

[658] Supra note 636.

locations - assuming that sufficient energy is available to power the transportation systems. In addition, the existence of transportation systems (combined with ICT) might, for instance, support the emergence of a global community that can address global commons problems by bringing nations, people, cultures, and economies closer together.[659] Such a scenario would suggest that maintaining or even expanding the existing transportation system would enhance its value for future generations. However, as Gudmundsson and Hojer (1996) recognize, the reverse is also true.

The development of large-scale, highly-connected, and long-lived transportation systems could lead future generations into a 'mobility trap' where high levels of mobility become a necessary part of everyday life. The problem with such an outcome is that a highly mobile society may suffer from community disintegration and environmental degradation since individuals would be less connected to a place and, therefore, less concerned for its social and environmental health.[660] A related problem is the high cost of maintaining an extensive network of transportation infrastructure. The large operational, maintenance, and capital rehabilitation expenditures are likely to provide only marginal returns for society, which might find investments in education or health care to be more beneficial.

Gudmundsson and Hojer (1996) support the argument that preserving or expanding the existing physical stock of infrastructure may in fact limit future options. "[I]*nvesting heavily to reinforce existing transport systems may in the end prove to be a highly costly and even socially destructive way of safeguarding access for future generations to what they want or need. Obviously, to what extent this will actually prove to be the case we cannot say. But this principle* [S_b] *suggests that less physically demanding lifestyles, modes of access and systems of movement should be seriously considered as alternatives*" (ibid, p. 278).

Determining the balance of investment in transportation-related human vs. manufactured capital is a complex issue. Directing public funds towards initiatives and programs to make the physical transportation system more sustainable must also be accompanied by investments in transportation professionals who wish to pursue this objective. An argument put forward in Section 2.2.3 is that investing in education, healthcare, and nutrition is essential to enhancing human capital and an individual's *capability* to achieve a high-level of well-being. A failure to invest in these elements is likely to reduce the ability of future generations to meet their needs since they will lack the necessary knowledge (and health) to maintain and improve their inherited assets/systems. Support for this line of argument can be found in the UN's 1994 Human Development Report (Box 6.2).

> "*Not every specific resource or form of capital needs to be preserved. If more efficient substitutes are available, they must be used. What needs to be preserved is the overall capacity to produce a similar level of well-being - perhaps even with an entirely different stock of capital. This difficult issue requires much further research. But one thing is clear: preserving productive capacity intact does not*

[659] See Sections 2.5 and 3.5.1 for a discussion of the concept of globalization and the role of transportation.
[660] See the related discussion in Section 6.2.4.3 on the human need for connectedness.

mean leaving the world in every detail as we found it. What needs to be conserved are the opportunities for future generations to lead worthwhile lives. ... Because the accumulation of human capital can replace some forms of exhaustible resources, human development should be seen as a major contributor to sustainability" (UNDP 1994, pp. 18-19).

While there is no 'right' way to calculate the balance of investment in preserving/developing transportation-related human vs. manufactured capital, given the uncertainties associated with future developments a more flexible approach would seem to support a dedicated investment in human capital. Such a focus would also reinforce efforts to reduce inequality in both current and future generations since more individuals would be given the opportunity (or choice) to live a rewarding life (see Section 2.1.3). However, the "*existence benefits*" (WBCSD 2004, p. 16) - or positive externalities - that stem from the mere presence of the transportation system remain an important counterweight that supports arguments for investment in manufactured capital.

It is clear that the decision of whether or not to maintain transportation infrastructure and transportation-related human capital is complex. Failing to maintain the existing system passes the price tag of building a transportation system onto our children and grandchildren. However, maintaining systems that future generations find to be highly unsustainable also passes on the cost of transforming these systems into a more sustainable form.

In nations where the transportation system is largely built (such as the U.S.), adopting a dual focus on transforming existing systems (i.e., manufactured capital) towards sustainable development and investing in transportation professionals to guide this transformation process would be a wise approach to take.[661] Further, creating a development approach that focuses on reducing unsustainable activities (such as congestion, pollution, waste, etc.) should be the primary focus in the near-term. Focusing on improving the sustainability of transportation systems and developing transportation professionals to guide this process is likely to benefit both current and future generations.

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While this section has focused on preserving the value of human and manufactured capital, it is important to recognize that these two forms of capital (particularly the latter type) cannot be divorced form natural capital. Since manufactured capital depends upon

[661] The need to broaden the scope of how transportation professionals are educated has been well documented by Sussman (1995; 2000). While Sussman's ideas developed from the field of intelligent transportation systems (ITS), his concept of the 'T-shaped' professional is relevant to transportation professionals seeking work in the field of sustainable transportation. A 'T-shaped' professional is described as having a broad understanding of technology, systems, and institutions in the transportation domain (represented by the horizontal bar) and in-depth knowledge in one of these specialties (represented by the vertical bar) (Sussman 1995). More generally, Ashford (2004) has written of the need to integrate education for sustainable development into established disciplines such as engineering and science. By considering the ideas of Sussman and Ashford together, it should be possible to develop a set of principles to guide academic programs and research to support the principles of sustainable transportation.

natural capital, it is difficult - some say impossible (Ayres 1978; Georgescu-Roegen 1993) - to separate them. For example, investing in (traditional) transportation infrastructure and vehicles/equipment reduces the amount of available non-renewable forms of natural capital. In addition, the negative externalities (e.g., pollution and habitat intrusion) from the transportation system can also deplete natural capital by inhibiting the life support functions of the environment. Under a non-declining or constant capital stock model (Rees 1995), if the investment in the transportation system offsets the depletion of natural capital - i.e., total wealth is maintained - the action is treated as supporting the 'weak' form of sustainable development.[662] However, a problem with this type of capital model lies with the monetization of capital for comparison purposes. As argued in Section 4.2.1.3, the monetization of non-market goods is very difficult.

A potential problem with the non-declining capital model is that future consumption patterns (and income), technological capabilities, and population levels could drastically change the stocks of capital needed by society in both a positive and negative direction.[663] As argued above, simply maintaining the current stocks of transportation infrastructure, for instance, might not align with the interests of a future society. Indeed, the evolving nature of society is likely to continually shape future transportation demands as well as being shaped itself by new transportation system developments (Button and Nijkamp 1997, p. 215). Thus, applying quasi-option values to the transportation system is complicated by two factors: [1] the uncertainty associated with whether the inherited transportation system is likely to be of value to future societies; and [2] the impact that maintaining the transportation system has had on the stock of natural capital. Both of these factors need to be considered when trying to determine whether or not to maintain the transportation system, making analysis extremely difficult. It seems, therefore, that the only feasible options available to decision-makers are to: [1] minimize the impacts of the transportation system on natural capital (and on the health and well-being of society); [2] begin searching for ways to transform the transportation system towards sustainable development; [3] continue to invest in transportation-related human capital; and [4] ensure that the transportation system meets the needs of the present generation - the subject matter of the next section.

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[662] Under the strong sustainability paradigm, stocks of natural and manufactured capital must be maintained separately. In practice, such a task is extremely difficult. Simply maintaining the transportation-related manufactured capital will require the use of non-renewable natural capital. The best that can be achieved, therefore, is to minimize the use of non-renewables and search for renewable substitutes that can be sourced from the 'interest' off of existing natural capital.

[663] The 'IPAT' formula (Ehrlich and Holdren 1971) and its derivations (Holdren et al. 1995; Pittel 2002) provide a simple way to capture the dynamics of development and how natural capital is impacted by changes in population, affluence, and technology. For example, even if the population level remained constant and technological innovation drastically reduced the intensity of resource use, aggregate resource use can increase due to rising levels of GDP per capita. This phenomenon is understood as the rebound effect or the Jevons paradox (see Section 2.4.1), and it explains, for instance, why petroleum demand can increase as the energy efficiency of vehicles increases since more people can afford to drive.

6.2.4.3 Improving Quality of Life (QoL) for Individuals (D_a)

The third principle (D_a) relates to the overall objective of increasing or preserving the quality of life (QoL) of individuals within the current generation. Gudmundsson and Hojer (1996, p. 273) interpret QoL in a broad sense, stating that it should be "*measured in whatever way one may agree upon.*"

In general, QoL is a complex, multidimensional construct that can be viewed using three major philosophical approaches (Brock 1993; Diener and Suh 1997). In the first approach, QoL depends upon achieving the characteristics of the 'good life' as defined by normative principles or values embedded in philosophical, religious, or other systems. For example, the ancient Greek philosophers believed that the good life resides in *virtue*, whereas many religious texts view the good life as one that God would have us live (see related discussion in Section 2.1.1). Thus, an individual could have a high QoL if his/her actions were guided, for instance, by Aristotle's principle of habitual moderation (Table 2.1).

The second approach determines QoL based upon the satisfaction of preferences. This utilitarian formulation considers QoL to be directly linked to an individual's ability to obtain the things that he/she perceives will most enhance his/her well-being and happiness. "*People select the best quality of life for themselves that is commensurate with their resources and their individual desires*" (Diener and Suh 1997, p. 190). The idea that people act in a rational manner to improve their QoL is a foundational principle of neo-classical economics (see Section 4.2.1).

In the final approach, QoL is based on the *experience* of individuals and is obtained through measuring subjective well-being (SWB). SWB has three core interrelated components - i.e., life satisfaction and pleasant and unpleasant events (Diener and Suh 1997). The philosophical roots of this approach can be traced back to Jeremy Bentham's utilitarian principle, which states that society should aim to achieve the greatest happiness for the greatest number.

Over the past few decades, growing attention has been paid to measuring QoL using social indicators and measurements of SWB (Land 1996; Zapf 1999). Social indicators measure QoL using *objective*, quantifiable statistics such as income, consumption, health, life expectancy, literacy, environmental conditions, etc. Perhaps the most well-known measure of this type is the UN Human Development Index (HDI), which estimates QoL using life expectancy, knowledge, and income (see Section 2.1.3). In contrast, measures of SWB rely upon an individual's *subjective* perceptions of his/her QoL that are influenced by social and environmental factors.

Gudmundsson and Hojer's (1996) approach to measuring the impacts of transportation on QoL focus mainly upon social indicators (Table 6.5)[664] that are discussed within the

[664] Readers interested in learning more about how transportation can affect QoL are directed towards the National Research Council's (NRC's) report *Community and Quality of Life* (NRC 2002). This report was commissioned by the Bureau of Transportation Statistics (BTS) and the U.S. Department of Transportation

framework of welfare economics. Indeed, the vast majority of sustainable transportation indicators can be described as (objective) social indicators (Cambridge Systematics 1996; CST 2002; EEA 2002; Litman 2005b; OECD 2000; Rand Europe et al. 2004; WBCSD 2001; 2004). However, research has begun to consider the impacts of transportation on QoL using *subjective* measures of well-being (Gatersleben and Uzzell 2002; Steg and Gifford 2005).[665]

Table 6.5: Major Transportation Effects on Quality of Life

Positive Effects	Negative Effects
Access	Accidents, insecurity, and barriers
Mobility	Noise and vibrations
More diversity of supply	Impaired air quality
Cheaper goods and services	Loss of production value
Visual enjoyment [*subjective measure*]	Visual intrusion and damage [*subjective measure*]

Source: Gudmundsson and Hojer (1996, p. 279).

While social indicators/indexes and measures of SWB are valuable, it is also possible to consider QoL by exploring the extent to which basic human needs are satisfied. The Brundtland Commission's definition of sustainable development is based upon the notion of meeting "*the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED 1987, p. 43). Thus, one can argue that at a fundamental level, QoL depends on the ability of present and future generations to meet their needs.

In Section 2.1.2, four sets of needs are identified as essential to the functioning and well-being of humans (Kasser 2002, pp. 24-25):

— Safety, security, and sustenance;
— Competence, efficacy, and self-esteem;
— Autonomy and authenticity; and
— Connectedness.

Human needs motivate behavior and their satisfaction enables physiological and psychological development to occur. While the needs listed above are common to all humans, the satisfiers to these needs are socially and culturally defined (Max-Neef et al. 1989). Therefore, the same need can be satisfied quite differently across communities,

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(DOT) to identify what data and decision-support mechanisms need to be developed to ensure that transportation decisions do not reduce the livability of communities.

[665] The rationale for Steg and Gifford's (2005, p. 65) research is that "[t]*ransport policies will be less acceptable, and consequently, less feasible and less effective, if they have significant negative impacts on QoL.*" Therefore, designing transportation policies that are either neutral to or enhance QoL is seen as a desirable objective. Steg and Gifford (2005) specifically question the conviction of many politicians that a truly sustainable transportation system is politically unattainable. They show how the feasibility of sustainable transportation scenarios can be tested by measuring (subjectively) whether or not the scenarios are likely to improve an individual's QoL. The disaggregated (i.e., individual) information required to undertake this analysis enables decision-makers to develop compensation schemes for those individuals/groups who are likely to be negatively affected by a certain policy. This action can help mitigate those factors that are reducing QoL and make a specific transportation scenario more feasible.

and - due to the continual evolution of social and cultural values - the satisfier(s) to a specific need is likely to evolve *within* a community over time.

Understanding how human needs are affected by transportation decisions is important since society is unlikely to support initiatives that lower its QoL (which should be measured using both objective *and* subjective indicators) (Steg and Gifford 2005). The following text takes a *preliminary* look at each of the four sets of human needs listed above to determine whether it is possible to identify the role of transportation in their satisfaction.

Safety, Security, and Sustenance

This first set of human needs relates to our essential biological needs for food, water, and oxygen and our innate desire for safe and secure accommodation/circumstances (Kasser 2002). In this regard, the transportation system plays an essential role in supplying - and providing access to - the food and material needs of modern society. However, at the same time, negative environmental and social impacts from transportation affect the satisfaction of our need for clean air and water and uncontaminated food. Therefore, a tension exists between providing access to goods and services that improve QoL and the reduction in QoL that occurs as a result of making them available and accessible via transportation.

Since a significant proportion of transportation activity is derived from the market, one might argue that *ensuring that the demand for (freight) transportation services can be met is essential to the satisfaction of this set of human needs.* However, building system capacity to meet demand, especially in developed nations, is no longer an acceptable practice. The knowledge that latent demand is likely to consume any additional system capacity has made planning for new infrastructure investments a controversial and costly process. The problem is made more complex by the growing integration of national economies and the pressure this trend is placing on job security.

It is possible to explore the role of transportation in economic globalization and the impact this might have on employment using Ricardo's theory of comparative advantage. In Section 4.2.4, Heckscher-Ohlin's model of factor endowment trade theory - which is built upon Ricardo's theory of comparative advantage - is introduced. The Heckscher-Ohlin model suggests that countries should *specialize* in the production of commodities for which they have an advantage in resource endowments and/or productive capabilities, and exchange any surplus home-produced commodities for those more easily produced by others. If transportation costs are included in this model, it should be possible to identify the economically-optimal location of a manufacturing center between its sources of materials and labor, and the markets for its final products. However, if the costs of freight transportation continue to fall (Glaeser and Kohlhase 2003; Lakshmanan and Anderson 2002), the distance from resources to production centers and production centers to markets will become less of a constraining factor. The long-term implication of this observation is that a nation's comparative advantages are likely to be determined by its

administrative conditions[666] and the costs and innovative capacity (or productiveness) of its labor force. In addition, falling freight transportation costs are likely to increase the demand for long-distance transportation as nations try to extend the reach of their comparative advantages.

An important conclusion from the above discussion is that a low cost and efficient international transportation system can facilitate national specialization which - in a competitive international economy - can reduce the price of commodities, making essential goods and services affordable to lower income groups. Such an outcome is likely to have mixed results in relation to the basic human needs of safety, security, and sustenance. On the one hand, those nations producing the commodities will benefit from increased employment and rising levels of income. Such trends should provide individuals with the opportunity to purchase the necessary goods and services to satisfy, for instance, their basic sustenance and accommodation needs.[667] On the other hand, those nations (or regions) losing their uncompetitive industries are likely to experience unemployment and a loss of their citizens' capacity to meet this first set of fundamental human needs.[668] While such an outcome is treated as economically efficient in relation to the global economy, this is no consolation to those who find themselves out of work and relying on a social safety net (if one exists).

While many governments seek to gain from participating in the global economy, the possibility that such participation might result in a reduction of employment is rarely discussed. A good example of the positive view of economic globalization can be found in the U.S. Department of Transportation's (DOT's) 2003-2008 Strategic Plan.

> "*Transportation systems within and among nations are lifelines to economic growth, to freer trade, and to greater cultural exchange. Our globalized economy hinges on efficient supply chains and just-in-time manufacturing: transportation is critical to both. With leaner inventories, companies must rely on transportation that enables them to conduct business in the most cost-effective, competitive way*" (U.S. DOT 2003a, p. 8).

Viewing the transportation system's impact on human needs through trade theory is useful, but such an approach tends to endorse economic globalization as the most economically efficient and, therefore, 'best' way for the world to develop. An alternative perspective is that the international integration of economies can weaken the democratic accountability of governments (Korten 2001) and national specialization can leave nations vulnerable to shifts in global consuming habits (see Section 4.2.4).

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[666] While a nation's comparative advantage is (theoretically) determined by its geographical location and its natural and human capital endowment, the *administrative* conditions within a nation can also influence competitiveness (Bleijenberg 1995). For example, a nation that has low environmental standards and taxes might be 'artificially' competitive. This artificial competitiveness translates into 'artificial' transportation demand, which means that any expansion in system capacity to meet this demand might be an inefficient use of capital.

[667] It should be acknowledged that these goods and services are made accessible by the existence of the transportation system.

[668] See related discussion in Sections 2.5, 3.5.1, and 4.2.4.

One of the strongest views against economic globalization is put forward by the International Forum on Globalization (IFG) (IFG 2002). The IFG (2002) argues that the growth in world trade and the associated increase in the transportation of goods and materials between nations are indicators of unsustainable forms of development rather than signs of progress. It states that "*the most important single act to improve the health of the planet and the quality of urban life would be to lessen the volume of international and long-distance transport. This goal can only be achieved by consciously reversing present priorities favoring large-scale export-oriented global economies and instead invoking the principle of* ***subsidiarity****: emphasizing local economies, using local resources and labor, and primarily benefiting local communities*" (ibid, p.165).

The IFG's (2002) position on sustainable development is in alignment with 'eco-development,' which emerged during the 1970s (as the precursor to sustainable development) and can be defined as ecologically and economically sound regional and local development (see Section 3.3.3.3). It is interesting to note that the redefinition of eco-development to sustainable development was largely the result of the need to account for economic globalization, which was seen as a positive force for change around the early 1980s (see Section 3.4.2). While reversing trends towards globalization and returning to a more regionally focused form of development is likely to reduce demand for long distance transportation, this proposition seems almost insurmountable given the uncontrollable nature and inertia behind globalization. However, the scale of the problem should not be seen as a reason to dismiss the idea. Indeed, the future of humanity might even lie in a resurgence of the principles of eco-development within a global community.

To conclude, while the above discussion reveals the transportation system's critical *supporting* role in meeting an individual's safety, security, and sustenance needs, attempting to justify system development on the grounds that it improves QoL in these dimensions is likely to revolve around one's position on (international) trade. An example of a generic measure that could be connected to this first set of human needs is the distance that categories of commodities travel before reaching the consumer. While such a measure is complex in itself, it would provide an indication of whether or not resources and employment (in the selected categories) are sourced locally. However, given that the same measure can be interpreted in completely different ways, it would be inappropriate to use it as an indicator of QoL. Therefore, one must conclude that the technical and political difficulties of developing transportation strategies to support this first set of human needs makes such an objective extremely hard to achieve.

Competence, Efficacy, and Self-esteem

To satisfy the basic human needs for competence, efficacy, and self-esteem an individual needs to feel like a capable and worthy person who is able to achieve the activities he/she sets out to accomplish and obtain the things that he/she values (Kasser 2002). While it is possible to consider the broad supporting role of transportation in meeting this set of needs, this section focuses on the satisfaction an individual derives from *owning* and *using* a mode of transportation (such as an automobile, motorcycle, bicycle, or segway). Hence, the focus leans towards two subsidiary sets of esteem needs: [1] the need for

strength, achievement, adequacy, and confidence; and [2] the need for prestige, recognition, attention, and appreciation (Maslow 1943).[669] Given the automobile's significant impact on modern society (Flink 2001), the following discussion looks at how the automobile has become more than simply a convenient mode of transportation. Here, the focus is predominantly on the second set of esteem needs.

Three primary reasons for owning an automobile are enhanced mobility, the freedom to travel whenever necessary, and the high level of comfort (relative to other modes) experienced while traveling (ESRC 1995). However, these factors do not explain why people spend a large proportion of their income on luxury or personalized automobiles when a functional vehicle would suffice. To understand these factors we need to consider the automobile as an extension of the individual. Viewing an automobile in this manner helps explain why people select vehicles that express individuality or status. In an interesting discussion of transportation trends in Britain, Root (2000) makes the following observations about why people invest in automobiles (many of which can be related to self-esteem needs).

> "*Cars confer status, personal space, power, and so on, and, in fantasy at least, they create and satisfy new types and levels of individuality, without the needs of others impinging (in practice, others do interfere, via speed limits, traffic jams, and so on). Cars are not just utilitarian conveniences, but, particularly for men, they are objects of lust, envy, greed, love, excitement, fantasy and progressiveness ... Women have different, perhaps more practical and pragmatic attachments to their cars*[670] *... Complex relationships with cars, the status and the mobility they provide have been signified by everything from national obsessions with car advertising, young people's preferences for driving over voting ... to high expenditure on customized number plates, fashionable 'people carriers' and extravagant company car fleets*" (Root 2000, p. 451).

The dual purpose of the automobile as a form of mobility and an expression of the self is a powerful combination that vehicle manufacturers have sought to exploit when marketing their products (Ewan 1988; Flink 2001; Inglis 2004). The ability to associate images of excitement, wealth, power/status, luxury, seclusion, and freedom with an automobile "*makes the car the most psychologically expressive object that has so far been devised*" (Marsh and Collet 1986, p. 25). As a result, customers often choose a vehicle based upon the image (or lifestyle) that it portrays, rather than its functionality or performance. As Durning (1992, p. 82) comments, "[t]*he skill of automobile marketers in pushing symbol over substance is evident in the popularity of high-performance vehicles among urbanites who rarely use the special features.*" The problem with such an outcome is that buying a vehicle to gain prestige, recognition, attention, or appreciation (the second set of esteem needs) may not improve an individual's psychological well-

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[669] Maslow (1943, p. 382) argues that the "[s]*atisfaction of the self-esteem need leads to feelings of self-confidence, worth, strength, capability and adequacy of being useful and necessary in the world. But thwarting of these needs produces feelings of inferiority, of weakness and of helplessness.*"

[670] For an interesting discussion of the role the automobile played in shaping women's identify see Scharf (1991).

being since these needs are externally contrived (Galbraith 1958; Georgescu-Roegen 1971).[671] On the other hand, having the means to own and operate a vehicle is likely to give a person a sense of achievement as well as increasing his/her freedom (the first set of esteem needs). In this regard, an individual's QoL is likely to improve. Thus, the problem with considering the ability of the automobile to improve an individual's QoL is that there are tensions between the satisfaction derived from mobility and the dissatisfaction associated with - what Lefebvre (1971) calls - 'false needs.'

In Section 2.1.4 the notion of *producer-created demand* is introduced as a problematic feature of advanced capitalist economies. The basic idea is that the needs of society are 'conditioned' by advertising, which distorts the power of consumer sovereignty and leads to over-consumptive and (potentially) unfulfilling lifestyles. In the context of the automobile industry this phenomenon is known as the *seduction theory* of automobiles (Turrentine 2002).

Seduction theory is based upon the idea that the original motivation to purchase an automobile came from a blind 'love' for the power and status it afforded an individual, rather than its functionality (Turrentine 2002). However, as the automobile became an entrenched part of modern lifestyles, the original 'love' for the automobile transformed into an 'addiction.' Growing levels of suburbanization and the expansion of roads within and between cities locked society into a state of *automobility*[672] - also known as *automobilization* (Beckmann 2002) or *car dependence* (Gorham 2002b) - marginalizing other (more environmentally benign) modes of transportation. The idea that society is in someway addicted to the automobile is described by Manno (2002, p. 82) as a function of the automobile's 'high commodity potential' - i.e., "[c]*ars are individually owned, their operation is nearly globally standardized, they allow tremendous individual autonomy, they are always available and simple to use, and they greatly expand individual mobility.*"

Manno (2002) argues that the large public and private investments in infrastructure and R&D needed to support commoditized lifestyles mean that (in the transportation sector) automobiles and their supporting infrastructure continually evolve and improve. The

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[671] Self-esteem that is based upon receiving the praise of others is also said to be 'contingent' on external standards (Deci and Ryan 1995).

[672] Sheller and Urry (2002, p. 174) define 'automobility' as "*a complex amalgam of interlocking machines, social practices and ways of dwelling, not in a stationary home, but in a mobile, semi-privatised and hugely dangerous capsule.*" They continue, "*civil society should be re-conceptualised as a 'civil society of automobility', a civil society of quasi-objects, or 'car-drivers' and 'car-passengers', along with disenfranchised 'pedestrians' and others not-in-cars, those that suffer a kind of Lacanian 'lack'*" (ibid, p. 174). Hence, Sheller and Urry (2002) argue that the automobile should not be considered simply as an item for consumption or an extension of the individual. The ability of the automobile to transform civil society as a result of its flexibility and coercive effect on public policy means that viewing humans and machines as autonomous agents is insufficient. In their view, a civil society of automobility is one in which those individuals who are not part of the 'auto' system have been disenfranchised and excluded from full citizenship. They call for a new culture of automobility - which one might interpret as a culture of 'sustainable mobility' - where lighter, more fuel efficient, and environmentally sound automobiles are used, public transportation is enhanced, human safety inside and outside of vehicles is improved, and social exclusion is reduced through the development of intermodal transportation networks.

automobile's visible rate of change is seen to be a sign of competitiveness, progress, and development. Thus, promoting modes of transportation with low commodity potential (such as bus and railway networks) where rates of change tend to be slower can be seen - at least on the surface - to be less likely to meet the needs of modern society. Given the fact that high levels of *automobility* are likely to persist in developed and many developing nations for the foreseeable future, many see *hypercars* as the solution to the negative environmental impacts from automobiles (Hawken et al. 2000; Lovins 1995). While an important piece of the overall transportation puzzle, investing in super efficient cars alone is not going to solve congestion or reintegrate communities divided by invasive infrastructure developments. Further, while the perceived status of owning a hypercar is likely to be quite different to that of owning an SUV, if the purchase of the hypercar is led by an extrinsic motivation (or false need) it is questionable whether this action will satisfy the esteem needs of an individual.

In conclusion, this discussion focuses on the second philosophical approach to QoL - i.e., determining QoL based upon the satisfaction of preferences (although the term 'preferences' is considered more narrowly in relation to 'human needs'). The ability of automobile advertisements to establish false needs in a consumer society is seen to be a major barrier to the satisfaction of basic human needs such as self-esteem. While consumers might believe their purchasing decisions will realize a high QoL, if these decisions are motivated by a desire to conspicuously consume, many people are likely to be left with feelings of inferiority, weakness, and helplessness.

If it is assumed that it is impossible to separate the functionality of a 'commoditized' mode of transportation (such as an automobile, motorcycle, bicycle, or segway) from its psychological meaning to the individual, firms producing these modes of transportation are likely to continue using lifestyle images to sell their products. Given this assumption, an interesting question is whether it is possible to market modes of transportation that satisfy - or remain neutral to - basic human needs such as self-esteem as opposed to marketing false needs. With the current industry's (necessary) focus on maximizing profits rather than whether basic human needs are being satisfied, answers to this type of question are not likely to arise anytime soon. Therefore, for now at least, it seems that individuals are left with the task of uncovering the veil of false needs placed over commoditized modes of transportation in order to avoid the pitfalls of materialism. As with the first set of human needs, developing transportation strategies that aim to support this second group of needs is likely to be a highly complex task. However, it seems that a positive - though unlikely - first step would be for vehicle manufactures to rethink their marketing strategies to avoid the creation of false needs around their products.

Autonomy and Authenticity

> "*The Declaration of Independence guarantees the pursuit of happiness, not speed. Our transportation system should provide* ***all*** *Americans with access to jobs, decent housing, the necessities of life and individual autonomy*" (Dittmar 1995, p. 10).

The third set of human needs relates to autonomy and authenticity - the innate human need for increased freedom and more opportunities to live life in a self-directed manner (Kasser 2002). With regards to transportation, one could argue that developing a system that provides individuals with equal freedoms and opportunities to travel in a self-directed (or self-determined) manner would *support* the satisfaction of these needs. However, relying on an 'equality of opportunity' criterion to develop and manage the transportation system might result in the unequal treatment of disadvantaged members of society (see related discussion in Section 2.2.3). For example, while a transportation service might be available for everyone to use, prohibitive costs, safety, or ease-of-use factors can create mobility or accessibility barriers for disadvantaged members of society (such as the poor, elderly, or disabled).

Sen (1992) argues that instead of focusing on equality of opportunities, we should use the idea of 'capability' to describe an individual's freedom to achieve a desired objective (or functioning). In this regard, an important criterion against which transportation investments and policies should be considered is 'equality of capabilities.'

In an insightful discussion of the relationship between transportation and development, Colonna and Fonzone (2003) consider mobility to be a *native* human need that should be supported by transportation developments that improve an individual's capabilities. "*Transport systems can be considered capabilities because they alter accessibility that is the possibility to reach given places. The rationale for investments in transportation fields should be the overall improvement of capabilities*" (ibid, p. 13).

The development of transportation systems that focus on improving accessibility is seen to be an important determinant of QoL and the livability of communities (AARP 2005; NRC 2002). If an 'equality of capabilities' principle is added to this objective, the QoL of *all* members of society is likely to be enhanced.[673] In practice, such a principle may result in a variety of policy responses. For example, in relation to congestion charging, it increases the importance of ensuring that lower income groups do not suffer any loss of accessibility or mobility. This might be achieved through either a direct subsidy or indirectly through an increase in - or enhancement of - existing public transportation services.

In conclusion, this section introduces the idea that basic human needs for autonomy and authenticity can be related to the development and management of the transportation system using Sen's notion of 'equality of capabilities.' In particular, it highlights the need

[673] For a more comprehensive discussion on *transportation equity*, see Section 6.2.4.4.

to provide individuals with equal freedoms and capabilities to travel *within* the system, rather than looking at how system capacity might be expanded to achieve this objective.

Connectedness

The final human need is connectedness - the strong desire for humans to be intimate and close to others (Kasser 2002). This need has possibly the most intuitive link to transportation since connecting origins and destinations (or places more generally) is the primary objective of the transportation system. However, the manner and extent to which places are connected must be considered with care. While transportation systems can support a connected community, invasive infrastructure developments, increasing traffic volumes, and poor land use planning can lead to social disintegration (Whitelegg 1993). For example, Appleyard and Lintell (1969) and Appleyard (1981) provide convincing evidence that increased traffic volumes reduce the level of social interaction in a street community.

In much the same way that the (capability-enabling) accessibility provided by the transportation system supports the human need for autonomy and authenticity, it also supports the need for connectedness.[674] The creation of transportation systems that can provide an individual with access to family, friends, employment, and recreational/leisure activities is likely to support a strong social network. However, as indicated above, the way in which the transportation system connects the social network is important.

The high level of automobility in the U.S. indicates that other modes of transportation - such as trains, buses, bicycles, and walking - have become marginalized. This is problematic with regards to the need for connectedness since possibilities for social interaction are reduced by vehicle-dominated urban forms (Whitelegg 1993) and the sanctuary of the automobile (Edmondson 1998).[675] Indeed, the phenomenon of 'carcooning' (Mokhtarian and Salomon 2001) signifies the withdrawal of individuals from their social network, which includes their own family (Gorham 2002b).

While it is recognized that the 'quiet time' experienced during a commute can be of benefit to an individual (Mokhtarian and Salomon 2001),[676] if we are concerned about opportunities for social interaction then we need to consider how transportation modes and their supporting infrastructure can affect human interaction. By treating accessibility as a proxy for connectedness, it should be possible to determine how transportation systems (in an urban/rural setting) can be developed to support social interaction. As

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[674] While it could be argued that 'mobility' (i.e., passenger-miles traveled) can also be used as a proxy for connectedness, this measure does not provide any indication of whether more or less mobility is likely to support social interaction.

[675] This problem is made worse if people are selecting the automobile for reasons of prestige or status. Kasser (2002, p. 64) presents convincing evidence that "*when people highly value wealth, possessions, status, and image, the emphasis they place on interpersonal relationships and contributions to their community declines.*"

[676] With the advent of mobile phones and advanced traveler information systems (ATIS) the amount of 'quiet time' experienced by drivers during a commute is likely to fall as technology becomes an integral part of vehicles.

Whitelegg (1993, p. 98) comments "[t]*ransport alone cannot deliver rich social networks but it can go a long way to provide the right conditions.*" Since accessibility can be measured in a variety of ways (NRC 2002; U.S. DOT 1997), creating or selecting an acceptable and appropriate metric that supports the notion of connectedness is important.

In an insightful book, *Ecocity Berkeley*, Register (1987) makes the case that accessibility should be provided by proximity rather than transportation.[677]

> "*Instead of thinking of **going** places, think in terms of **being** places. That is, think in terms of establishing desirable places close to one another. Transportation is what you have to do to get to places inconveniently located: the less the better. For an occasional adventure, transportation is great and the world needs people not only going to foreign places but learning about them in depth and with sympathy. However, when it comes to travel to keep a vital urban lifestyle together, the less that is necessary the healthier your life and your environment. If diversity is designed into the city, commuting is minimized and other local* [and long-distance] *travel can be reserved for special occasions*" (Register 1987, p. 33).

While the vision of an ecocity - or alternatively a 'carfree city' (Crawford 2002)[678] - is plausible for urban passenger transportation, the challenge is how to realize this vision when faced with the forces of economic globalization. As long as international trade continues to grow (UNCTAD 2004),[679] so too will the demand for long-distance freight transportation. In addition, there is also strong evidence to suggest that growth in income leads to an increase in personal mobility (Schafer and Victor 1997; 2000). Hence, it seems that any desire to improve accessibility is going to have to contend with increasing levels of passenger and freight mobility.

To conclude, this section argues that accessibility is a useful measure of the ability for individuals to remain connected with others, especially if the distance between places is reduced. Hence, land use and transportation policies that increase accessibility are seen to support the fundamental human need for connectedness. A potential problem with using accessibility to measure connectedness is that it is difficult to know whether there is an 'optimal level' of accessibility that should be sought. Since the connectedness of a community is closely related to its social capital, it might be possible to combine

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[677] Interestingly, this view is supported by the U.S. Department of Transportation (U.S. DOT), which states that accessibility is not just a function of improved transportation, but occurs through the interaction of four core variables:

1. "***Transportation**. Accessibility improves with more links and more frequent, faster, or cheaper service.*
2. ***Proximity to opportunities**. All else being equal, accessibility improves if opportunities are brought closer together and declines if they are further away.*
3. ***Personal circumstances**. Access increases with income and with the physical and mental ability to take advantage of opportunities, including transportation.*
4. ***Quality of opportunities**. Accessibility improves if more or better opportunities become available at the same distance*" (U.S. DOT 1997, pp. 173-174).

[678] See Carfree Cities, http://www.carfree.com/ (accessed on 04/09/06).

[679] See the trade data presented by the U.S. International Trade Administration (ITA), http://www.ita.doc.gov/ (accessed on 04/09/06).

measures of accessibility and social capital to determine whether increases in accessibility lead to noticeable gains in social capital.

Concluding Remarks - Improving QoL by Satisfying Basic Human Needs

While the above sections are intended to be exploratory in nature, it is possible to draw several preliminary conclusions. First, the initial idea of developing transportation systems to support the satisfaction of fundamental human needs and improve QoL is highly complicated, especially for the first two sets of needs - i.e., safety, security, and sustenance and competence, efficacy, and self-esteem. This is primarily because the *supporting* role of the transportation system is secondary to other factors that play a more direct role in satisfying a specific need. Second, applying Sen's (1992) notion of 'equality of capabilities' to the development of transportation systems, is likely to support the satisfaction of human needs for autonomy and authenticity by removing mobility and/or accessibility barriers facing disadvantage members of society. Finally, transportation and land use strategies that increase accessibility and provide a fertile ground for social interaction are likely to support the satisfaction of our need for connectedness as well as enhance social capital.

6.2.4.4 Ensuring a Fair Distribution of Life-Quality (D_b)

> "*The natural and built environments and the quality of life in a community are inextricably linked to the distribution of transportation system impacts and the social equity of transportation policies and programs*" (TRB 2002, p. 82)

Equity can be considered in two important dimensions - [1] *between* generations (i.e., intergenerational equity) and [2] *within* the current generation (i.e., intragenerational equity - equity between nations, regions, ethnic groups, ages, sexes, income groups, etc.). The first two principles (S_a and S_b) of Gudmundsson and Hojer's (1996) framework are concerned only with intergenerational equity. This final section, however, focuses on intragenerational equity and how it can be affected by transportation.

Table 6.6 shows how one's interpretation of what is equitable in a transportation context depends upon the equity, fairness, or justice principle that is used to view an issue (Hay and Trinder 1991). For example, if drivers have become accustomed to a certain level of congestion charging, a sudden increase in costs beyond their 'expectation' of what is fair might leave them feeling that an injustice has occurred. However, others may view equity in the context of 'demand' and base their support for transportation policies on a *willingness to pay* or *fee for service* criterion. At a more fundamental level, transportation can be considered as a 'basic need' (see the related discussion in the previous section), where services are provided as an essential *support* component of everyday living.[680]

[680] The challenge of the 'basic needs' approach is determining what constitutes a basic transportation need as well as the relative importance given to this need by the various (heterogeneous) groups of people who are mobility-disadvantaged - e.g., the elderly, young, blind, wheel-chair bound, poor, etc. (Rosenbloom and Altshuler 1977).

Alternatively, a 'formal equity' approach to decision-making would ensure that each individual *within* a reference group receives the same level of transportation services. In contrast, a 'substantive equity' approach focuses on equity *between* reference groups, and aims to ensure that all individuals receive comparable levels of transportation service. What these examples indicate is that the fairness of a transportation policy is determined by the principle against which it is considered.

Of the ten principles shown in Table 6.6, three are seen to be of particular relevance to transportation decision-makers: [1] *expectations*; [2] *formal equity*; and [3] *substantive equity* (Banister 1994). The first principle relates to whether people feel that they have been fairly treated and, as indicated above, depends upon whether an individual's *legitimate* expectations have been met. The ability to meet public and political expectations is an essential component of any transportation initiative. However, a problem with this principle is whether the expectations are, in fact, legitimate. It is possible to consider the question of legitimacy by looking at 'expectations' from the perspective of the second and third principles.

Table 6.6: Principles of Equity, Fairness, and Justice and Potential Transportation Applications

Principle	Definition	Transport Application
Procedural fairness	Consistency, evenhandedness, non-arbitrariness in procedures	Exclusion of certain interested groups or individuals from the policy process
Expectations	Maintenance of conditions upon which reasonable expectations have been formed	Sudden or major increase in rail fares, unexpected siting of a new road
Formal equity	Equal treatment within a reference group; like benefits enjoyed by like persons	All ratepayers to have access to facilities supported through local taxation
Substantive equity	Equality in final outcomes	Provision to secure equal access to facilities or equal use
Need as demand	A want backed by a willingness to pay	Provision of unsubsidised transport services
Basic need	Minimum requirements to fulfil certain universal objectives	Provision of subsidised transport services to rural areas
Wider need	Wants	Free public transport
Liberty rights	Rights of choice and the corrective duties of forbearance	Right to intervene in the policy process
Claim rights	Duty to provide something to the rights-holder	Right to concessionary fares
Desert	Distribution according to individual desert, merit, or contribution to the common good	Uncertain, possibly provision of concessionary fares for the aged

Source: Hay and Trinder (1991, p. 454).

Formal equity - also known as *horizontal equity* or *egalitarianism* (Litman 2005a) - refers to the equal treatment of like individuals or groups. In the context of transportation policy, this principle means that like individuals or groups should receive an equal share

of spending and benefit from the same level of transportation services, regardless of their own needs. However, there are two possible exceptions to this principle: [1] situations where a Michelman's (1967) test can be applied to justify a short-term cost for a long-term benefit; and [2] where the special treatment of a group is justified on the grounds of substantive equity.

Given the inherent difficulty of treating 'like persons alike,' Ellickson (1977) recommends using a Michelman's (1967) test for horizontal equity. This test proposes that "*requiring a person to bear a loss is not unfair if he should be able to perceive that a general policy of refusing compensation to people in his situation is likely to promote the welfare of people like him in the long run*" (Ellickson 1977, p. 415). The idea of a Michelman's test aligns well with the trade-off/positional analysis framework (described in Section 4.2.1.4), where a successive set of trade-off matrices can be used to inform stakeholders of how their situation is likely to change over time given a specific (dynamic or static) policy.

For the second exception to formal equity, it is possible to envision a situation where all like individuals or groups have the same *opportunity*, but do not have the same *capability* to benefit from a service. For example, if a 'like group' is defined by income or ethnicity, the heterogeneity within this group (e.g., differences in age, physical ability, health, etc.) means that some individuals are more likely to be able to take advantage of a service than others. In this instance, the principle of substantive equity can be used to adjust for any inequalities *within* a reference group.[681]

Substantive equity - also known as *vertical equity*, *social justice*, *environmental justice*, and *social inclusion* (Litman 2005a) - refers to the different treatment of individuals or groups if this treatment will lead to a more equitable final outcome. The theory behind substantive equity is most clearly explained by Rawls's (1971) *Theory of Justice* (see Section 2.2.1).[682] Rawls (1971) argued that new social arrangements should only be accepted if they offer greater advantage to individuals or groups who are relatively worse off to begin with. When applied to transportation decision-making, the Rawlsian principle of substantive equity has a wide range of implications. For example, it favors *progressive* policies and programs that improve the circumstances of economically-, socially-, and mobility-disadvantaged members of society.[683] It also reinforces the

[681] It should be recognized that the principle of substantive equity can be used to address inequality both within a reference group and between reference groups.

[682] It is important to recognize the difference between a Rawlsian outcome and one that is consistent with environmental justice and Title VI of the 1964 Human Rights Act. A Rawlsian outcome is a form of positive discrimination that aims to improve the position of the most disadvantaged rather than allowing them to receive the same benefits/costs as advantaged groups. An outcome that is consistent with environmental justice and Title VI seeks to avoid situations where disadvantaged groups receive a higher burden than other groups, but there is no conscious decision to make them relatively better off under a new transportation policy or project.

[683] In contrast, a *regressive* policy places a heavier burden on the more disadvantaged members of society.

importance of analyzing the environmental justice aspects of existing and new transportation policies and programs (Alsnih and Stopher 2003; TRB 2002).[684]

A potential weakness of Rawls's (1971) *Theory of Justice*, however, is that it is formulated using the 'equality of opportunity' principle and does not consider whether individuals have the 'capability' to realize this opportunity (see Section 2.2.3). If Sen's (1992) capability-centered view is also used to assess substantive equity, the result is likely to be a more accurate assessment of whether an equitable final outcome has been achieved. Therefore, substantive equity should be considered in two dimensions: [1] *equality of opportunity*; and [2] *equality of capability* (or outcome) (Banister 1994; Litman 2005a).[685]

The consideration of substantive equity in this manner implies a two-stage process of equity evaluation. First, the principle of 'equality of opportunity' means that positive discrimination or progressive policies should be used to provide economically- and socially-disadvantaged groups with a more equal share of the benefits of transportation. It also means that the opportunity to live a safe and healthy life and to take an active role in the transportation decision-making process is more equally distributed across different groups. Thus, the first stage looks at equality of opportunity *between* reference groups, which are differentiated by income and social class.

Second, the principle of 'equality of capability' should be used to determine whether individuals *within* different social and income groups have the ability to use available transportation services/systems. In effect, the second step attempts to identify those members of society who require special transportation services such as wheelchair accessible forms of mobility or services that enable the elderly to access shops, healthcare, and social and recreational activities (AARP 2004; 2005).

By considering equity using formal (or horizontal) *and* substantive (or vertical) equity, it should be possible to determine the legitimacy of an individual's or group's 'expectation' of fairness. In the situation where an expectation is deemed to be unreasonable, the decision-maker is faced with the challenge of generating sufficient public and political support to make a redistributive policy a reality. The outcome of such a task is likely to depend upon whether the public adopts a communitarian or utilitarian posture to decision-making (see Section 2.2.2). In the former position, the public is more concerned with overall social welfare and is, therefore, more likely to adjust its expectations of fairness for the greater good. In the latter situation, the decision-maker must act as trustee for society and identify strategies to generate support for what is likely to be perceived as a coercive policy.

Finally, the process of equity evaluation means that transportation analysts are required to make trade-offs between the various types of equity. While all ten of the principles in

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[684] For guidance on how the principles of environmental justice can be applied to transportation decision-making, see the FHWA and FTA *Environmental Justice* website, http://www.fhwa.dot.gov/environment/ej2.htm (accessed on 04/09/06).

[685] These two dimensions are also applicable to formal equity.

Table 6.6 are relevant to transportation decision-making, if the ultimate objective of decision-making is to move towards sustainable development then the principles of formal and substantive equity are likely to be the most useful. Hence, a transportation policy that improves the distribution of QoL can be described as one that ensures equality across individuals or groups and improves the opportunities *and* capabilities of the most disadvantaged members of society.

While Gudmundsson and Hojer (1996) do not make a formal distinction between the different types of equity, the principles of formal and substantive equity and environmental justice are implicit in their discussion of transportation-related inequalities. By considering transportation in the wider context of sustainable development, they make two arguments that relate to how transportation affects the distribution of QoL between nations and within regions.

At the heart of Gudmundsson and Hojer's (1996) argument is the fact that the level of mobility and accessibility to goods and services experienced by developed nations is far greater than that experienced by developing nations. The inefficiency and lack of transportation systems in many developing nations, combined with lower levels of income, contribute to vastly different levels of QoL (at least in a *material* sense). While Gudmundsson and Hojer (1996) acknowledge that economic instruments are likely to be the most effective way to redistribute wealth from developed to developing nations,[686] adopting transportation policies that help improve physical access to places, services, and consumer goods is argued to be an important step in moving towards sustainable development.

The responsibility for creating macro strategies to 'level' the state of transportation systems throughout the world lies predominantly with international institutions such as the World Bank and UN. Indeed, building efficient and equitable transportation systems in developing nations has long been one of the core development objectives of the World Bank.[687]

At the regional and local level, the decision-making approach used to select transportation projects or policies plays an important role in determining the distribution of life-quality. The fact that the GAO (2003), DOT (2003b), and OMB (1997) have endorsed benefit-cost analysis (BCA) to assist transportation decision-making creates a problem in this regard.[688] BCA is blind to the distributional impacts of a policy or program (see Section 4.2.1.3). Economists have tried to surmount this problem by searching for 'potential' Pareto-efficient outcomes using the Kaldor-Hicks criterion. Such

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[686] While the redistribution of wealth through aid was a core objective of sustainable development during the early 1990s, the emergence of economic globalization has moved the focus from 'aid' to 'trade' and 'capacity development' (see Sections 3.4.6 and 3.5.1). The U.S. in particular has adopted the position that reducing poverty through trade is critical for sustainable development. However, it has ignored the question of whether its consumptive habits should be constrained to reduce its significant ecological footprint.

[687] See the World Bank, *Infrastructure, The Building Blocks of Development, Transport*, http://www.worldbank.org/infrastructure/ (accessed on 04/09/06).

[688] While the BCA is endorsed by these organizations, this does not mean that other approaches are excluded.

an outcome is one where the total economic value (TEV) of social resources is increased to a level at which those who benefit can compensate those who lose and still be better off. However, there is no requirement for a transfer of wealth and, in fact, one rarely occurs in practice. Further, inequality is more likely to increase using BCA since those most likely to receive benefits are already the more advantaged members of society.[689] Using similar arguments, Gudmundsson and Hojer (1996) conclude that the use of BCA with the Kaldor-Hicks criterion is likely to result in transportation policies/decisions that can lead to environmental and social injustices - violating the fourth principle (D_b) of their framework.

An alternative to BCA that can be used to support equitable and more democratic decision-making is the hybrid trade-off/positional analysis framework introduced in Sections 4.2.1.4 to 4.2.1.6. This framework is based upon a trade-off matrix that makes the distributional impacts of a policy explicit. The framework also supports the Michelman's test by requiring a comparative analysis of the impacts of a policy over time. While the distributional implications of a policy are made explicit, the trade-off matrix is *neutral* to how inequalities should be dealt with. Therefore, deciding upon the exact distribution of benefits and costs among the stakeholder groups is the responsibility of the decision-maker. In this regard, the decision-maker's value system is made visible by the trade-offs he/she makes.

In an effort to avoid arbitrariness and guide decision-making towards sustainable development, the Rawlsian/utilitarian decision-making philosophy was created in Section 2.2.2. This framework (or value system) presents one way that decision-makers can move away from focusing on purely utilitarian outcomes towards ones that are more equitable and compatible with decision-making for sustainable development. While the framework leans towards Rawlsianism, it should be thought of as a 'pluralistic moral philosophy' in that it considers both Rawlsian and utilitarian outcomes.

In an important work on ethical land-use, Beatley (1994) adopts a similar way of thinking whereby Rawlsianism and utilitarianism are both called upon to make decisions. However, it should be recognized that Beatley (1994, p. 17) does not lean towards either philosophical approach, arguing that "*no single paradigm is applicable in all circumstances.*" Beatley's (1994) moral pluralism allowed him to create a series of principles and imperatives of ethical land-use policy that are directly relevant to - what might be called - 'ethical transportation policy.' Box 6.2 presents Beatley's (1994) principles and imperatives which have been adapted to a transportation context.

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[689] This phenomenon is connected to the 'wealth effect.' For example, if individual travel time savings are used to calculate the benefit of a highway project, wealthy individuals (with a high value of time) are likely to generate a higher economic benefit than poorer individuals for the same reduction in travel time. Therefore, a project that benefits the wealthy members of society is likely to create a higher overall economic benefit than a similar project that serves lower income groups. This result is problematic since a standard BCA is not concerned with distributional issues and simply identifies the project with the highest 'economic' benefit for society.

Box 6.2: Principles of Ethical Transportation Policy from Beatley's (1994, pp. 263-272) Key Elements of Ethical Land-Use

***Maximum Public Benefit* [Formal, Substantive, and Intergenerational Equity]**

Ethical ... [transportation policy] seeks to promote the greatest quantity of social benefits or welfare, other things being equal. ... [Transportation] policy which seeks primarily to promote the interests and welfare of a few, and disregards the interests and welfare of the larger public, should be considered unethical. Utilitarian objectives in ... [transportation] policy must be constrained by other important moral duties, including the acknowledgement of certain ... [mobility and accessibility] rights, obligations to distributive justice, and obligations to future generations and the environment itself. Ethical ... [transportation policy] requires looking beyond narrow economic and utilitarian reasoning when considering the merits of ... [transportation] policies and decisions.

***Distributive Justice* [Substantive Equity]**

Ethical ... [transportation policy] requires careful consideration, at every stage possible, of the distributive effects of ... [transportation] decisions and policy. At a minimum, ethical ... [transportation policy] requires that actions be avoided which serve to lessen the social and economic conditions of those least-advantaged in society. ... [Transportation] policy can and should be used to improve the conditions of these individuals and groups. In short, ... [transportation] policymakers must acknowledge that, in a variety of ways, ... [transportation] policy can be influential in promoting a just society.

***Preventing Harms* [Polluter Pays Principle]**

Ethical ... [transportation] policy prevents or minimizes the imposition of harms (on people and the environment). The principle of culpability holds that those who cause ... harms are accountable for them.

Land-Use Rights

Ethical land-use policy must protect minimum social and environmental rights due every individual irrespective of income or social position. These rights may be legal or constitutional, or they may be moral. Land-use rights may be viewed as moral entitlements to basic minimum social goods, such as affordable housing, access to transportation and mobility, health care, recreation, and natural resources such as beaches and mountains. Individuals are entitled to be free from certain excessive levels of environmental risk; for example, from air and water pollution, or from hazardous waste disposal. The concept of individual and public rights places parameters on the extent to which government can enact land-use [or transportation] policies to maximize social utility or welfare.

Environmental Duties

Ethical ... [transportation policy] acknowledges obligations to protect and conserve the natural environment, both for humans and other forms of life. Ethical obligations to the environment lie at both ecosystem, species and organism levels. In particular, ethical ... [transportation] policy acknowledges that *Homo sapiens* is not the only species on the planet and that nonhuman life has inherent worth as well. Ethical duties to the environment suggest that ... [transportation] policy should be oriented to minimize the extent of the human "footprint." ...

***Obligations to Future Generations* [Intergenerational Equity - Principles S_a and S_b]**

Ethical ... [transportation] policy acknowledges important obligations to posterity and to generations of people yet to come. Ethical ... [transportation policy] acknowledges that current ... [transportation] practices and decisions can have substantial impacts on future generations; that is, current practices can so foul the natural environment that life in the future will be difficult or extremely unpleasant. Ethical ... [transportation policy] argues that human beings have special obligations to protect ... resources which may enrich the lives of future residents ... . All ... [transportation] decisions today must incorporate consideration of their cumulative, long-term effects.

***Life-Style Choices and Community Character* [Livable Communities and Subsidiarity]**

Ethical ... [transportation policy] allows individuals to pursue unique life-style choices. Thus, ...

Box 6.2: Principles of Ethical Transportation Policy from Beatley's (1994, pp. 263-272) Key Elements of Ethical Land-Use

[transportation] policy tolerates a diversity of life-styles and assists individuals in pursuing their own fundamental life plans. Ethical ... [transportation policy] acknowledges that communities have the moral authority to establish and promote a certain physical community character, but these efforts must be tempered by the need to respect individual rights and life-style choices that directly affect only the individual.

Expectations and Promise-Keeping **[Transparency and Accountability]**

Ethical ... [transportation policy] requires that public ... [transportation] authorities keep the promises they make. ... [Transportation] ethics requires acknowledgement and respect for explicit and tacit promises made. Ethical ... [transportation] policy does not, however, require public ... [transportation] bodies to satisfy private expectations formed on the basis of broader economic or social trends. At a minimum, ethical ... [transportation policy] requires planners and public ... [transportation] bodies to do everything possible to clarify when public promises are made, when they are not made, and when citizens' expectations concerning ... [transportation] are valid and legitimate.

The Privilege of Landownership and Use [690]

Ethical ... [transportation policy] views the use and development of land as a privilege, not an inviolable right. Private landownership is necessarily subject to the constraints and restrictions established by society. Diminution of land value due to ... [transportation policy and programs] is a morally relevant consideration, but it must be balanced against the ethical merits and objectives of public restrictions. As long as land is not physically taken by government, and personal access and use by its owner remain, a declaration of a "taking" does not seem justified.

Interjurisdictional Land-Use Obligations

Ethical ... [transportation] policy acknowledges that no political jurisdiction is freestanding; ethical obligations exist to other jurisdictions, particularly those which are adjacent or surrounding. At a minimum, ethical ... [transportation policy] requires one jurisdiction to consult with and coordinate with other jurisdictions, and consider the impacts of its ... [transportation] policies on communities and citizens beyond its borders. Ethical ... [transportation] policy implies that jurisdictions have obligations to minimize the imposition of harms on other jurisdictions ... .

Fair and Equitable Political Process **[Stakeholder Participation]**

... [Transportation] policy and decisions must be formulated through a fair and equitable political process. ... [Transportation] policy-making must provide the opportunity for all interested and affected parties to participate. Ethical ... [transportation policy] requires that efforts be taken, whenever possible, to ensure that a level political playing field be maintained and that all community interests and factions, and geographical regions, be able to exercise meaningful influence on the outcomes of ... [transportation] decisions. As a moral community increases in scope, including, for example, future generations and other forms of life that may be unable to speak for themselves, ethical ... [transportation policy] imposes special ethical requirements on elected and appointed representatives to consider them in their decision-making. Ethical ... [transportation policy] also requires certain minimum ethical conduct on the part of ... [transportation] officials, including the avoidance of conflicts of interest.

[690] It should be noted that the recent decision by the Supreme Court (Kelo et al. v. City of New London et al., 23 June 2005) to give municipalities broad powers to seize private property for private economic development runs against this principle. The ruling was passed on the grounds that the 'taking' in question was part of a carefully considered development plan that was not likely to benefit any particular social group.

In conclusion, this section introduces the theoretical foundation for ethical transportation decision-making that supports the objective of ensuring a fair distribution of life-quality (D_b). While the notion of fairness depends upon the ethical principle used to consider an issue, there are two principles that are seen to be of particular relevance to transportation. These principles are formal (or horizontal) and substantive (or vertical) equity. Furthermore, if these principles are considered in both an equality of opportunity and capability context, the outcome of an equity analysis is likely to be more complete.

Finally, it is argued that the trade-off matrix and the Rawlsian/utilitarian decision-making philosophy are two tools that can help decision-makers formulate transportation policies that support the objectives of sustainable development. The former provides a neutral matrix in which distributional inequalities of a policy become visible, and the latter provides decision-makers with the theoretical basis for taking action to address inequalities. The principles of ethical transportation policy shown in Box 6.2 are believed to be consistent with the Rawlsian/utilitarian decision-making philosophy and provide a useful operational context.

6.2.4.5 Conclusion: Combining the Sustainable Transportation and Sustainable Development Perspectives on Transportation

An important question raised in this chapter is whether it is beneficial to develop transportation policies and programs from a sustainable development (i.e., holistic) rather than a sustainable transportation (i.e., transportation-centered) perspective. While such a distinction might seem semantic, the discussions in the previous sections highlight that both approaches are important and necessary, but the transportation-centered perspective would benefit from being broadened to include its relationship with other sectors.

The holistic view is important since it defines the boundaries (the ecological limits) within which all sectors must collectively operate. Two important frameworks that lend themselves to this perspective are the 'capital model' of sustainable development and ecological economics. The holistic view also invites a broader consideration of quality of life (QoL) and expands the analysis of equity to include distributional impacts of transportation between regions and nations. In contrast, the transportation-centered view is important since it provides *sector-specific* objectives that guide the development of transportation policies and programs using the Three E's of sustainable transportation. However, a problem with existing definitions and principles of sustainable transportation is that they fail to explicitly recognize the need to integrate/coordinate transportation policies with those of other major sectors. Hence, the *link* between the holistic and transportation-centered perspectives of sustainable development is unclear. The following discussion explores this problem and presents a simple solution.

Adopting a holistic view of development highlights the importance of knowing whether existing sectors (such as energy, transportation, agriculture, etc.) are operating within sustainable parameters. A useful framework for considering this holistic view is the 'capital model' of sustainable development. This model works by identifying the current stocks of natural, man-made, human, financial, and social capital and determines how

these should be maintained or invested in for future generations.[691] While these stocks of capital cover the physical, social, and virtual domains - the core building blocks of development - this discussion is primarily interested in the physical domain that is captured by *natural*, *man-made*, and *human capital*.

An important conclusion from Section 6.2.4.1 is that *natural capital* can only be protected and enhanced if governments monitor and set limits to resource usage and pollution levels. These limits can be defined in terms of maximum sustainable yield, carrying capacity, critical levels, quality standards, vulnerability, resilience, fragility, etc. (Munn 1989; Nijkamp 1994). The limits become the operating parameters within which sectors must function. It follows that a sector's actions can only be described as 'sustainable' (with regards to natural capital) if the sector is operating within its allotment of pollution rights and resource usage rates. The allocation of such would either need to be set by government or determined using market mechanisms,[692] which is where ecological economics can be applied. While the definitions and principles of sustainable transportation recognize the need to limit pollution and the use of resources to sustainable levels (see Figure 6.10 and Table 6.3), they do not recognize the role of *other* sectors in achieving this objective. It is clear that the transportation sector does not have sole responsibility for protecting natural capital and this fact needs to be reflected by the definitions and principles of sustainable transportation.

Figure 6.17 indicates how all sectors can contribute to the problems or challenges facing society. Identifying adequate solutions to the challenges shown in Figure 6.17 requires a multi-sectoral response. While partial (sector-centered) solutions might reduce environmental burden, unless these improvements are set in a national and/or global context it is not possible to determine whether or not such actions are sustainable.[693] This fact reinforces the argument for establishing national limits for resource usage and pollution levels.[694]

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[691] In practice, however, only the first four of these types of capital are considered in any detail due to the difficulty in measuring social capital.

[692] The elegance of market mechanisms is that a government would not be required to determine how the burden of staying within ecological and resource-use limits should be divided between sectors. Instead, the trading mechanisms would (theoretically) allocate these burdens in the most economically efficient manner.

[693] This point highlights the problem with adopting the current view of sustainable transportation. While improvements in the transportation sector are clearly a positive step forward, it is not possible to measure the extent of the improvements without placing them in a larger context. While the current definitions of sustainable transportation recognize the need to protect natural capital, they do not link the transportation-centered and holistic views in a manner that guides decision-making.

[694] If sustainable development is to be realized, the earth's ecological limits must be identified and human activities must be constrained to function within these limits. Given the current political state of the world, it seems highly unlikely that such limits would ever be agreed upon. However, if substantial progress is made on addressing global climate change, for instance, and a 'global' carbon trading system is introduced, this action might pave the way for similar instruments in other critical areas. If one assumes that establishing global ecological limits will not happen anytime soon, this does not prevent *proactive* nations from setting their own national limits and taking actions to stay within these limits. Hence, it is not unrealistic to assume that a nation would set limits to its resource usage and pollution levels. If this argument is linked to the 'strong' Porter hypothesis in Section 4.2.3.4, placing 'macro' limits on industrial activity might lead to disrupting innovations that would position a nation as a world leader in environmentally-sound and cost-effective technology.

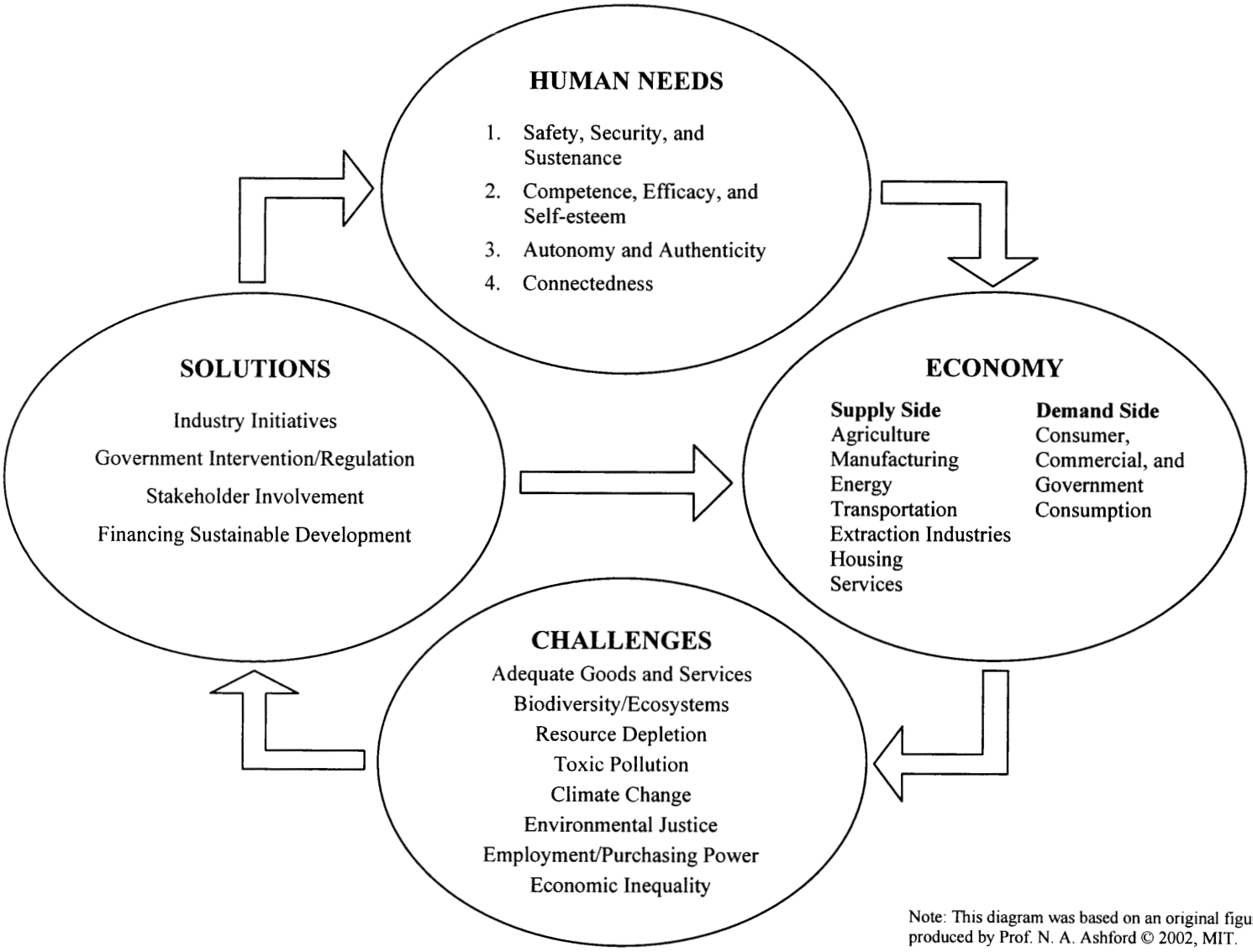
One way to adjust the existing definitions of sustainable transportation is to recognize the need for the transportation sector to coordinate (or at best integrate) its decision-making processes with those of other sectors (Table 6.7).

Table 6.7: Recommended Changes to the Definition of Sustainable Transportation with respect to Natural Capital

	A sustainable transportation system ...
Emissions and Waste	[*..., in coordination with other sectors,*] limits emissions and waste to levels within the planet's ability to absorb them, and does not aggravate adverse global phenomena, including climate change, stratospheric ozone depletion, and the spread of persistent organic pollutants
Renewable Resources	[*..., in coordination with other sectors,*] ensures that renewable resources are managed and used in ways which do not diminish the capacity of ecological systems to continue providing those resources
Non-renewable Resources	[*..., in coordination with other sectors,*] ensures that non-renewable resources are used at or below the rates of development of renewable substitutes

While the adjustments to the definitions are minor, they present an explicit requirement for the transportation sector to work with other sectors to solve problems associated with natural capital. Of course, the definitions of sustainable energy, agriculture, manufacturing, etc. must also include similar language for this approach to be effective. Linking the sector-centered and holistic perspectives of sustainable development in this manner *widens* the solution space for each sector.[695] For example, the revised sustainable transportation definition makes inter-sector cooperation a primary agenda item in the search for solutions to the challenges listed in Figure 6.17. Thus, if the transportation sector began to work closely with the energy sector, for instance, an entirely new set of solutions might become available that combines each sector's core competencies in new ways (see Section 8.4).

[695] In Section 6.1.7, it is argued that the system boundary is only set once the research question has been asked. Requiring decision-makers from each sector to work together to identify integrated solutions to problems relating to natural capital means that the research question has broadened the system boundary significantly. The boundary now reaches beyond each sector to incorporate all relevant sectors.



Note: This diagram was based on an original figure produced by Prof. N. A. Ashford © 2002, MIT.

Figure 6.17: Drivers, Challenges, and Solutions to Sustainable Development

The idea of maintaining/improving *natural capital* is conceptually straightforward; however, setting limits to pollution levels and resource usage is likely to be difficult from both a scientific and political perspective. If the same principle of maintaining/improving capital is applied to *man-made* and *human capital* the analysis becomes far more complicated. Identifying acceptable and objective ways to 'value' the preservation or development of these forms of capital is extremely difficult (see Section 6.2.4.2).[696] Instead of trying to maintain/improve these two forms of capital, a better approach would be to focus on maintaining *natural capital* and make a sustained commitment to human development. The former policy would have the effect of guiding investments in man-made capital since the availability of resources and the space available for pollution/wastes would be constrained. The latter policy would seek to continually improve education, healthcare, and nutritional levels (see Section 2.1.3). Improving these determinants of human well-being would not only enhance the quality of life for the current generation, but also ensure that human potential is preserved and improved for future generations.

Two other lenses of the holistic perspective are improving QoL for individuals (Section 6.2.4.3) and ensuring a fair distribution of life quality (Section 6.2.4.4). These two lenses tend to blur the lines between the transportation-centered and holistic views of sustainable development as they are central to both. The only difference is that viewing transportation from the perspective of sustainable development invites a broader view of QoL and equity. For example, instead of considering the effects of transportation on QoL using traditional transportation measures such as accessibility, mobility, noise, and air quality (see Table 6.4), one can ask the broader question of whether the transportation system is supporting fundamental human needs. Similarly, the holistic view expands the consideration of equity beyond a focus on individuals and social groups to include equity between regions and nations. The decision of whether to use a transportation-centered or holistic perspective will depend upon the objectives and scale (i.e., local or international) of the analysis.

In conclusion, it is important and necessary to consider the development of transportation policies and programs from both a sustainable development (i.e., holistic) and sustainable transportation (i.e., transportation-centered) perspective. By considering both approaches the disadvantages of each approach are countered by the advantages of the other (Figure 6.18). To help integrate the two approaches, several minor changes to the prevailing definitions of sustainable transportation have been recommended.

[696] The tight interconnection between natural and man-made capital means that if the use of natural capital is constrained, so too is the development of man-made capital. However, to what extent the development of man-made capital is constrained will depend upon whether a 'weak' or 'strong' form of sustainable development is applied.

The Three E's of Sustainable Transportation (*the transportation-centered view*)	**Viewing Transportation from the Perspective of Sustainable Development** (*the holistic view*)
Advantage:	*Advantage*:
— Provides sector-specific objectives and principles that guide the development of transportation policies and programs.	— Highlights the need to establish a national framework/policy to address sustainable development that can encourage sectors to coordinate/integrate their activities.
Disadvantage:	*Disadvantage*:
— Does not explicitly connect impacts from the transportation sector with those from other sectors. Thus, transportation tends to be considered in a vacuum.	— Does not provide detailed sector-specific objectives and principles to guide the development of transportation policies and programs.

Figure 6.18: Advantages and Disadvantages of Adopting a Transportation-Centered or Holistic View of Sustainable Development

6.3 A Sustainable Transportation Decision-Support Framework

A major challenge facing the concept of sustainable transportation is the creation of a viable decision-support framework. The idea of combining the transportation-centered and holistic perspectives of sustainable development raises some important questions about which organizing frameworks, lenses, or ideas should be used or integrated to achieve this objective.

This section shows how the major organizing frameworks and lenses of sustainable development (introduced in Chapters 2 and 4) can be brought together to form a multidimensional decision-support framework for sustainable transportation. The core aspects of this framework are presented in Table 6.8. By highlighting the current versus sustainable approaches to developing the transportation system, it is possible to articulate the multidimensional nature of the proposed framework.

Table 6.8: Moving Towards a Sustainable Transportation Decision-Support Framework - Current vs. Sustainability Approaches to Developing the Transportation System

	Current Approach	Sustainability Approach
System Conceptualization [a]	*Mechanistic, linear, and reductionist* - Reduce the transportation system into a number of sub-systems - e.g., highways, bus networks, transit networks, cycleways, airports, etc. - where each sub-system is analyzed separately/in isolation and the whole is considered to be the sum of the separate parts.	*Holistic systems approach* - The transportation system is considered as a series of interconnected socio-technical systems that function like biological and ecological systems. A healthy system displays modal diversity for people and freight that increases with population size. The system is analyzed both in terms of its sub-systems and their interconnections, as well as how the system/sub-systems interact with the natural environment. The whole cannot be analyzed as a simple sum of its parts.
Transportation Planning [a, b]	Maximize system capacity, travel speed, and mobility. Land use considerations are often secondary to transportation planning and vice versa.	Maximize system efficiency through the provision of a highly interconnected and multimodal transportation system that encourages the use of the most efficient modes of transportation. Promote accessibility rather than mobility. Land use planning (including environmental considerations) is an integral part of transportation planning; '*transportation-land-environment planning*' replaces '*transportation planning*' as a descriptor.
Stakeholder Involvement [b]	Modest level of stakeholder involvement. Stakeholders may provide information or are included at certain points of the planning process. Stakeholders are sometimes included in scenario planning/visioning exercises.	High level of stakeholder involvement. Stakeholders have a more influential role in the planning/decision-making process and are more cognizant of the distributional impacts of transportation policies/programs/projects. Stakeholders play a central role in participatory backcasting/scenario planning exercises.
Modal Choice	The automobile is the predominant and only choice of transportation for many people. In large metropolitan areas, public transportation is more accessible, but to varying degrees.	A more balanced approach to the provision of transportation is applied. Where feasible, innovative solutions should be tested to begin to bridge the gap between public and private transportation.[c]

	Current Approach	Sustainability Approach
Funding	Transportation funding tends to be directed at specific modes. A significant proportion of available funding is targeted at highways since vehicles are the dominant mode of transportation.	Transportation funding is directed towards enhancing and integrating modal diversity and, in general, is not constrained to a particular mode. In a situation where the transportation system is largely built, funding focuses on operating, maintaining, and transforming the existing system towards a more sustainable form. Provide significant and sustained financial support for sustainable transportation research.
U.S. DOT Strategic Objectives	— Safety; — Mobility; — Global connectivity/economic growth; — Environmental stewardship; and — Security.[697] Strategic objectives are focused on *managing* areas where improvements are deemed necessary.	— Safety; — Accessibility; — Multimodality; — Economic development; — Environmental protection/enhancement; and — Security. Rather than simply *managing* the strategic areas, the U.S. DOT should search for ways to achieve *transformational improvements* in each area (see Competitiveness/Innovation).
Equity	Equity considerations are primarily informed by Title VI of the 1964 Human Rights Act, the 1990 Americans with Disabilities Act, and the 1994 Presidential Executive Order on Environmental Justice.	The principles of ethical transportation policy (see Box 6.2) are applied in the choice of options and pathways for achieving those options. Federal law and guidance related to equity is adhered to.
Employment [d]	Ensure a supply of adequately trained people, facilitate dialogue with workers, and provide safe working environments.	Continue current approach while searching for radical improvements in the human-technology interface (i.e., the integration of human resources and engineering artifacts).
Economics and Policy Development/Analysis	Neo-classical economics. Policy development is based upon static efficiency. Primary analysis tools: Benefit-cost analysis (BCA) and cost-effectiveness analysis (CEA).	Ecological economics. Policy development is based upon *dynamic efficiency* - i.e., the need to consider how change occurs over time. Primary analysis tool: Trade-off/positional analysis (supported by the Rawlsian/utilitarian decision-making philosophy).

[697] Source: The U.S. Department of Transportation, *Strategic Vision 2005-2008*, http://www.dot.gov/stratplan2008/strategic_plan.htm (accessed on 04/09/06).

	Current Approach	Sustainability Approach
Competitiveness/ Innovation [d]	Competitiveness is achieved by improving system efficiency and lowering the costs of transportation services. Innovation is encouraged through single-purpose government policies such as research programs, demonstration projects, government purchasing, market incentives, etc.	Competitiveness is achieved through changing the nature of meeting market needs by encouraging radical or disrupting innovation. Innovation occurs through an integrated process of technological, institutional, social/behavioral, and organizational changes. Government policy is integrated and co-optimized (i.e., is designed to achieve multiple objectives) and a range of incentives (including more stringent environmental regulation - i.e., the 'strong' Porter hypothesis) is used to encourage disrupting innovation.
Externalities	A wide range of environmental, social, and economic externalities are identified or acknowledged, but a very limited effort is made to internalize the social costs of any negative transportation externalities.	A comprehensive set of environmental, social, and economic externalities is identified and significant effort is made to prevent or internalize the social costs of any negative transportation externalities either through mandated standards or economic instruments. Great care is taken to properly balance efficiency and equity.
Pollution and Waste	Control emissions and waste.	Pollution and waste are *prevented* through system changes wherever possible. Pollution and waste streams are kept within ecological limits.
Energy and Resources	Promote energy and resource conservation.	Transition resource and energy dependence away from non-renewable resources towards renewable resources. Promote dematerialization/ecological modernization.

	Current Approach	Sustainability Approach
Trade	The international transportation system is developed in response to the demands of international trade. The predominant view of trade is based upon Ricardo's theory of comparative advantage, which is not directly concerned with the negative environmental and social impacts of international transportation. Hence, the development of the international transportation system tends to respond to market demands with little or no consideration of the broader system impacts.	The international transportation system is developed to support trade while protecting important social and environmental objectives. The impacts of trade are considered using ecological economics. The idea that trade can be analyzed in a 'value-neutral' way using neo-classical economics is rejected. Instead, trade is analyzed from more than one ideological perspective.[e, f] Thus, the development of the international transportation system depends upon market demand as well as other important environmental and social considerations.
The Four Environmental Drivers of the Concern for Sustainable Development[698]	Governments tend to focus on one or two of the four major environmental concerns to the exclusion of the others.	Governments provide a more balanced approach to addressing the four major environmental concerns.

Key: [a] Replogle (1991; 1995); [b] Litman (2003a); [c] Hoogma et al. (2002), [d] Ashford et al. (2002); [e] Janelle and Beuthe (1997); and [f] Söderbaum (2005).

Table 6.8 provides a clear indication that the creation of a more sustainable transportation system may in some cases require the adoption of an entirely new value system or approach to decision-making. Achieving the transformations described will require important changes across many aspects of the transportation enterprise. These aspects include human behavior, technology, regulations/markets, institutions, firms, and analysis tools/methodologies. In many cases, what is required is the co-evolutionary change of several aspects, which is somewhat analogous to the way that elements of an ecological system might respond to a dramatic environmental change. Thus, changing the transportation decision-making environment is a critical aspect of the proposed framework. Taken as a whole, the aspects discussed in Table 6.8 present the tools and guiding principles of the sustainable transportation decision-support framework.

An important component of this framework is the way in which the transportation system is conceptualized (see Section 6.1.6). Since the concept of sustainable transportation covers the social, technological, and natural domains (see Sections 6.2.2 and 6.2.4), it would seem appropriate to consider the transportation system as part of a *socio-technical-*

[698] The four environmental drivers of the concern for sustainable development are [1] the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being; [2] the rapid use of finite resources and energy supplies; [3] the direct impacts of toxic pollution on human health and the health of other species; and [4] the disruption of the global climate.

natural system.[699] Therefore, any general representation of the transportation system should incorporate important interactions among these domains.

Conceptualizing the transportation system in such a holistic manner supports the 'sustainable approach' to economics, externalities, pollution and waste, energy and resources, and trade described in Table 6.8. It also reinforces the importance of establishing a national policy on sustainable development that sets the boundaries (i.e., the ecological limits) within which each sector must operate (see Sections 6.2.4.1 and 6.2.4.5).[700] Without such constraints, it is not possible to determine whether the aggregate pollution and waste streams and resource usage rates from all sectors are sustainable.[701] While developing such limits will be controversial, a failure to try to do so is morally indefensible on the grounds of fairness. For instance, failing to act implies that there is no desire to determine whether current actions are limiting the development options available for developing nations and future generations.[702]

Establishing macro parameters to guide development fits well with the transdisciplinary field of ecological economics (see Section 4.2.2), which is concerned with the scale of human activity and the allocation and distribution of resources. In effect, ecological economics attempts to change the rules of commerce by setting limits to what can be traded.[703] While adopting an ecological economics approach is necessary for sustainable development, it is not sufficient. It provides no guidance on how human activity can be transformed to keep society within ecological limits (see Section 4.2.3.1).[704] Therefore, the *process* of system transformation forms a central theme throughout the sustainable transportation decision-support framework and is perhaps best captured by the ideas under the headings of 'Economics and Policy Development/Analysis' and 'Competitiveness/Innovation.'

Finally, in addition to the broad lenses/ideas presented in Table 6.8, the decision-support framework includes aspects that focus specifically on transportation related issues. For example, the 'sustainable approach' to transportation planning, stakeholder involvement, modal choice, funding, the U.S. DOT strategic objectives, equity, and employment

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[699] The term 'socio-technical-natural system' was used by Forrester (1971) to describe how social, technological, and natural systems continually interact as they change, grow, or are stressed.

[700] Section 6.4 provides the foundation for the development of a set of sustainable transportation indicators that is based upon the 'Hall-revised UNCSD indicator framework' (developed in Section 5.7). The links between transportation indicators and the national set of indicators provide good examples of how a nation's comprehensive key indicator systems could be integrated.

[701] Here, 'sustainable' refers to the state (or position) of a system and whether it is functioning within ecological limits. In contrast, 'sustainable development' refers to the *process* by which a 'sustainable state/position' will be achieved.

[702] See Chapter 3 (Sections 3.3.8 and 3.4.4 in particular) for a discussion of the debates between developed and developing nations during the formation of the concept of sustainable development.

[703] In contrast, neo-classical economics allows the market to set the rules of commerce and is not directly concerned with ecological limits. See Section 4.2.1 for a discussion of the limitations of neo-classical environmental and resource economics.

[704] The problem with ecological economics is that it assumes that if ecological limits can be set, then technology will somehow adjust (using pricing or other economic or legal instruments) to operate within these limits.

provide specific guidance on how current practices should be changed or improved. The major themes are the integration of transportation policies with other related areas such as land use planning and environmental quality, a more involved role for stakeholders in the planning and decision-making process, and a more balanced approach to transportation funding that supports the creation of an integrated, multimodal system.

6.4 Connecting the Hall-Revised UNCSD Indicator Framework with Indicators of Sustainable Transportation

The purpose of this section is to [1] apply the Hall-revised UNCSD indicator framework (developed in Section 5.7) to the transportation sector and [2] highlight any gaps that exist between the Hall-revised UNCSD indicator framework and a representative set of indicators of sustainable transportation developed by others. The section also discusses how a set of indicators of sustainable transportation can be used in a trade-off matrix.

The Hall-revised UNCSD indicator framework is a set of metrics that can inform the *creation* and *integration* of national and sector indicator frameworks of sustainable development.[705] Since the Hall-revised framework focuses on national level indicators, it frames the 'macro' issues that are critical to sustainable development. By aligning sector indicator frameworks with the relevant national (macro) indicators, it should be possible to develop a comprehensive system of indicators that is consistent across all sectors. This is the type of architecture the U.S. Congress is currently considering; in principle, it will pull together information from a number of 'topical indicator systems' (GAO 2004). While the logic behind the proposed indicator architecture is clear, the author recognizes that developing the actual indicator frameworks is a complex process.

The **first task** in creating a comprehensive system of indicators is to evaluate which of the national indicators of sustainable development apply to each sector. Here, the focus will be on the transportation sector.[706]

During the analysis of the national indicators, three types of outcomes are likely. In the first outcome, the transportation sector is identified as having a *direct connection* to a specific national indicator (Table 6.9). A few examples of national indicators that will be affected by the transportation sector are *Climate Change*, *Air Quality*, *Urbanization*, and *Material Consumption* (all of these are sub-themes in the Hall-revised UNCSD indicator framework). This list also includes the sub-theme *Transportation*, which measures the distance traveled per capita, and ton-miles per category of freight, by mode of transport.

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[705] Given the macro-level focus of the Hall-revised UNCSD indicators, they are likely to be less relevant for *community-level* indicator initiatives. See Redefining Progress (1997), *The Community Indicators Handbook*, for a useful review of community-level indicators of sustainable development.

[706] It is noted that the process of developing a set of sustainable transportation indicators is somewhat constrained by the existence of the national set of indicators. The Hall-revised UNCSD indicator framework is offered as a starting point from which a national government can develop its own framework of indicators. It is understood that no set of indicators will remain constant, but continually evolve as new ideas and understandings arise. Therefore, the Hall-revised indicator framework simply presents what is seen today as best practice.

It is interesting to note that more mobility can be both 'good' from an economic perspective (if GDP is the leading measure, rather than GPI [Genuine Progress Indicator]), and 'bad' from a resource use and emissions perspective (assuming there are no radical technological changes in the medium-term). This interpretation means that the transportation indicator is not 'directionally safe,' and therefore should be supported by clear targets (see the second task described below).

In the second type of outcome, the transportation sector is identified as having the *potential to influence* a national indicator, although the causal chain through which this influence occurs is complex and uncertain. The sub-themes *Economy* and *Trade* (see Table 5.6 in Section 5.7) are likely to fall into this category. For example, while investment in transportation might increase GDP, the reverse is also true, making it difficult to measure economic performance using transportation-related metrics. Hence, the connection between the national and transportation indicator frameworks for these areas is somewhat ambiguous.

In the third type of outcome, the transportation sector is identified as having *no connection* to a specific national indicator. In this situation the national indicator can be disregarded. A review of the Hall-revised UNCSD indicator framework reveals that none of the national indicators under the 'Peace and Security' category are related to transportation.

Table 6.9 presents those indicators in the Hall-revised UNCSD indicator framework that are perceived (by the author) to have a direct connection to the transportation sector and excludes those indicators that have an uncertain or no clear connection to transportation.

Table 6.9: Indicators in the Hall-Revised UNCSD Indicator Framework That Have a Direct Connection to the Transportation Sector

Theme	Sub-theme	Indicator
Social		
Equity	Poverty	Percent of Population Living below Poverty Line
Health	**Safety**	**Accident Rates (by activity and sector)**
Housing/ Urbanization	**Urbanization (Neighborhood/ Community)**	**Urban Sprawl (index combining residential density; neighborhood mix of homes, jobs, and services; strength of activity centers and downtowns; and accessibility of the street network)** **[*also see 'Land/Urbanization' theme/sub-theme under the 'Environment' category for a related indicator*]**
Security	Crime	Number of Recorded Crimes per 100,000 Population
Employment	**Health and Safety**	**Rates of Occupational Injuries and Disease for Job Type**
	Skill Enhancement and Creativity of Job	**Years of Schooling Required for Job Type**
		Percent of Work Time Devoted to Continuing Professional Education (CPE) for Job Type **[*also see 'Competitiveness/Inherent Cost' theme/sub-theme under the 'Economic' category for a related indicator*]**
	Job Satisfaction	**Level of Satisfaction with Job Type (measured using psychometrics)**

Theme	Sub-theme	Indicator
	Job Security	**Average Time in Job Type before Involuntary Redundancy**
		Does Labor Law Allow for Immediate Dismissal? (employment at will)
	Purchasing Power	**Average Wage (by Job Type)/Consumer Product Index**
	Number of Jobs	**Total Number Employed (including contingent/temporary, informal sector, and unpaid employment)**
		Numbers of Jobs Held by Individual
	Underemployment	**Level of Underemployment (measured using compensation, hours, and extent to which existing skills and/or experience are utilized)**
	Unemployment	Unemployment Rate [*moved from 'Equity/Poverty' theme sub-theme*]
Happiness	**Satisfaction with Life**	**Subjective Well-Being (SWB)**
Capital	**Human Capital**	**Population Demographics (could be extended to include measures of health and education)**
	Social Capital	**Qualitative Measures of Social Integration, Knowledge, Trust, and Honesty in Society**
Environmental		
Atmosphere	Climate Change	Emissions of Greenhouse Gases **[by sector and source - e.g., Methane (CH_4), Nitrous Oxide (N_2O), Carbon Tetra-Chloride (CCl_4), Methyl Chloroform (CH_3CCl_3), CFC-11 (CCl_3F), CFC-12 (CCl_2F_2), and CFC-113 ($C2Cl_3F_3$)]**
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas **[e.g., Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Carbon Monoxide (CO), Non-methane Volatile Organic Compounds (VOCs), and Ozone]**
Land	Urbanization	Area of Urban Formal and Informal Settlements
Oceans, Seas, and Coasts	Coastal Zone	Algae Concentration in Coastal Waters
Fresh Water	Water Quality	BOD in Water Bodies
Biodiversity	Ecosystem	Area of Selected Key Ecosystems
	Species	Abundance of Selected Key Species
Waste	**Waste Generation and Management**	**[*see 'Consumption and Production Patterns/Waste Generation and Management' theme/sub-theme for indicators*]**
Natural Capital	**Non-renewable/ Renewable Resources**	**Non-renewable/Renewable Resource Stocks and Flows**
Economic		
Consumption and Production Patterns	Material Consumption	**Annual per Capita Consumption (or Throughput) of Passenger Cars, Gasoline and Diesel, Electricity, Meat, Fish, Paper, Coffee, etc.**
		Import[/Export] of Polluting Goods and Raw Materials as Percentage of Total Imports[/Exports] of Goods and Services
	Energy Use	Annual Energy Consumption per Capita **[and by economic sector]**

Theme	Sub-theme	Indicator
		Share of Consumption of Renewable Energy Resources
		Intensity of Energy Use **[energy use per unit of GDP]**
	Waste Generation and Management	Generation of Industrial and Municipal Solid Waste
		Generation of Hazardous Waste
		Waste Recycling and Reuse
	Transportation	Distance Traveled per Capita by Mode of Transport
		Distance Traveled per Category of Freight by Mode of Transport (Ton-miles)
	Advertising	**Advertising Spending (encouraging unnecessary/excessive throughput)**
Competitiveness (market share)	**Lower Cost (inherent)**	**Cost Savings Attributed to Enhanced Capital, Labor, and Labor-Capital Interface Productiveness**
	Lower Cost (derived from environmental or social factors)	**Cost Savings Attributed to Environmental, Health, and Employment Factors**
	Performance	**Rate of Increase in Performance by Industry Sector/Product Type**
Capital	**Human-made/Built Capital**	**Physical Stock of Productive Capacity of an Economy**
	Financial Capital	**Available Financial Capital**
Institutional		
Institutional Framework	Strategic Implementation of Sustainable Development	National Sustainable Development Strategy
	International Cooperation	Implementation of Ratified Global Agreements
Institutional Capacity	Science and Technology	Expenditure on Research and Development as a Percent of GDP
Governance	**Rule of Law**	**Perceptions of the Incidence of Crime**
		Enforceability of Contracts
	Government Effectiveness	**Quality of Public Service Provision**
		Quality of the Bureaucracy
		Competence of Civil Servants
		Independence of the Civil Service from Political Pressures
		Credibility of the Government's Commitment to Policies

Note: The text in bold indicates that the indicator (or descriptor) has been added to the original UNCSD indicator framework by the author.

Undertaken in parallel with task one is the **second task**, which is to construct a clear vision of the underlying determinants or characteristics of sustainable transportation and the goals/targets that define this vision (see Principle 1 of the Bellagio Principles - Box 5.1 in Section 5.2). This step is important since it outlines the general themes that will be included in the sustainable transportation indicator framework.

A useful guiding vision for the creation of a set of sustainable transportation indicators is provided by the European Council.

"*THE COUNCIL ... RECOGNISES, that there is a need for further action in order to attain a sustainable transport system defined as one that*

— *allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;*

— *is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;*

— [in coordination with other sectors,] *limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise*" (European Council 2001a, pp. 15-16).

Since the purpose of this section is to illustrate *how* a sustainable transportation indicator framework could be created, no specific goals/targets have been developed. However, the principles of sustainable transportation presented earlier in this chapter are a useful guide for the development of such goals/targets (see Table 6.3 in Section 6.2.2).

Having already identified the national indicators that relate to the transportation sector in the first task (Table 6.9), the **third task** involves the creation of *supplemental indicators* to complete and particularize the sustainable transportation indicator framework. The creation of these indicators should be guided by the vision and the goals/targets developed in task two.

When developing supplemental indicators, Principles 2 through 5 of the Bellagio Principles - i.e., taking a holistic perspective, focusing on essential elements, adopting an adequate scope, and having a practical focus - will be of particular relevance.[707] These requirements reinforce the importance of undertaking a transparent and open indicator selection process that brings together stakeholders and decision-makers (see principles 6 through 8 of the Bellagio Principles). In the U.S., creating such a process would most likely be the responsibility of the Bureau of Transportation Statistics (BTS). By giving this responsibility to the BTS, the indicators would become embedded within the U.S. DOT (see principles 9 and 10 of the Bellagio Principles), increasing the likelihood that they would influence policy-making within the agency.

Since working with the relevant stakeholders to develop a feasible set of indicators for sustainable transportation was beyond the scope of this analysis, a comparative approach was taken to highlight the core themes included in a number of existing indicator sets. A review of published indicators of sustainable transportation identified thirteen different indicator sets developed by government agencies, organizations, research programs, and individuals (Appendix B). While the different sets can be grouped under the heading of

[707] While the decision to use a particular type of indicator is somewhat arbitrary, it is influenced by the policy instruments and character of the programs to be investigated. For example, if the focus was on air quality, detailed component indicators might be appropriate. Thus, the choice of a particular kind of indicator is dictated by practicality and policy relevance, and also the ease or difficulty of measuring any one of the three types of component, composite, and determinant/derived indicators.

'sustainable transportation,' the focus of each set varies between a balanced approach to social, environmental, and economic concerns to a specific focus on one or two of these aspects.

Table 6.10 presents a comparison of the common themes addressed by each of the thirteen sets of indicators of sustainable transportation. The arrows (↑↓) adjacent to each of the themes (listed down the left column of the table) indicate the direction that a theme should move over time. In cases where the direction is not obvious, a two way arrow is shown (↕). The checks (✓) indicate that an indicator set contains one or more indicators that address a specific theme such as accessibility or safety. The asterisks (*) highlight those indicator sets that were perceived (by the author) to be best suited to address a specific theme. Thus, the 'best' indicators are sourced from several different existing sets of indicators. The most popular themes are listed at the top of each category and the most comprehensive indicator sets are listed to the left of the table.

Table 6.11 presents a 'representative' set of indicators of sustainable transportation. The indicators shown in the table were extracted from those indicator sets that were marked with a check and asterisk (✓*) in Table 6.10. The extraction of 'best indicators' should be a good approximation of what might have resulted from a multi-stakeholder process undertaken in task three.

Table 6.10: Comparison of Themes Addressed by Existing Sets of Sustainable Transportation Indicators[708]

THEME	SUMMA (Rand Europe et al. 2005)	TERM (EEA 2002)	Litman (Litman 2003b; 2005b)	Mobility 2030 (WBCSD 2004)	STPI (CST 2002)	U.S. DOT NTS (CS 1996)	Zietsman and Rilett (Zietsman and Rilett 2002)	Kon-SULT Web based [709]	UN/ECE (UN/ECE 2000)	White-legg (White-legg 1997)	Gudmun-dsson (Gudmun-dsson 2001)	EST (OECD 2000)	U.S. DOT Env. Perf. Meas. (U.S. DOT 2004)
SOCIAL													
Accessibility ↑	✓	✓	✓*	✓	✓	✓	✓	✓	✓	✓			
Safety ↑ / Accidents ↓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓			
Mobility ↕		✓*	✓		✓	✓	✓		✓	✓			
Security ↑ / Crime ↓	✓			✓*		✓	✓	✓		✓			
Equity ↑	✓*		✓	✓		✓	✓	✓					
Livability ↑ / Amenity ↑	✓*		✓				✓	✓	✓				
Level/Quality of Service ↑			✓	✓		✓*			✓				
Employment Density ↑			✓		✓*								
Social Cohesion ↑	✓*												
Working Conditions ↑	✓*												
ENVIRONMENTAL													
Air Pollution ↓	✓*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Noise ↓	✓	✓	✓	✓	✓		✓	✓	✓*	✓	✓	✓	✓
GHG Emissions ↓	✓*	✓	✓	✓	✓			✓	✓	✓	✓	✓	
Energy Use ↓	✓	✓		✓	✓	✓*	✓	✓	✓	✓	✓		
Land use ↕ / Land take ↓	✓*	✓	✓	✓	✓		✓			✓	✓	✓	
Ecosystem Disruption ↓	✓	✓*	✓	✓	✓		✓			✓	✓		✓
Human Health Impacts ↓		✓*	✓		✓	✓				✓	✓		
Waste ↓	✓*	✓			✓						✓		
Material Use ↓	✓		✓	✓*									
Pollution to Water ↓	✓*		✓		✓								
Discharge by Ships ↓	✓*	✓									✓		
Release of Hazardous Mat. ↓						✓*				✓	✓		

[708] See Appendix B for explanations of the sets of indicators of sustainable transportation shown in this table.
[709] Source: KonSULT, *Transport Strategy, Objectives*, http://www.env.leeds.ac.uk/its/public/level1/l1_obje.htm (accessed on 04/09/06).

THEME	SUMMA (Rand Europe et al. 2005)	TERM (EEA 2002)	Litman (Litman 2003b; 2005b)	Mobility 2030 (WBCSD 2004)	STPI (CST 2002)	U.S. DOT NTS (CS 1996)	Zietsman and Rilett (Zietsman and Rilett 2002)	Kon-SULT Web based [709]	UN/ECE (UN/ECE 2000)	White-legg (White-legg 1997)	Gudmun-dsson (Gudmun-dsson 2001)	EST (OECD 2000)	U.S. DOT Env. Perf. Meas. (U.S. DOT 2004)
Discharge by Pipelines ↓											✓		✓*
Recycling ↑				✓*							✓		
Vibration ↓								✓*					
Visual Intrusion ↓								✓*					
Light Emissions ↓	✓*												
ECONOMIC													
Costs to Economy ↓	✓*	✓	✓	✓	✓	✓	✓						
Productivity ↑ / Efficiency ↑	✓	✓	✓		✓	✓*	✓		✓				
Affordability ↑	✓*	✓	✓	✓	✓	✓							
Accessibility (freight) ↑	✓*	✓		✓		✓		✓					
Mobility (freight) ↕		✓*			✓	✓			✓	✓			
Congestion ↓ / Delays ↓			✓		✓	✓	✓*	✓					
Safety ↑ / Accidents (freight) ↓		✓		✓*		✓	✓		✓				
Travel Time ↓ / Reliability ↑			✓	✓*		✓	✓						
Operating Costs ↕	✓*			✓			✓	✓					
Security ↑ / Crime (freight) ↓				✓*		✓	✓						
Internalization of Costs ↑		✓	✓						✓*				
Technology Adoption ↑		✓			✓*	✓							
Benefits to Economy ↑	✓*						✓						
INSTITUTIONAL													
Policy Integration ↑		✓*							✓				
Formal Cooperation ↑		✓*											
Implementation ↑ / Monit. ↑					✓*								
Comprehensive Planning ↑			✓*										

Notes:

↑ ↓ ↕ = Direction in which a 'theme' should move.

✓ = Identifies indicator sets that have one or more indicators that address a specific theme.

* = Highlights the indicator set that contains the most useful/interesting measure(s) for a specific theme (subjective evaluation by author).

Table 6.11: Representative Set of Indicators of Sustainable Transportation (based upon Table 6.10)

Theme	Indicators	Reference
SOCIAL		
Accessibility ↑	Land use mix: - Number of job opportunities and commercial services within 30-minute travel distance of residents. Land use: - Average number of basic services (schools, shops, and government offices) within walking distance of homes. Smart growth: - Implementation of policy and planning practices that lead to more accessible, clustered, mixed, multi-modal development. Children: - Portion of children who can walk or bicycle to schools, shops, and parks from their homes Electronic: - Portion of population with Internet service.	(Litman 2003b)
Safety ↑ / Accidents ↓	- The probability that an individual will be killed or injured in an accident while using a mobility system. - The total number of deaths and serious injuries (expressed as DALY – disability-adjusted life years) per year by category (air transport, automobile, truck, bus, moped, bicycle, pedestrian, etc.).	(WBCSD 2004)
Mobility ↕	Passenger transport (by mode and purpose): - total passengers - total passenger-km - passenger-km per capita - passenger-km per GDP	(EEA 2002)
Security ↑ / Crime ↓	- For individuals, the probability that one will be harassed, robbed, or physically assaulted during a journey. - For society, … the total number of incidents (perhaps weighted by severity).	(WBCSD 2004)

Theme	Indicators	Reference
Equity ↑	Horizontal equity (fairness): - Percentage of "self-financing" of transport costs by the users, differentiated by mode. Vertical equity (income): - Ratio between richest/poorest 20% (quintile) for transport related household expenditures. - Ratio between richest/poorest 20% (quintile) households for access to basic services. - Ratio between richest/poorest 20% (quintile) households for public transport reliance. Vertical equity (mobility needs and ability): - Explicitly earmarked public transport expenditures for the disabled and elderly in % of total public transport expenditures. - Percentage of easy accessible low floor vehicles in % of the total urban transport fleet. Intergenerational & Interregional (spatial) equity: - Important outcomes of interest, but no indicators can be suggested here.	(Rand Europe et al. 2005)
Livability ↑ / Amenity ↑	Walkability, pedestrian friendliness: - Total length of separate walking paths and/or special pedestrian areas in % of the length of the whole transport network. Traffic calming: - Total length of city streets with speed limits of maximum 30 km per hour in % of the length of the whole city street network. Children's journey to school: - Percentage of children driven to school by car. Open space availability and accessibility: - Percentage of inhabitants/households living within maximally 15 minutes walking distance from urban green areas.	(Rand Europe et al. 2005)
Level/Quality of Service ↑	- Passenger assessment of level of quality/satisfaction and/or degree of change in: travel time, speed, cost, number of alternatives, congestion, reliability, safety, etc. (survey). - Shipper assessment of service in terms of shipment time, cost, reliability of on-time arrival, modal/scheduling flexibility, damage/loss, etc. (survey).	(Cambridge Systematics 1996)
Employment Density ↑	- Employment density by CMA (Census Metropolitan Area), and urban size, class, and zone.	(CST 2002)
Social Cohesion ↑	Public opinion profile on transport and transport policy issues: - Percentage of adults supporting radical pro- and anti-car positions in the transport policy discourse. Violation of traffic rules: - Percentage of drivers violating traffic rules and regulations. Long distance commuting: - Percentage of commuters commuting daily over distances of more than 10 km.	(Rand Europe et al. 2005)

Theme	Indicators	Reference
Working Conditions ↑	Occupational accidents: - Number of recorded (notified) serious occupational accidents per year and 100,000 employees in the transport sector. Precarious employment conditions: - Percentage of employees in precarious employment conditions. Work absence due to accidents and illness: - Number of reported work absence days per year and 100,000 employees.	(Rand Europe et al. 2005)
ENVIRONMENTAL		
Air Pollution ↓	- Transport emissions of air pollutants by mode and by type of pollutant. - Emissions of air pollutants from vehicle and parts manufacture, and transport maintenance by mode and by type of pollutant.	(Rand Europe et al. 2005)
Noise ↓	- Proportion of population exposed to greater than 65 db A, by source of noise (taking into account different sources of noise, including air traffic). - Measure of on-street and off-street levels of noise.	(UN/ECE 2000)
GHG Emissions ↓	- Transport emissions of greenhouse gas by mode and by type of gas. - Greenhouse gas emissions from vehicle and parts manufacture, and transport maintenance by mode and by gas.	(Rand Europe et al. 2005)
Energy Use ↓	- Fuel consumption rates (mpg or Btu per mile) of transportation modes (passenger and freight), current year and fleet average.	(Cambridge Systematics 1996)
Land use ↕ / Land take ↓	- Land take by transport infrastructure by mode (km^2). - Land take by transport infrastructure by mode percentage of country surfaces (percentage of surface area).	(Rand Europe et al. 2005)
Ecosystem Disruption ↓	- Fragmentation of ecosystems and habitats. - Proximity of transport infrastructure to designated areas.	(EEA 2002)
Human Health Impacts ↓	- Population exposed to exceedances of … air quality standards for PM_{10}, NO_2, benzene, ozone, lead, and CO.	(EEA 2002)
Waste ↓	- Total amount of non-recycled waste generated by transport by mode and by type of waste.	(Rand Europe et al. 2005)
Material Use ↓	- Total volume of material use by transport sector. - Transport sector's share of total use.	(WBCSD 2004)
Pollution to Water ↓	- Amount of pollutants released by run-offs by type of pollutant and by mode. - Amount of wastewater produced from manufacture and maintenance of transport infrastructure not treated in wastewater treatment plants.	(Rand Europe et al. 2005)

Theme	Indicators	Reference
Discharge by Ships ↓	- Illegal discharges of oil by ships at sea. - Amount of wastewater discharged into sea from ships. - Amount of waste discharged into sea from ships.	(Rand Europe et al. 2005)
Release of Hazardous Material ↓	- Number and severity of incidents/accidents involving release of hazardous/toxic materials, by mode.	(Cambridge Systematics 1996)
Discharge by Pipelines ↓	- Tons of hazardous liquid materials spilled per pipeline million ton-miles shipped.	(U.S. DOT 2004)
Recycling ↑	- Recycling rates of material used by transport sector.	(WBCSD 2004)
Vibration ↓	- Vibration.	(Kon-SULT - web site)
Visual Intrusion ↓	- Visual intrusion.	(Kon-SULT - web site)
Light Emissions ↓	- Area of lighted transport infrastructure.	(Rand Europe et al. 2005)
ECONOMIC		
Costs to Economy ↓	Infrastructure costs: - Traffic system-related public and private construction costs by mode. - Traffic system-related public and private improvement and maintenance costs by mode. Public subsidies: - Public expenditures/investments in transport and mobility-related sectors, e.g., for development of vehicles, transhipment technologies, mobility-related information and communication technology, research, and transport operation. External transport costs: - Accident costs by mode. - Delay costs due to congestion by mode. - Environmental costs by mode.	(Rand Europe et al. 2005)
Productivity ↑ / Efficiency ↑	- Carrying efficiency of passenger modes (private vehicle persons per vehicle mile; transit passengers per seat mile; intercity air, rail, bus load factors). - Urban highway temporal utilization efficiency (percentage of person, freight trips occurring within peak periods). - Commodity shipment modal distribution (ton-miles of primary commodity by mode, distance, domestic/international).	(Cambridge Systematics 1996)
Affordability ↑	- Average percentage of household expenditures related to transport.	(Rand Europe et al. 2005)

Theme	Indicators	Reference
Accessibility (freight) ↑	Intermodal terminal facilities: - Terminal facilities with access by intermodal traffic system (road, rail, waterway) [Percentage of terminals with access by more than one mode]. Accessibility of origins/destinations: - Accessibility Index between important economical centres and regions by mode.	(Rand Europe et al. 2005)
Mobility (freight) ↕	Freight transport (by mode and group of goods): - total tonnes - total tonne-km - tonne-km per capita - tonne-km per GDP	(EEA 2002)
Congestion ↓ / Delays ↓	- Travel rate, delay rate, total delay, average speed, mobility index, hours of congestion, LOS [Level of Service], volume/capacity ratio, duration of heavy congestion, vehicles per lane mile, and percentage of corridor congested.	(Zietsman and Rilett 2002)
Safety ↑ / Accidents (freight) ↓	- The probability that a given shipment will be damaged or destroyed. - Total value of goods damaged or destroyed in a crash.	(WBCSD 2004)
Travel Time ↓ / Reliability ↑	Personal mobility: - Average time required from origin to destination, including all switches of vehicle/mode and all "waiting" time. - Variability in door-to-door travel time for a "typical" mobility system user. Goods mobility: - Average origin to destination time required for shipment. - Variability in origin-to-destination time for "typical" shipments of different types.	(WBCSD 2004)
Operating Costs ↕	Supplier operating costs: - Monetary costs of transport operators (fixed and variable components).	(Rand Europe et al. 2005)
Security ↑ / Crime (freight) ↓	- For individuals, the probability that a shipment will be stolen or damaged through pilferage. - For society, ... the total value of goods lost to theft and/or pilferage.	(WBCSD 2004)
Internalization of Costs ↑	- How much are real costs of urban transport covered by the user (road pricing/fuel pricing).	(UN/ECE 2000)
Technology Adoption ↑	- Index of energy intensity of cars and trucks. - Index of emissions intensity of the road-vehicle fleet. - Percent of alternative fuel vehicles in the fleet. - Percent of passenger-km and tonne-km fuelled from renewable energy. - Percent of labour force regularly telecommuting.	(CST 2002)

Theme	Indicators	Reference
Benefits to Economy ↑	Gross value added: - Share of an economy's gross value added (GVA) generated by transport. Public revenues from taxes and traffic system charging: - Public revenues from traffic system charging (tolls and user charges). - Public revenues from transport sector related taxes (petroleum, vehicle, and emission taxes). Benefits of transport: - Indirect positive growth and structure effects realised by the transport sector.	(Rand Europe et al. 2005)
INSTITUTIONAL		
Policy Integration ↑	- Number of Member States that have implemented an integrated transport strategy.	(EEA 2002)
Formal Cooperation ↑	- Number of Member States with a formalised cooperation between the transport, environment, and spatial planning ministries.	(EEA 2002)
Implementation ↑ / Monitoring ↑	- Number of sustainable transport indicators regularly updated and widely reported. - Public support for initiatives to achieve sustainable transportation. - Number of CMAs (Census Metropolitan Areas) where planning and delivery of transport and related land use matters have a single authority.	(CST 2002)
Comprehensive Planning ↑	- Range of solutions considered in transport planning (more is better).	(Litman 2003b)

Note: ↑ ↓ ↕ = Direction in which the 'theme' should move.

A comparison of the transportation-related themes/sub-themes in the Hall-revised UNCSD indicator framework (Table 6.9) with the themes from the 'representative' merged set of indicators of sustainable transportation reveals a relatively good agreement between the two sets (Table 6.12). Three fifths of the themes in the transportation-related Hall-revised UNCSD indicator framework are already included in the merged set of sustainable transportation indicators or are 'related' to a theme in this set. Themes in the Hall-revised framework that are not currently included in existing sets of sustainable transportation indicators - such as *job satisfaction* and *advertising* - are also not included in the original UNCSD indicator framework. The excluded themes are presented in bold text in the table below.[710] This observation highlights the importance of making the necessary changes at the macro level that will encourage the development of new indicators within each sector that measure progress towards sustainable development.

Table 6.12: Comparison of the Transportation-Related Themes/Sub-Themes in the Hall-Revised UNCSD Indicator Framework with the Themes from the 'Representative' Set of Sustainable Transportation Indicators

Hall-Revised UNCSD Indicator Framework (Table 6.9)		**Merged Indicators of Sustainable Transportation (Table 6.11)**
Theme	**Sub-theme**	**Theme**
Social		**Social**
Equity	Poverty	Affordability Equity (*related*)
Health	Safety	Safety/Accidents
Housing/Urbanization	Urbanization (Neighborhood/ Community) (*related to 'Land/Urbanization'*)	Accessibility (*related*) Land use/Land take (*related*) Livability/Amenity (*related*)
Security	Crime	Security/Crime
Employment	Health and Safety	Working Conditions
	Skill Enhancement and Creativity of Job	-
	Job Satisfaction	-
	Job Security	-
	Purchasing Power	-
	Number of Jobs	Employment Density (*related*)
	Underemployment	-
	Unemployment	-
Happiness	Satisfaction with Life	Accessibility (*related*) Social Cohesion (*related*) Level/Quality of Service (*related*)
Capital	**Human Capital**	-
	Social Capital	Social Cohesion
Environmental		**Environmental**
Atmosphere	Climate Change	GHG Emissions

[710] Note that the indicators in bold relate predominantly to employment and some social concerns, topics customarily omitted from discussions of sustainable development. These indicators are, however, important and expose a more comprehensive vision of sustainable development.

Hall-Revised UNCSD Indicator Framework (Table 6.9)		Merged Indicators of Sustainable Transportation (Table 6.11)
Theme	**Sub-theme**	**Theme**
(cont.)	Ozone Layer Depletion	Air Pollution
	Air Quality	Air Pollution
Land	Urbanization	Land use/Land take (*related*)
Oceans, Seas, and Coasts	Coastal Zone	Discharge by Ships (*related*) Pollution to Water (*related*)
Fresh Water	Water Quality	Pollution to Water
Biodiversity	Ecosystem	Ecosystem Disruption
	Species	Ecosystem Disruption (*related*)
Waste	Waste Generation and Management (*same as 'Consumption and Production Patterns/Waste Generation and Management'*)	Waste
Natural Capital	Non-renewable/Renewable Resources	Material Use
Economic		**Economic**
Consumption and Production Patterns	Material Consumption	Material Use
	Energy Use	Energy Use
	Waste Generation and Management	Waste
	Transportation	Mobility
	Advertising	-
Competitiveness (market share)	**Lower Cost (inherent)**	Technology Adoption (***does not cover labor or labor-capital interface productiveness***)
	Lower Cost (derived from environmental or social factors)	-
	Performance	Productivity/Efficiency
Capital	**Human-made/Built Capital**	-
	Financial Capital	Benefits to Economy (*related*)
Institutional		**Institutional**
Institutional Framework	Strategic Implementation of Sustainable Development	Policy Integration (*related*)
	International Cooperation	-
Institutional Capacity	**Science and Technology**	-
Governance	**Rule of Law**	-
	Government Effectiveness	-

Note: The bold text highlights those themes in the Hall-revised UNCSD indicator framework that are not included in the 'representative' merged set of indicators of sustainable transportation.

Having outlined how a comprehensive system of sustainable transportation indicators could be formulated, the following text discusses how these indicators could be used in a trade-off matrix as part of an integrated decision-making process for sustainable transportation.

In addition to tracking progress, sustainable transportation indicators could be incorporated into a trade-off matrix to evaluate the impacts of existing and proposed

policies, programs, and legislation. Table 6.13 shows how the indicators could be displayed in the columns of a generic trade-off matrix. Each row of the matrix represents a potential stakeholder group.[711]

Table 6.13: Generic Sustainable Transportation Trade-off Matrix

Stakeholder Group	**Social**		**Environmental**		**Economic**		**Mobility**		**...**	
Theme	Accessibility	...	Air Quality	...	Lower Cost (inherent)	...	Comprehensive Planning	...	...	...
Customers (public)	✓		✓		✓		✓			
Customers (firms)	✓		✓		✓		✓			
Non-customers	✓		✓		✓					
Equipment Manufacturers					✓					
Equipment Operators					✓					
Construction Workers					✓					
Maintenance Crews					✓					
Affected Species										
...										

Key:

✓ Represents whether a policy, program, or piece of legislation is relevant to the indicator and the stakeholder.

The trade-off matrix[712] disaggregates the consequences of a policy, program, or piece of legislation into its various impacts (measured using the indicators) and shows how these relate to policy-relevant groups of actors such as consumers, producers, workers, etc. In addition, the benefits and costs are expressed in their *natural units* - i.e., if an indicator measures the level of PM_{10} in the atmosphere, it presents this measure as a concentration and does not translate it into a monetary value. The monetary impacts of a policy are only measured by the 'economic' indicators. Such indicators might measure the actual cost of a policy as well as any inherent cost savings generated (e.g., avoided healthcare

[711] While the matrix presented here focuses on transportation, a similar matrix could be developed for the national indicators of any other sector or of sustainable development writ large. In such a matrix the national indicators would be presented across the top of the matrix and the major sectors (i.e., transportation, agriculture, housing, etc.) would be listed under stakeholders.

[712] See Sections 4.2.1.4 to 4.2.1.6 for a detailed discussion of the application of trade-off analysis as a decision-support tool.

expenditures). Thus, the environmental, social, and economic impacts associated with a policy are kept separate, and can therefore be traded off against one another (or co-optimized). The process of making these trade-offs reveals the inherent assumptions that are often hidden by subjective valuation and aggregation techniques.[713] Non-aggregation also means that decision-makers become more accountable for their decisions since the decision-making *process* is more transparent.

The strength of trade-off analysis is that it is a democratic process that incorporates the ideological orientation of politicians and citizens. In particular, it articulates the following (Soderbaum 2000, p. 87):

— options or alternatives of choices and the impacts associated with these;
— the interests/stakeholders that are affected and whether there are conflicts between these interests/stakeholders; and
— whether the ideological orientations can provide a new lens for valuation and decision-making.

Given the shear number of interpretations of sustainable development, using a decision-making process that avoids promulgating uniquely 'correct' answers, and considers an issue from many sides seems more appropriate. Due to the reasons discussed above, the trade-off matrix is a better tool for decision-making for sustainable transportation than other techniques such as benefit-cost analysis.

When assessing a transportation policy, program, or piece of legislation using a trade-off matrix, it is unlikely that it will affect all of the indicators of sustainable transportation or the entire group of stakeholders. The checks (✓) shown inside the trade-off matrix represent the points at which a transportation policy, for instance, might affect both an indicator and a stakeholder group. Following the matrix, the impacts that occur within each box should be described. In addition, the dynamic element of the policy can be explored in a comparative sense using a time series of trade-off matrices (see Section 4.2.3.4). This approach to trade-off analysis considers how a policy is likely to influence technological or social change over time. For example, as new technology is developed and introduced in response to more stringent regulation or a new emissions trading scheme, the environmental and social impacts are likely to change. A time series of trade-off matrices can explore how these changes are likely to unfold and inform decision-makers and stakeholders of the potential benefits of a specific policy.

When addressing specific problems identified *within* the trade-off matrix, the perceived and actual role of government in public participation is crucial, as is the role adopted by stakeholders. Research undertaken by Ashford and Rest (2001) indicates that the outcome of discourse between government agencies and the public depends on the roles adopted by each. The critical question here is whether the positions adopted are likely to result in outcomes that support sustainable development.

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[713] For example, the time period in which each effect is experienced is revealed and is not discounted to a present value.

In Section 2.2.2, the argument is made that decisions which lead to a 'Rawlsian outcome' are likely to move society towards sustainable development. A Rawlsian outcome is defined as a decision that supports Rawls's two principles of justice and a third (suggested) environmental principle.

> **First Principle**: "*each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all*" (Rawls 1971, p. 302).
>
> **Second Principle**: "*social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged, consistent with the just savings principle, and (b) attached to offices and positions open to all under conditions of fair equality of opportunities*" (Rawls 1971, p. 302).
>
> **(Suggested) Third Principle**: social arrangements are to be organized so that they (a) protect and continually improve the environment, especially for those individuals and species most heavily affected by environmental degradation/pollution, and (b) do not result in activities that exceed the ecological carrying capacity of the environment.

While Rawls's two principles of justice focus on the social world, the third principle is designed to force decision-makers and stakeholders to consider how their decisions might affect the natural world. It is believed that combining the social and natural realms in this manner supports the fundamental elements of sustainable development. First and foremost, this approach places *social equity* at the center of decision-making. Second, it supports the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society. Finally, it makes the 'movement' towards a better *environment* a critical component of any new social arrangements.

The Rawlsian approach should be seen as a movement (a process) and not a final state. However, it is nonetheless possible to operationalize Rawls's theory of justice by bounding the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian. This bounding is achieved by identifying both the utilitarian (i.e., market) and Rawlsian outcomes to a problem and then seeking a solution (through stakeholder dialogue) that falls between these two outcomes (see Figure 4.3 in Section 4.1.4). Ideally, the final outcome should be perceived as fair, economically feasible, and in line with the interests of society as a whole. This procedure is referred to as the Rawlsian/utilitarian decision-making process.

A potential problem with making decisions that transition society towards sustainable development is the *rate* at which this transition occurs. In situations where environmental processes are threatened and thresholds are exceeded, it is important to establish environmental limits. These limits should be defined in the goals/targets established in step two of creating an indicator framework and be reflected by the indicators.

In conclusion, the final section of this chapter shows how a national set of sustainable development indicators can be integrated with a national set of sustainable transportation indicators. The comparative analysis of existing indicators shows that while there is a relatively good connection between the core themes of sustainable development and

sustainable transportation, several additional themes need to be incorporated into the predominant view of sustainable transportation. Finally, the section provides a brief example of how the indicators of sustainable development can be used in a trade-off matrix, an important element of the sustainable transportation decision-support framework presented in Section 6.3.

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7 The Extent to Which the Sustainable Transportation Decision-Support Framework is Reflected by MPO Attitudes and Practices

The primary objective of this research is to highlight a new direction (a way of thinking) for transportation planning and decision-making that encourages decisions that support the concept of sustainable development. In Chapter 6, the concept of sustainable transportation is developed and a sustainable transportation decision-support framework is articulated based upon the ideas discussed and developed throughout this dissertation. One important aspect of the proposed framework is its multidimensional structure. However, this attribute is likely to make the framework appear highly complex to transportation professionals who will ultimately be responsible for its implementation. For instance, the decision to use the proposed framework requires a commitment to very different ways of thinking that may require the acquisition of new knowledge for the framework to be implemented or used effectively.

In an effort to understand the potential gaps between the current approach to transportation planning and decision-making and the approach embodied in the sustainable transportation decision-support framework, a questionnaire was developed to assess the extent to which several important ideas from the proposed framework are reflected in current MPO attitudes and practices. The questionnaire was sent to transportation professionals in Metropolitan Planning Organizations (MPOs) across the U.S. and the results are discussed in this chapter.

In addition to the MPO questionnaire, a number of meetings were held with several organizations/agencies in Washington, D.C. to discuss the questionnaire and the proposed decision-support framework more generally. Meetings were held with the Association of Metropolitan Planning Organizations (AMPO), the Congressional Research Service (CRS), the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), the Government Accountability Office (GAO), the Metropolitan Washington Council of Governments (MWCOGs), the National Association of Regional Councils (NARC), and the Office of the Secretary of Transportation (OST). The feedback and information obtained from these meetings has been integrated into the discussion of the results from the MPO questionnaire. In addition, Section 7.3 documents information and ideas that fall outside the analysis of the MPO questionnaire.

7.1 The Metropolitan Planning Organization (MPO)

This section provides a brief introduction to the Metropolitan Planning Organization (MPO) and explains why MPOs were chosen to be the focus of the questionnaire.

While MPO-like organizations have been in existence since the 1950s (ACIR 1995), it was not until the passage of the Federal-Aid Highway Act of 1973 that they were

formally designated and given a more prominent role in the urban transportation planning process (Weiner 1992; 1997). The Federal-Aid Highway Act required states to establish MPOs for urban areas with populations greater than 50,000. It also made federal funds available for urban transportation planning - i.e., half of one percent of all federal-aid funds was designated for MPOs, which was apportioned to states based upon their urbanized area population (Weiner 1997).

MPOs were required to develop urban transportation plans using a *continuing, cooperative, and comprehensive* process (known as the '3-C process'). The 3-C process was developed following the earlier Federal-Aid Highway Act of 1962, in which Congress mandated that urban transportation planning was a prerequisite for receiving federal funding (Dempsey et al. 2000; Weiner 1997). To comply with the federal planning mandate, an MPO needed to ensure that its transportation plan was 'continually' reevaluated and updated over time; was based upon 'cooperation' between federal, state, and local government as well as other bodies/stakeholders involved with, or affected by, transportation; and included a 'comprehensive' consideration of ten basic planning elements.[714]

The requirement that MPOs foster a cooperative planning environment meant that their organizational structures were tailored to local circumstances. Thus, the structure of each MPO was, and still is, unique (ACIR 1995). However, there are several characteristics that can be used to describe a 'typical' MPO (Figure 7.1) (GAO 1996; Plumeau 2004; ACIR 1995). First, most MPOs have a *policy board* that consists of locally elected or appointed officials from the metropolitan area. Second, the policy board is supported by a *technical committee* (consisting of professional staff from local, state, and federal transportation agencies) and a *citizen's advisory committee* (consisting of members of the public as well as stakeholder groups). In addition, the MPO board may establish special standing and ad hoc advisory committees to address specific issues or topic areas. Finally, there is the MPO staff, which should include the full range of transportation professionals. Thus, an MPO is a diverse consortium of local, state, and federal government and other important entities such as citizen groups and transit agencies created to facilitate transportation planning and policy-making.

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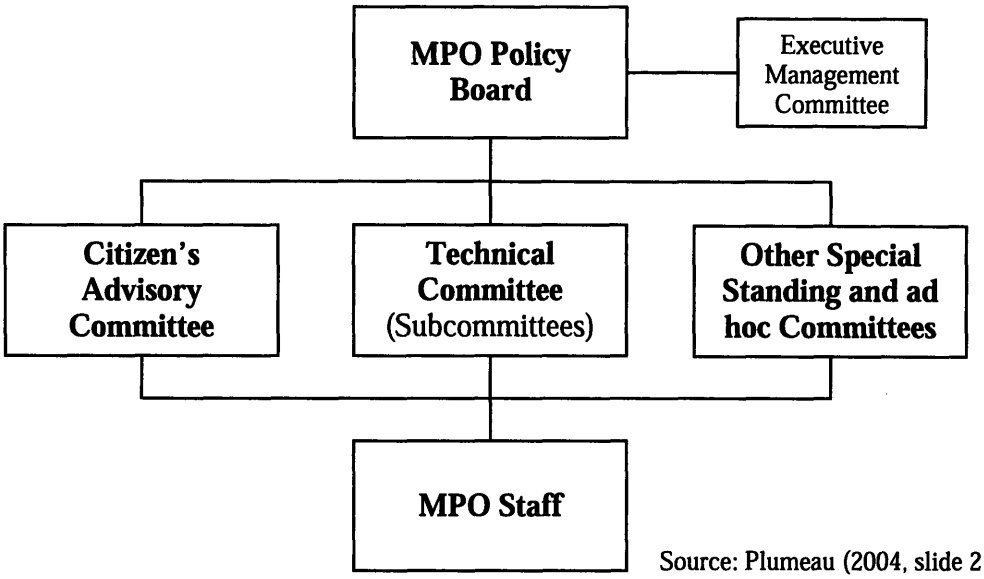
[714] These ten basic planning elements were: "*[1] Economic factors affecting development; [2] Population; [3] Land use; [4] Transportation facilities including those for mass transportation; [5] Travel patterns; [6] Terminal and transfer facilities; [7] Traffic control features; [8] Zoning ordinances, subdivision regulations, building codes, etc.; [9] Financial resources; [10] Social and community-value factors, such as preservation of open space, parks and recreational facilities; preservation of historical sites and buildings; environmental amenities; and aesthetics*" (Weiner 1997, p. 40).



Source: Plumeau (2004, slide 21).

Figure 7.1: 'Typical' MPO Structure

While the initial planning activities of MPOs were somewhat limited, the shift in federal policy during the early 1970s was significant (Puentes and Bailey 2003). It had the effect of putting metropolitan areas on a more equal footing with the State Departments of Transportation that previously had a "*domineering influence ... in pushing highway projects*" (ibid, p. 2).[715]

Following a period of funding stagnation during the 1980s due to the 'small government' policies of the Reagan Administration (Orfield 2002),[716] the role of MPOs in the transportation planning process increased significantly with the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. ISTEA increased MPO funding to one percent of the funds authorized for the five core federal-aid programs - i.e., the National Highway System (NHS), the Surface Transportation Program (STP), the Congestion Mitigation and Air Quality Improvement Program (CMAQ), the Interstate Maintenance Program, and Bridge Program. Metropolitan planning was also made an eligible activity under the NHS and STP.[717] In addition, MPOs located in areas that exceeded the national ambient air quality standards (NAAQS) were eligible to receive

[715] The reader should be aware that there is a growing literature on the effectiveness of MPOs in the transportation planning and decision-making process. For example, Puentes and Bailey (2003, p. 4) argue that despite the increased planning role of MPOs in TEA-21, "[s]t*ates continue to wield dominant power and retain the primary role in transportation programming and planning.*" While ISTEA, TEA-21, and SAFETEA have greatly strengthened the role of MPOs in the transportation planning process, the ability of MPOs to influence transportation plans seems to be largely dependent upon their relationships with State DOTs and Governors (Dempsey et al. 2000; Dilger 2003). A detailed discussion on the effectiveness of MPOs in the transportation planning process is beyond the scope of this section. However, this topic is raised again in the evaluation of the MPO questionnaire in subsequent sections.

[716] During the mid-1980s, preference for funding was given to the larger MPOs serving populations of over 200,000 at the expense of the smaller MPOs (GAO 1996).

[717] Source: National Transportation Library, *Intermodal Surface Transportation Efficiency Act of 1991 - Summary*, http://ntl.bts.gov/DOCS/ste.html (accessed on 04/09/06).

CMAQ funding to address their air quality problems. All of these measures and others combined to enhance the role of MPOs in urban transportation planning.

With the Interstate era coming to a close, Congress crafted ISTEA to reflect a change in focus away from highway construction towards system preservation.[718] In addition, the idea of creating a fully integrated and intermodal transportation system was seen as an effective way to enhance the mobility of Americans. Given the economic and cultural diversity of metropolitan regions, achieving ISTEA's objectives meant that greater control over transportation planning had to be given to metropolitan areas.

A report by the U.S. Advisory Commission on Intergovernmental Relations (ACIR 1995, p. iii) noted that ISTEA "*brought three new, far-reaching philosophies to the administration of federal surface transportation programs:*

1. ***Decentralization of decision-making*** *to the state and local governments, and particularly to the MPOs in the larger metropolitan areas of 200,000 population or more;*
2. ***Stronger environmental connections****, especially to the Clean Air Act; and*
3. ***Elevation of nontraditional goals and stakeholders to new prominence*** *in the planning and decision-making process.*"

The nontraditional goals referred to above relate to sixteen factors that MPOs were required by ISTEA to consider during the planning process.[719] In the two subsequent reauthorizations of ISTEA, the planning factors were reduced to seven in TEA-21 (the Transportation Equity Act for the 21st Century - passed in 1998) and then recently increased to eight in SAFETEA-LU (the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users - passed in 2005) - see Table 7.1. The rationale for halving the number of planning factors was that it was not possible to consider all sixteen in a consistent manner during the planning process. Interestingly, the planning factors in Table 7.1 are closely related to the principles of sustainable transportation presented in Section 6.2.2. Hence, one could argue that the intent of Congress is for MPOs to consider the concept of sustainable transportation when developing their metropolitan transportation plans.

In addition to changing the philosophy of transportation planning, ISTEA formalized the role of MPOs in the transportation planning process by requiring them - in cooperation with the state and relevant transit operators - to develop a 20-year long-range transportation plan (LRTP) and a short-range transportation improvement program (TIP). As part of the LRTP and TIP, ISTEA required MPOs to develop financial plans that demonstrated how the LRTP and TIP could be implemented using a 'reasonable' prediction of future public and private funding. The requirement to develop fiscally realistic long- and short-range plans presented an important change from previous

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[718] Source: National Transportation Library, *A Guide to Metropolitan Transportation Planning under ISTEA - How the Pieces Fit Together - U.S. DOT*, http://ntl.bts.gov/DOCS/424MTP.html (accessed on 04/09/06).

[719] Originally, ISTEA included fifteen factors, but a sixteenth was added with the passage of the National Highway System Designation Act of 1995 (GAO 1996).

planning activities, which tended to develop 'wish lists' of projects that exceeded what was financially feasible.

Table 7.1: Transportation Planning Factors in TEA-21 and SAFETEA-LU

TEA-21 (1998) 23 U.S.C. § 134 (f)(1)(A-G)	**SAFETEA-LU (2005)** 23 U.S.C. § 134 (h)(1)(A-H)
The metropolitan transportation planning process for a metropolitan area under this section shall provide for consideration of projects and strategies that will:	The metropolitan planning process for a metropolitan planning area under this section shall provide for consideration of projects and strategies that will:
(A) support the economic vitality of the metropolitan area (or State), especially by enabling global competitiveness, productivity, and efficiency;	(A) support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
(B) increase the safety and security of the transportation system for motorized and nonmotorized users;	(B) **increase the safety of the transportation system for motorized and nonmotorized users**; (C) **increase the security of the transportation system for motorized and nonmotorized users**;
(C) increase the accessibility and mobility options available to people and for freight;	(D) increase the accessibility and mobility of people and for freight;
(D) protect and enhance the environment, promote energy conservation, and improve quality of life;	(E) protect and enhance the environment, promote energy conservation, improve the quality of life, and **promote consistency between transportation improvements and State and local planned growth and economic development patterns**;
(E) enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;	(F) enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
(F) promote efficient system management and operation; and	(G) promote efficient system management and operation; and
(G) emphasize the preservation of the existing transportation system.	(H) emphasize the preservation of the existing transportation system.

Note: The bold text highlights important changes that have been made to the planning factors in SAFETEA-LU.

Since the groundbreaking passage of ISTEA, the role of MPOs in metropolitan transportation planning has been reinforced with TEA-21 and SAFETEA-LU. For example, TEA-21 provided MPOs with greater flexibility in how they could use federal funds.[720] In addition, funding for MPOs was recently increased to 1.25% of the five core federal-aid highway programs in SAFETEA-LU.[721]

[720] Source: FHWA, TEA-21, *Metropolitan Planning Fact Sheet*, http://www.fhwa.dot.gov/tea21/factsheets/metropln.htm (accessed on 04/09/06).
[721] Source: FHWA, SAFETEA-LU, *Metropolitan Planning Fact Sheet*, http://www.fhwa.dot.gov/safetealu/factsheets/mp.htm (accessed on 04/09/06). Note: In the debates on the

While federal legislation relating to MPOs has evolved since 1991, TEA-21 and SAFETEA-LU essentially reaffirmed and retained the structure of the metropolitan transportation planning process established in ISTEA. For example, the requirement that MPOs produce an LRTP and TIP has not changed since ISTEA, although some changes have been made to the time horizons, content, and updating requirements of the plans (Table 7.2). In addition, SAFETEA-LU encourages MPOs to improve their public involvement methods (particularly for bicyclists, pedestrians, and people with disabilities) and to consult and coordinate with officials responsible for state and local growth, economic development, environmental protection, health and human services, airport operations, and freight movements (AMPO 2005; Klancher 2005). With regards to health and human services, SAFETEA-LU requires that projects funded by three federal programs - i.e., the Special Needs of Elderly Individuals and Individuals with Disabilities, Job Access and Reverse Commute, and the New Freedom Program - be 'derived from a locally developed, coordinated public transit-human services transportation plan.'[722] The MPOs and state DOTs are primarily responsible for the development of these plans, which are required by FY 2007.

Table 7.2: The LRTP and TIP under TEA-21 and SAFETEA-LU

MPO Plan		TEA-21	SAFETEA-LU
Long-Range Transportation Plan (LRTP)	*Time Horizon*	20 years	20 years
	Contents	Future goals, strategies, and projects	Future goals, strategies, and projects. Plans must include a 'discussion' of potential environmental mitigation activities.
	Updates	Every 5 years (3 years for nonattainment and maintenance areas)	Every 5 years (4 years for nonattainment and maintenance areas)
Transportation Improvement Program (TIP)	*Time Horizon*	3 years	4 years
	Contents	Transportation investments	Transportation investments
	Updates	Every 2 years	Every 4 years

Sources: FHWA and FTA (2003), Plumeau (2004), and AMPO (2005).

Given MPOs' prominent role in the transportation planning and decision-making process, the fact that MPOs are the only transportation planning organization created by the surface transportation legislation - and are required to consider planning factors that closely resemble the principles of sustainable transportation - MPOs make a good target audience to test the ideas put forward in the proposed sustainable transportation decision-support framework.

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reauthorization of TEA-21, Puentes and Bailey (2003) made a strong case that the funding set aside from federal-aid highway programs should be increased to 2%.

[722] Source: FHWA, *Interim Guidance for Implementing Key SAFETEA-LU Provisions on Planning, Environment, and Air Quality for Joint FHWA/FTA Authorities*, http://www.fhwa.dot.gov/hep/igslpja.htm (accessed on 04/09/06).

7.2 The MPO Questionnaire: Rationale, Results, and Discussion

The rationale for developing the questionnaire was to explore the receptiveness of MPOs to some of the core ideas put forward in the sustainable transportation decision-support framework. Since it was not feasible to cover all aspects of the framework, the questions focused on four important ideas: [1] the Rawlsian/utilitarian decision-making philosophy (Sections 7.2.3 and 7.2.4); [2] the hybrid trade-off/positional analysis framework (Section 7.2.5); [3] the four environmental drivers of the concern for sustainable development (Section 7.2.6); and [4] the 'strong' Porter hypothesis (Section 7.2.7). In addition, the questionnaire also focused on the attention that MPOs give to transportation policy goals (Section 7.2.8).

7.2.1 Question Development and Pre-Test

Having identified the focus of the questionnaire, an initial set of questions was developed and then reviewed by several transportation experts at MIT. Following several review cycles within MIT, the questionnaire was sent out for external evaluation. General comments and advice on how the questionnaire could be improved were received from the Volpe National Transportation Systems Center, the Association of Metropolitan Planning Organizations (AMPO), and Sustainable Pittsburgh.

Following both the internal and external reviews, the questionnaire was pre-tested on staff members at the Boston MPO. This pre-test led to a further round of revisions that greatly improved the style and format of the questions. A significant change was to increase the use of 'Likert scales' to allow respondents to express their strength of agreement with specific statements. This alteration meant that more direct questions could be asked and a general understanding of the respondents' attitudes or reactions could be obtained. A copy of the final MPO questionnaire is shown in Appendix C.

7.2.1.1 Who Received the Questionnaire and How Was It Administered?

The intended recipients of the online MPO questionnaire were the board members, directors, deputy directors, and senior transportation planners/engineers of some 384 MPOs across the U.S. The contact information for this group of people was obtained from the University Transportation Centers (UTC) program. A recent UTC project had developed a database containing around 1,100 email addresses of MPO board/staff members in the intended target audience, and the UTC kindly granted permission to use its database for this survey. Due to the Boston MPO's role in the pre-test, the email addresses of its staff members were removed from the database.

The MPO questionnaire was administered using an online survey tool called Survey Monkey (www.surveymonkey.com). Once the MPO questionnaire had been developed and recreated online, a link to the questionnaire along with a brief description of the research was sent to all the recipients in the UTC email database. As people responded to the online questionnaire, their answers were automatically collected and stored on the

host web site. After a period of four weeks, the questionnaire was closed and a link to a summary of the initial results was activated and sent to the recipients. In total, 233 people started the questionnaire and 151 people (about 14% of the target group) answered all 27 questions. While multiple people in an MPO could respond to the questionnaire, many MPOs delegated the responsibility for answering the questionnaire to one staff member. This action partly explains the relatively moderate response rate.

The following sections provide the rationale behind the questions and present and discuss the results from the MPO questionnaire. A comparison of all the responses (i.e., partial and complete) against only those surveys that were completed in full revealed that the latter set was representative of all the responses received. Hence, removing the partially completed surveys from the data set had no effect on the overall results. The data presented and discussed in the following sections are from the set of 148 completed responses. Three responses were removed from the initial set of 151 since these respondents identified themselves as not being connected with an MPO.

7.2.2 General Information

7.2.2.1 Rationale for Questions 1 to 8

The first eight questions of the MPO questionnaire were designed to obtain general information on each respondent and his/her MPO. The questions covered the respondent's position in the MPO, the population and geographic area served by the MPO, the MPO's annual operating budget and voting structure, whether the MPO is part of a Council of Governments (COGs), and the air quality in the MPO's region. This information was collected to enable responses to the other questions to be analyzed according to the position of the respondent in the MPO, the size of the MPO, etc.

7.2.2.2 Results for Questions 1 to 8

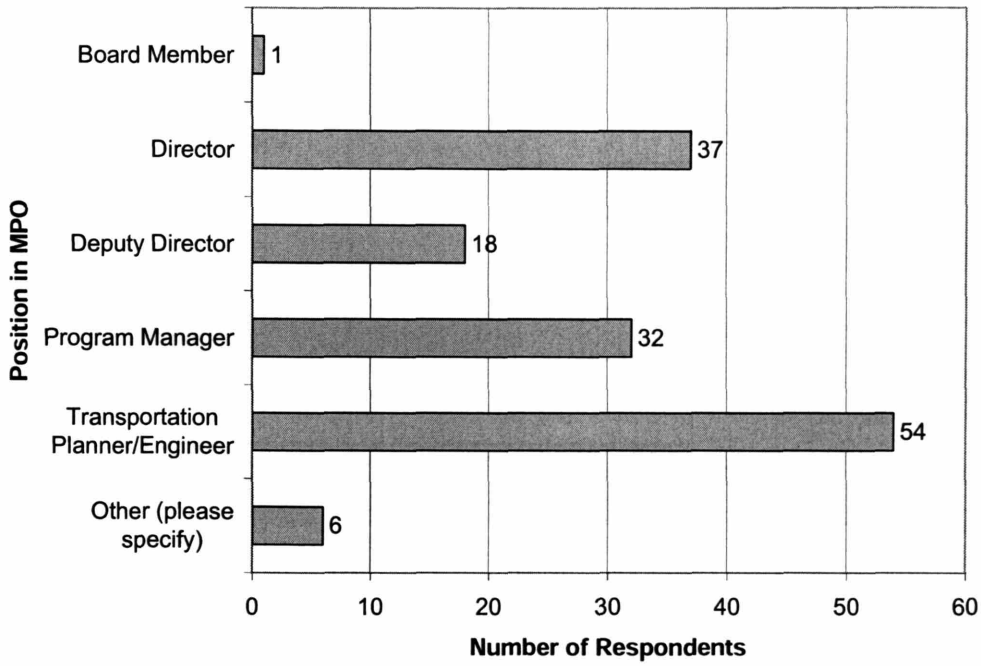

Figure 7.2: Question 1 - How would you describe your position in the MPO?

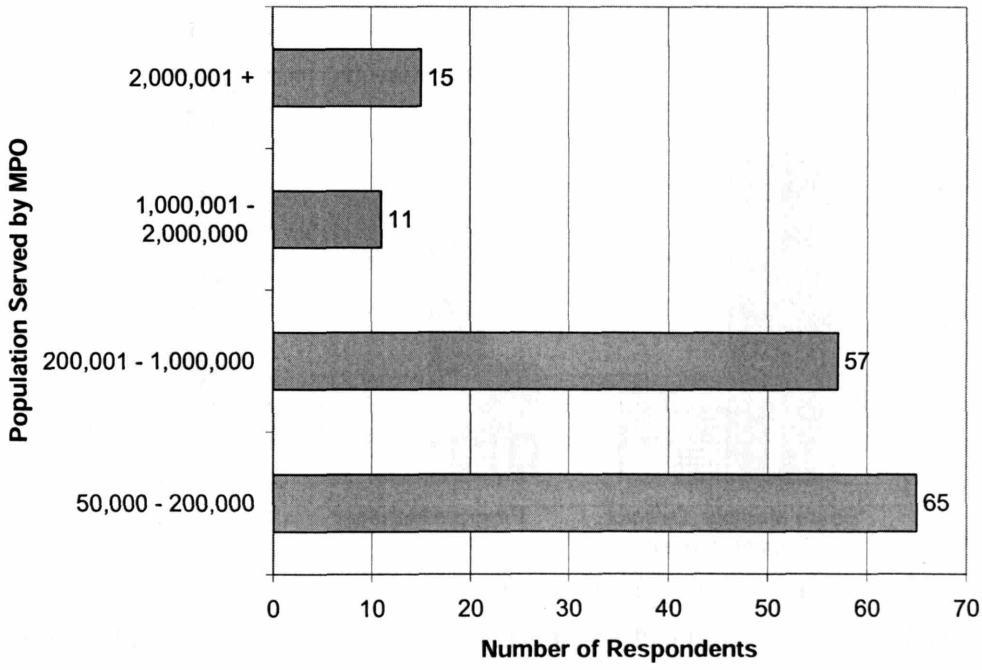

Figure 7.3: Question 2 - What is the population served by your MPO?

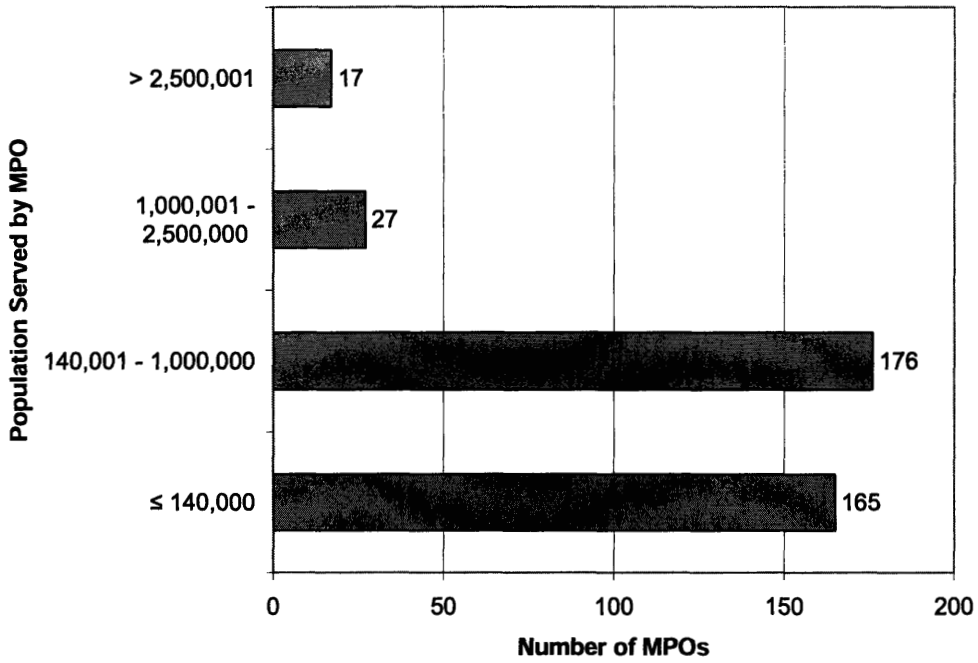

Figure 7.4: Actual Populations Served by MPOs (Source: FHWA/FTA MPO Database)[723]

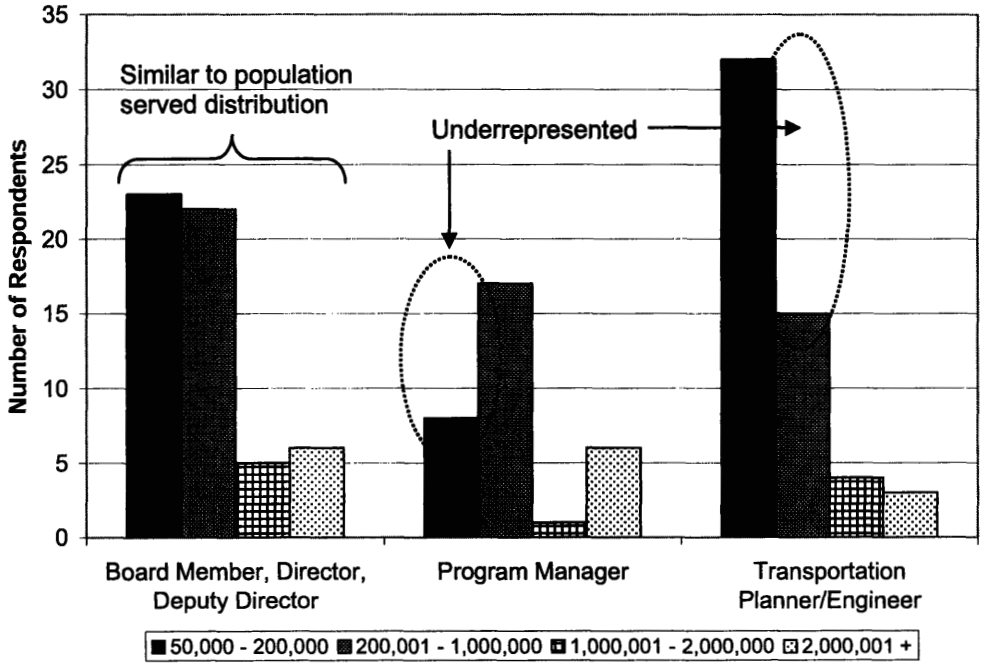

Figure 7.5: Respondent Positions in MPO (Question 1) Categorized by Population Served by the MPO (Question 2)

[723] Note: The reader should be aware that the y-axis on Figures 7.3 and 7.4 are not identical, so care must be taken when making comparisons.

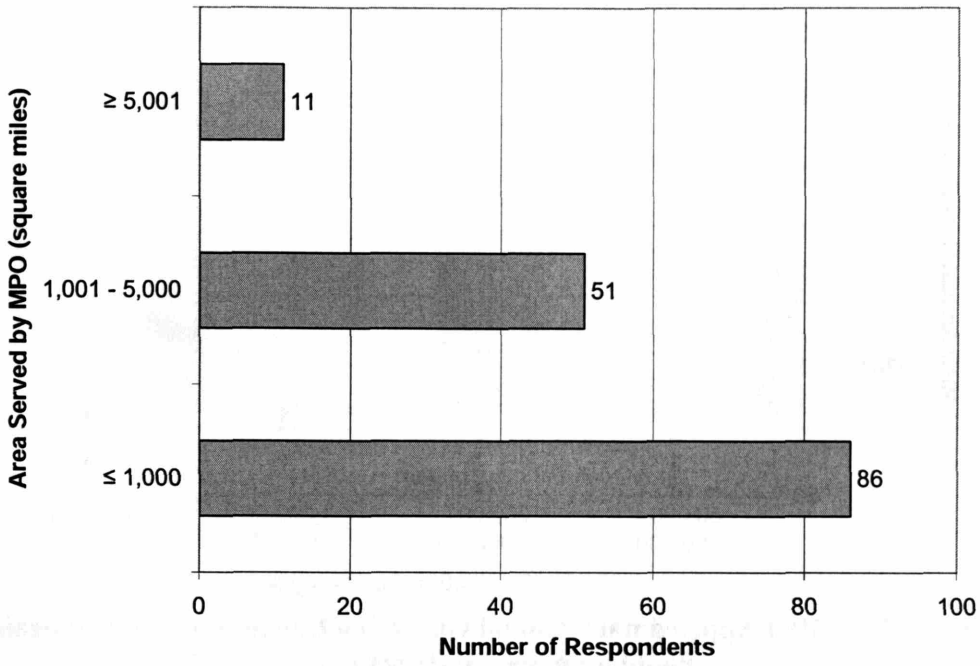

Figure 7.6: Question 3 - What is the geographic area served by your MPO?

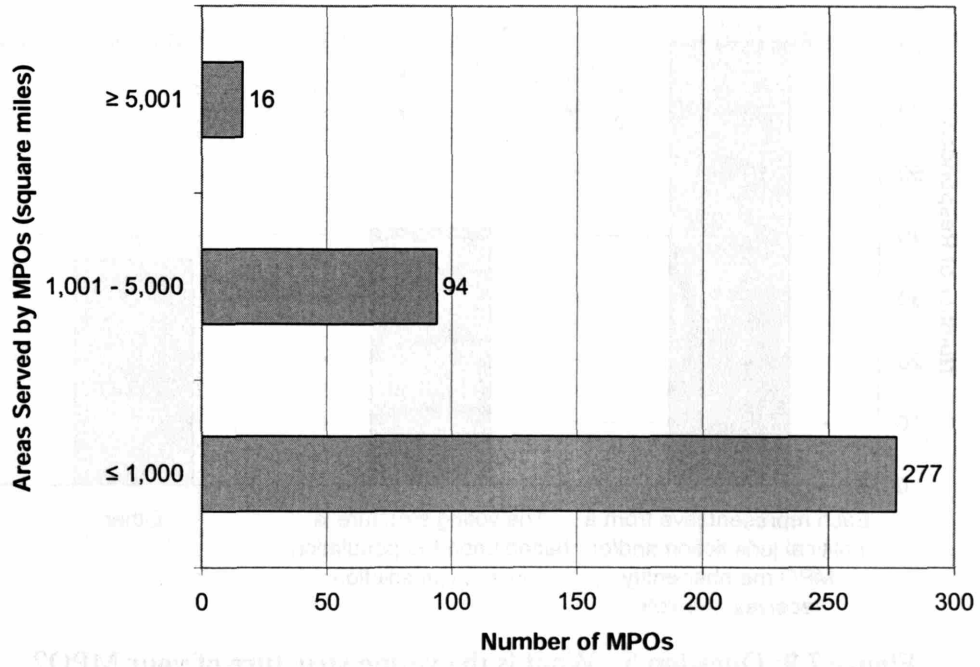

Figure 7.7: Actual Geographic Areas Served by MPOs (Source: FHWA/FTA MPO Database)

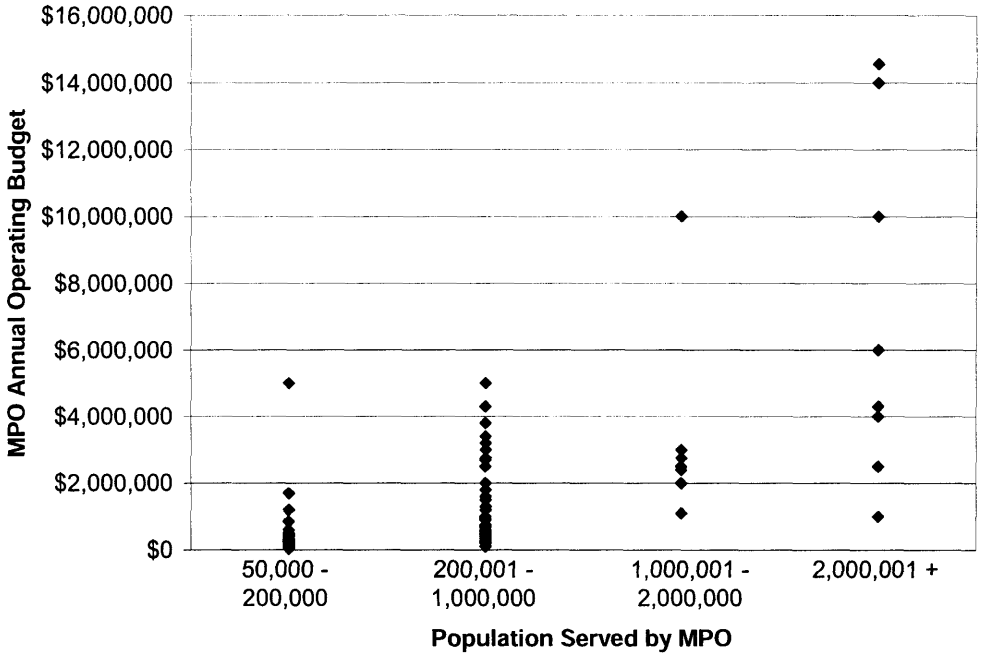

Figure 7.8: MPO Approximate Annual Operating Budget (Question 4) against Population Served (Question 2)[724]

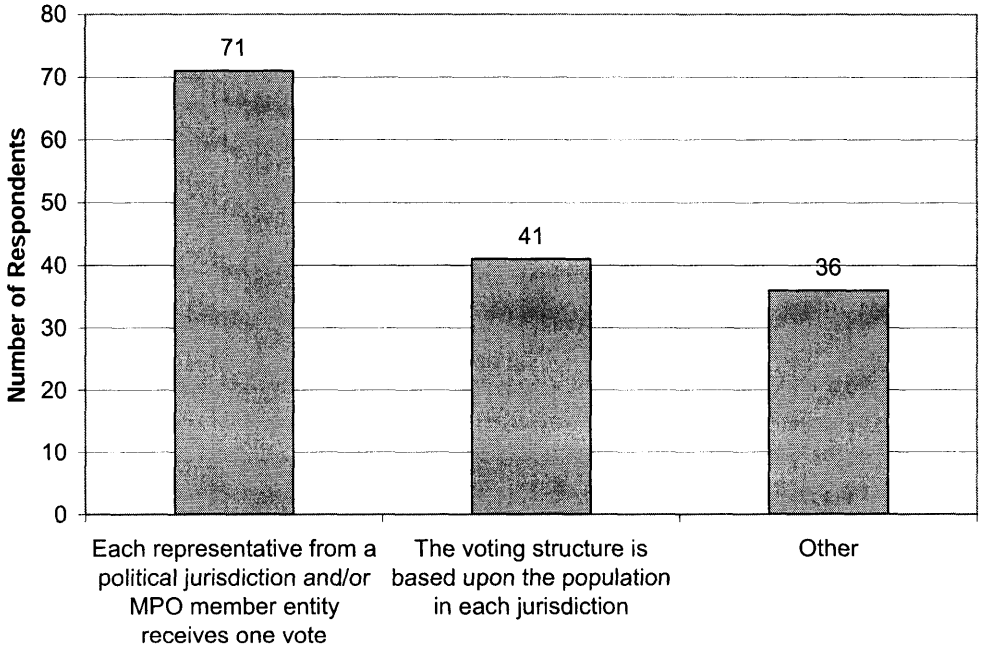

Figure 7.9: Question 5 - What is the voting structure of your MPO?

[724] Two data points were removed from this graph to pronounce the variation between the MPOs' annual operating budget and the size of the population served. The annual operating budgets for the two data points removed were $50 and $34 million; both were connected with populations of over two million.

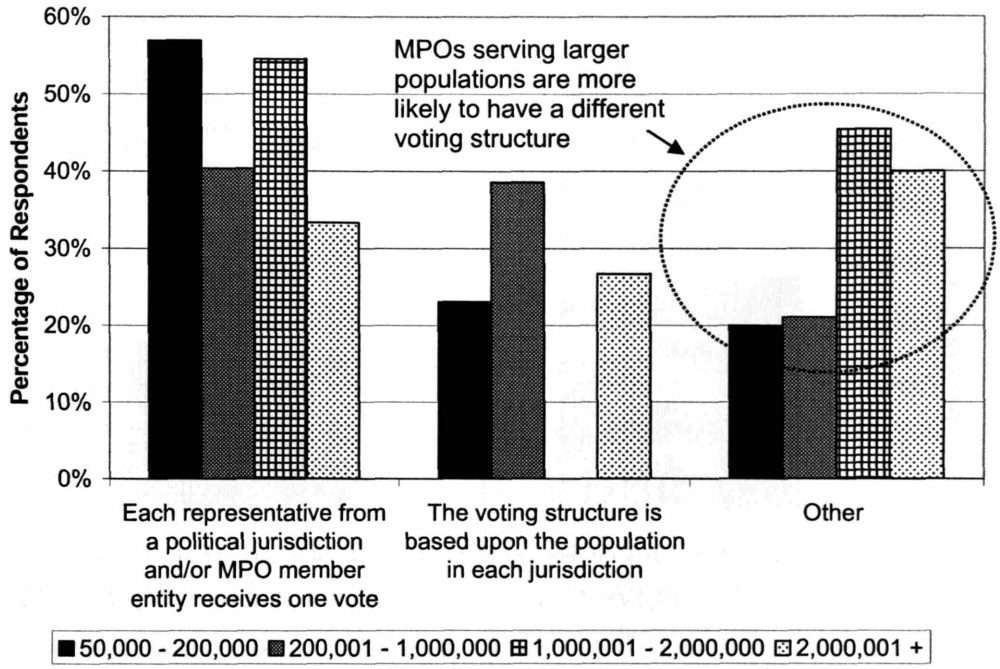

Figure 7.10: Percentage of Respondents (grouped by population served by MPO) That Have the Voting Structures Provided in Question 5

Table 7.3: Question 6 - Is your MPO part of a COG or regional planning agency?

Yes	**74 (50%)**
No	**74 (50%)**

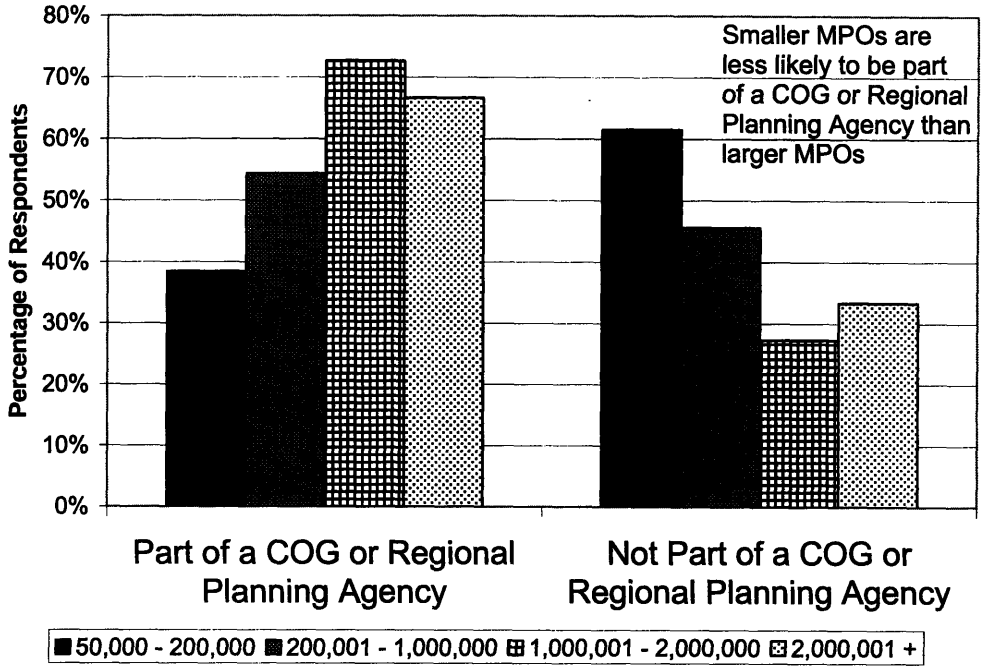

Figure 7.11: Percentage of Respondents (grouped by population served by MPO) That Stated Their MPO Is or Is Not Part of a COG or Regional Planning Agency

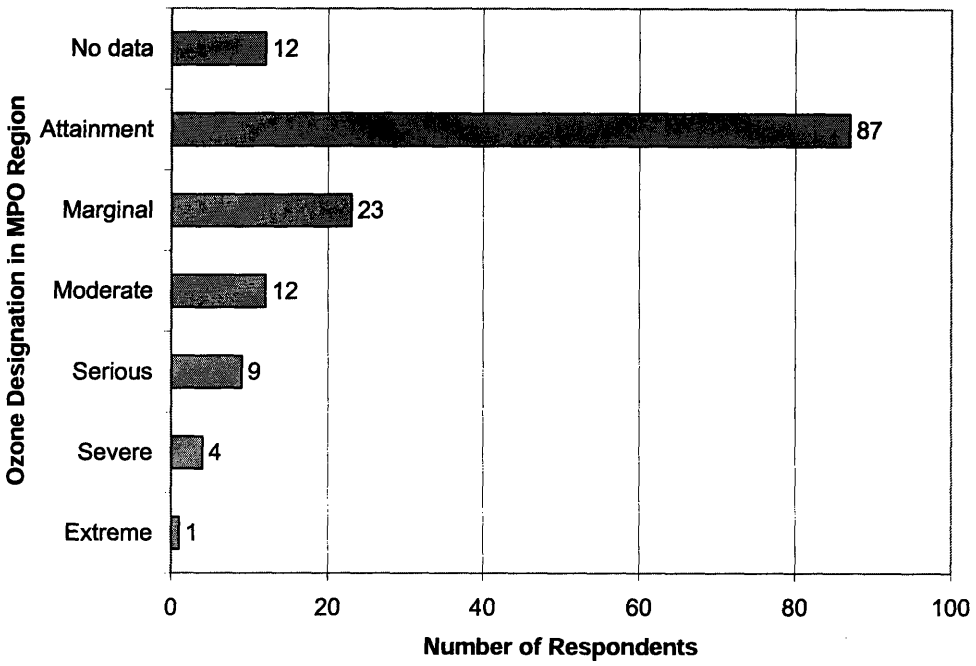

Figure 7.12: Question 7 - What is the worst (current) Ozone designation in your MPO region?

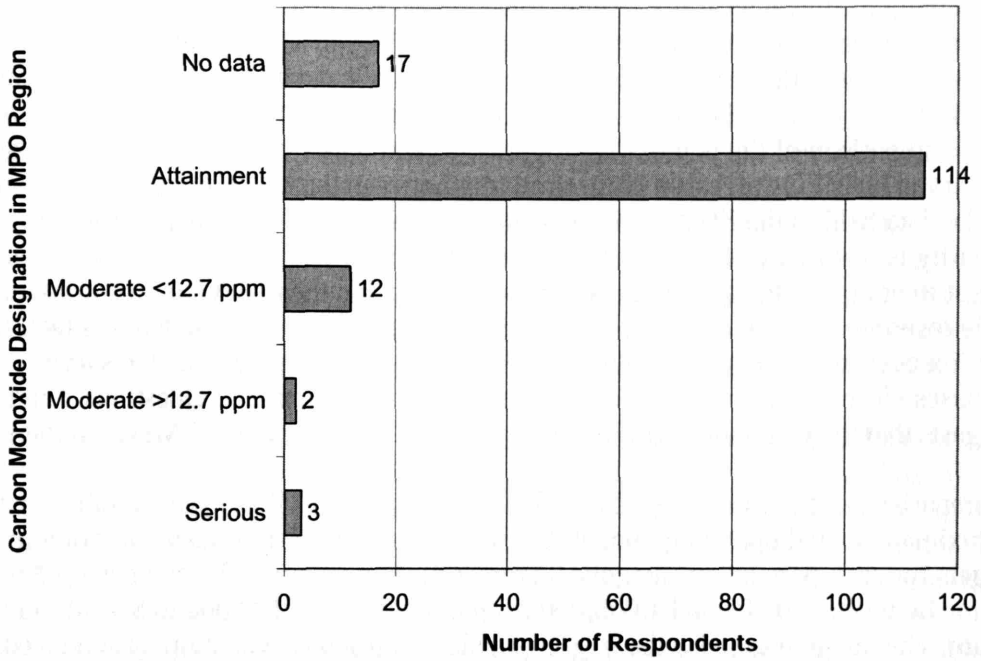

Figure 7.13: Question 8 - What is the worst (current) Carbon Monoxide (CO) designation in your MPO region?

7.2.2.3 Discussion

For Question 1 (Figure 7.2), if the respondent categories of *Board Member*, *Director*, and *Deputy Director* are grouped together (under the heading of '*Director*'), the results indicate that Directors account for 38% of the survey group, Program Managers 22%, and Transportation Planners/Engineers 36%.[725] These three core groups of respondents provide a useful filter through which the answers to other survey questions can be analyzed. A second filter of interest is the size of the MPO. Two measures of an MPO's size are the population and area that it serves - i.e., Questions 2 (Figure 7.3) and 3 (Figure 7.6), respectively. For the purpose of this analysis, population served is used as the primary measure of MPO size. A comparison of the respondents' roles in the MPO against the population served is shown in Figure 7.5. It indicates that the distribution of Directors is similar to the population served distribution (shown in Figure 7.3). However, Program Managers from small MPOs (serving 50,000 to 200,000 people) appear to be underrepresented as are Transportation Planners/Engineers from medium MPOs (serving 200,001 to 1,000,000 people).

Since the questionnaire was sent to several people in each MPO and the responses are anonymous, it is not possible to provide a definitive statement on whether the results are

[725] Note: 'Others' account for 4% of the respondents included in the analysis. The six people in the 'Others' category identified themselves as a technical advisory committee member, a public involvement coordinator, a committee member, a transportation planning director, a regional representative, and a state DOT advisory member.

representative. However, if the results from Questions 2 and 3 are compared with similar data in the Federal Highways Administration's (FHWA's) MPO database,[726] an interesting observation can be made. [Note: The FHWA database contains information on all 384 of the MPOs in the U.S., including the Commonwealth of Puerto Rico.][727] A visual comparison of the population (Figures 7.3 and 7.4)[728] and area (Figures 7.6 and 7.7) served by MPOs reveals a close similarity between the MPO questionnaire results and the data held in the FHWA MPO database. One potential explanation for this similarity is that many of the MPO board members/staff who received the initial (email) request to complete the questionnaire replied stating that their MPO was coordinating a single response. In total, some twenty emails from different MPOs stated this fact. If this situation occurred in a large number of MPOs, this would explain why the survey responses closely mirror the FHWA database. Hence, responses to Questions 2 and 3 'suggest' that the respondent group was reasonably representative of MPOs in the U.S.

A comparison of the categories of population served by an MPO (Question 2) with its approximate annual operating budget (Question 4) reveals a significant variation in MPO budgets for each population category (Figure 7.8). For example, the budgets for MPOs serving between 200,001 and 1,000,000 people range from $100,000 to $5 million per annum. The budget range for the largest population group is even more pronounced, ranging from $1 to $50 million. Such variation in budgets is likely to be related to the potential range of population served in each category; however, the size of the MPO and its scope of work/authority is also likely to be an important factor.

Question 5 asked MPOs about the voting structure of their board. The results show that almost half the respondents indicated that each representative from a political jurisdiction and/or MPO member entity receives one vote (Figure 7.9). Just over a quarter of respondents stated that their MPO's voting structure is based upon the population served in each jurisdiction, and about a quarter provided an alternative structure. A closer examination of the alternative voting structures reveals that MPOs serving larger populations are more likely to have a different voting structure (see the oval on Figure 7.10). The alternative structures tend to be based upon negotiated agreements between counties, cities, transit agencies, state departments, citizen representatives, etc.

Question 6 provides more information on the structure of MPOs, specifically whether they are part of a Council of Governments (COG) or regional planning agency. The results show that half the MPOs belong to a COG or regional planning agency (Table 7.3). If the data is filtered by population served by the MPO, it appears that smaller MPOs are less likely to be a part of a COG or regional planning agency (Figure 7.11). This outcome is to be expected since MPOs serving larger populations are more likely to

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[726] See the FHWA/FTA's *Metropolitan Planning Organization (MPO) Database*, http://www.planning.dot.gov/overview.asp (accessed on 04/09/06).

[727] The 384 MPOs include those that were designated as a result of new urbanized areas identified in the 2000 U.S. Census. Between now and the 2010 Census, it is unlikely that more than one or two new MPOs will be designated (Spear 2005). A new designation may occur if [1] a community conducts a special census to show that its population exceeds the 50,000 threshold to become an urbanized area, or [2] an existing MPO divides into two new MPOs.

[728] It is important to recognize that the scales of Figures 7.3 and 7.4 are not identical.

encounter multiple local governments and need to be a part of a COG or regional planning agency to coordinate their activities across jurisdictions.

While the results to Question 6 are interesting, it is important to recognize that the relationship between the MPO and COG can vary significantly. Discussions with NARC and AMPO revealed that in some circumstances the MPO and COG work very well together, while in others they do not necessarily talk due to differences in political goals/agendas. In a few circumstances the MPO and COG are the same entity. While such diversity cautions against general statements, it is likely that those MPOs that are part of a COG will have more capacity (i.e., funding, staffing, and authority) to address issues relating to sustainable development/transportation than freestanding MPOs.

The link between the MPO and COG raises an important question: should the power of the MPO be broadened to enable it to influence important issues such as land use (i.e., moving it closer towards the role of the COG), or should the COG be given the authority of the MPO? Interestingly, NARC explained how the latter idea was rejected when the MPO was established since the federal government was concerned that transportation plans would be overshadowed by other issues such as aging or housing. However, given that the current disaggregated approach to planning is unlikely to support sustainable development, the balance of authority between the MPO and COG is an area where real change could be made. For example, providing the MPO with more authority over land use planning could reduce some barriers to achieving a more sustainable transportation system. Conversely, passing the authority and responsibilities of the MPO to the COG is another model worth consideration; however, this model is likely to face more political barriers since it raises the question of whether the federal government is able to place planning requirements on local governments. Regardless of which approach is taken, the argument can be made that regional planning must be able to coordinate and integrate transportation, land use, housing planning, etc. if a region is to develop in a more sustainable manner.

Finally, Questions 7 and 8 indicate that the majority of respondents who answered the questionnaire were from regions in attainment for ozone (Figure 7.12) and carbon monoxide (CO) (Figure 7.13). [Note: An omission from both Question 7 and 8 was to provide respondents with the option of 'maintenance area' for ozone and CO. Several respondents stated that they selected 'attainment' when in fact their areas are officially classed as maintenance areas.]

7.2.3 Extent to Which the MPOs are Rawlsian and Stakeholders are Communitarian

7.2.3.1 Rationale for Questions 13, 14, 15, 16, and 17

A core argument of this dissertation is that a Rawlsian/utilitarian decision-making philosophy will encourage the creation of transportation policies and programs that support sustainable development if the policies/programs lie toward the Rawlsian end of the decision-making continuum.[729] However, the ability of government to develop equitable social arrangements that transition society towards more sustainable forms of development will depend upon how it, and society, views the purpose of development - i.e., either to establish a fair and just society (Rawlsianism), or alternatively to maximize the well-being of society in the neoclassical sense (utilitarianism). These two philosophies define the modern decision-making continuum (Figure 7.14). The rationale behind the questions discussed in this section was to determine the likelihood of achieving a Rawlsian outcome given the prevailing transportation planning environment.

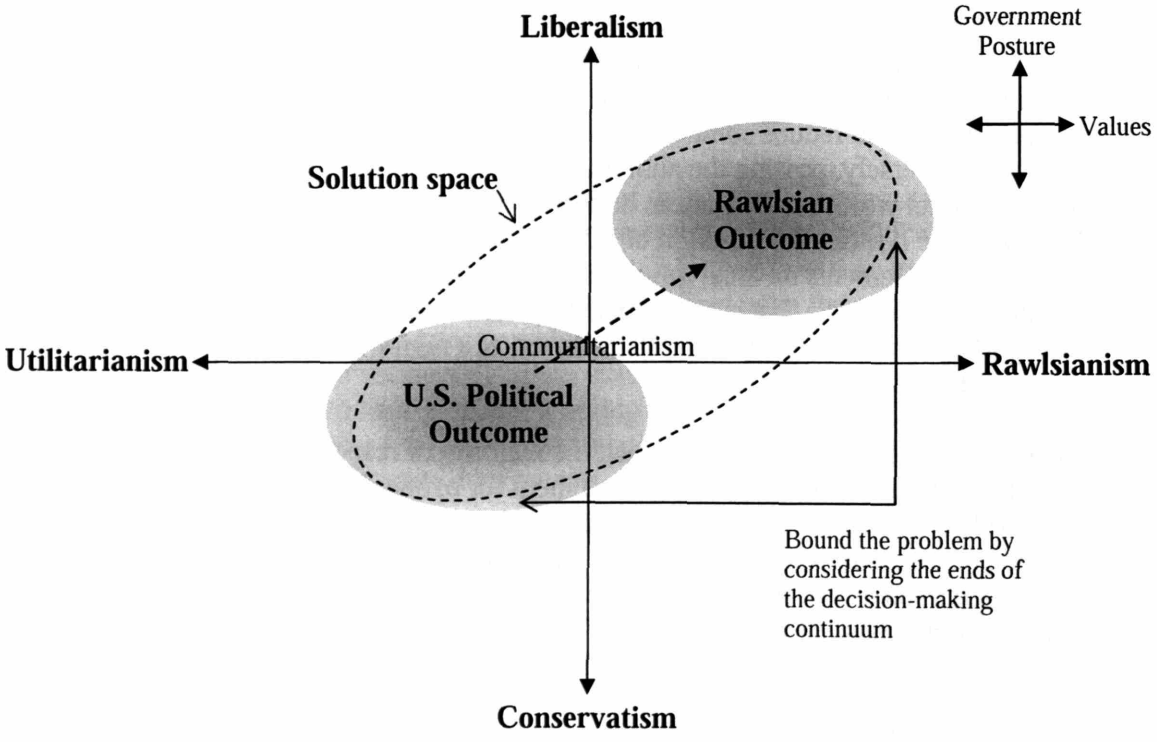

Figure 7.14: Mapping the Likely Outcomes from a Hypothetical Rawlsian and U.S. Decision-Making Process

[729] For a detailed discussion of the Rawlsian/utilitarian decision-making philosophy, see Sections 2.2.1 and 2.2.2.

First and foremost, a Rawlsian approach places *social equity* at the center of decision-making (the *First Principle of Justice*). Second, it supports the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society (the *Second Principle of Justice*).[730] Finally, it makes the 'movement' towards a better environment a critical component of any new social arrangement (the suggested *Third Principle of Justice*).[731] Applying this philosophy is important when evaluating existing and developing new transportation options/policies.

A *Rawlsian* approach is likely to reflect *more* of a concern for the equitable distribution of transportation services across stakeholder groups. In contrast, a *utilitarian* approach to transportation decision-making is likely to reflect *less* of a concern for equity in the distribution of services. Hence, determining whether a decision-making process leans towards utilitarianism or Rawlsianism is likely to provide some indication of the types of outcomes that one might expect. To explore this notion further, Table 7.4 presents the types and outcomes of interactions between government and stakeholders if the role of government and the stakeholder posture are known.

Table 7.4: Types and Outcomes of Interactions between the Government and Stakeholders

	STAKEHOLDER POSTURE	
GOVERNMENT'S ROLE	**UTILITARIAN** (Maximizing individual/social benefit)	**COMMUNITARIAN** (Promoting the 'greater social good')
As a trustee for the affected stakeholders	1. Decision made by government in a trusteeship role on behalf of all the *participating stakeholders*	2. Decision made by government in a trusteeship role on behalf of the stakeholders (mirroring a *normative* consensus, possibly expanding to benefit the larger non-participating public as well)
As a facilitator of utilitarian or majoritarian consensus, or alternative dispute resolution among the stakeholders	3. Stakeholder involvement processes reach a *consensus* or *compromise* among the *participating* stakeholders	4. Idealized stakeholder involvement processes reach *normative* consensus, possibly expanding to benefit the larger non-participating public as well

Source: Adapted from Ashford and Rest (2001, p. VII-14).

While Table 7.4 refers to the 'role of government,' it is important to recognize that MPOs are federally-sanctioned regional planning bodies - i.e., they are a form of 'quasi-governmental body.' Hence, many MPOs would not consider themselves as formal government entities. However, given the (potentially) influential role of MPOs in

[730] Social and economic inequalities are tolerated only if the most disadvantaged members of society are made better off under new arrangements.
[731] The suggested developed Third Principle of Justice is discussed in Section 7.2.6.

decision-making,[732] understanding the extent to which they adopt a Rawlsian posture should provide some insight into the likely outcomes from the transportation planning and decision-making process.

Table 7.5 extends the logic presented in Table 7.4 to identify the *likelihood* of obtaining a Rawlsian outcome within each of the four quadrants shown in Table 7.4.[733] It indicates how the role of the MPO and stakeholder influence are crucial factors in arriving at a Rawlsian outcome. A *Rawlsian outcome* is defined as one where new legislation, policies, or programs support initiatives that offer greater advantage to individuals or groups who are relatively worse off to begin with.

Table 7.5: Likelihood of Achieving a Rawlsian Outcome with a Rawlsian/Non-Rawlsian MPO *and* Strong/Weak Stakeholder Postures

	STAKEHOLDER POSTURE			
MPO's Approach to Decision-making	**UTILITARIAN** (Maximizing individual/social benefit)		**COMMUNITARIAN** (Promoting the 'greater social good')	
	Stakeholder Influence	**Rawlsian Outcome**	**Stakeholder Influence**	**Rawlsian Outcome**
Rawlsian MPO (MPO acts as trustee for stakeholders)	*Strong*	Outcome uncertain	*Strong*	Extremely likely
	Weak	Possible	*Weak*	Highly likely
Non-Rawlsian MPO (MPO acts as facilitator for utilitarian/ majoritarian consensus)	*Strong*	Extremely unlikely	*Strong*	Likely
	Weak	Unlikely	*Weak*	Possible

In an effort to determine the likelihood of achieving Rawlsian outcomes in the transportation planning and decision-making process, several questions were developed to identify the perceived role of the MPO and stakeholders.

Questions 13 and 14 sought to determine the role of the MPO in the decision-making process - i.e., to endorse the consensus reached by its members/participating stakeholders (Question 13), or alternatively to act as trustee on behalf of affected stakeholders (such as disadvantaged groups) without necessarily following majority views on important issues (Question 14). Thus, Question 13 attempts to find out the extent to which the MPO's role in the decision-making process is perceived to be non-Rawlsian, and Question 14 seeks to determine the extent to which the MPO's role is perceived to be Rawlsian. For both questions, the respondent was asked to indicate the extent to which he/she agreed/disagreed with the stated role of the MPO.

[732] The word 'potentially' is used since the ability of MPOs to influence decision-making varies significantly across metropolitan areas. By and large it depends on whether the state DOT has relinquished or retained control over the planning funds for the metropolitan area.
[733] For a detailed discussion of Tables 7.4 and 7.5, see Section 2.2.2.

Question 15 approached the essence of Questions 13 and 14 in a different way by asking what the 'primary role' of the MPO was in the decision-making process. The potential range of responses was constrained to the following four options:

- Reach consensus amongst its members/participating stakeholders.
- Implement programs with the greatest net benefit, regardless of their distributional impacts.
- Balance the needs of under-represented or disadvantaged groups with the wishes of the majority.
- Give special emphasis to under-represented or disadvantaged groups.

The first two responses can be described as non-Rawlsian, with the second option representing a purely non-Rawlsian outcome.[734] The last two responses can be described as Rawlsian, with the final option representing a purely Rawlsian outcome. The respondents were able to select only one option.

Whereas Questions 13 and 14 focused on the role of the MPO, Questions 16 and 17 shifted the focus to the perceived role of stakeholders in the planning and decision-making process. The stakeholders were broadly conceived as MPO member entities or interest groups that were not voting members of the MPO. Question 16 asked respondents to express their strength of agreement with the statement that "stakeholder groups/MPO member entities engaged in the planning/decision-making process are only interested in realizing their own objectives." Thus, the intent of the question was to gauge the extent to which stakeholders were perceived as adopting a utilitarian posture. Question 17 used the same structure but the statement was changed to gauge whether stakeholders were perceived as adopting a communitarian posture - i.e., that stakeholders "are willing to consider the issues of others, beyond their own interests."

In conclusion, Questions 13, 15, and 16 try to establish the extent of *utilitarian thinking* and Questions 14, 15, and 17 try to establish the extent of *Rawlsian thinking.*

[734] While the first option can be described as non-Rawlsian (or utilitarian), it does not mean that a Rawlsian outcome cannot be achieved. If stakeholders adopt a strong communitarian posture, their emphasis on the 'community' is likely to prevent or minimize the marginalization of disadvantaged groups. Therefore, a Rawlsian outcome is possible under a non-Rawlsian government.

7.2.3.2 Results for Questions 13, 14, 15, 16, and 17

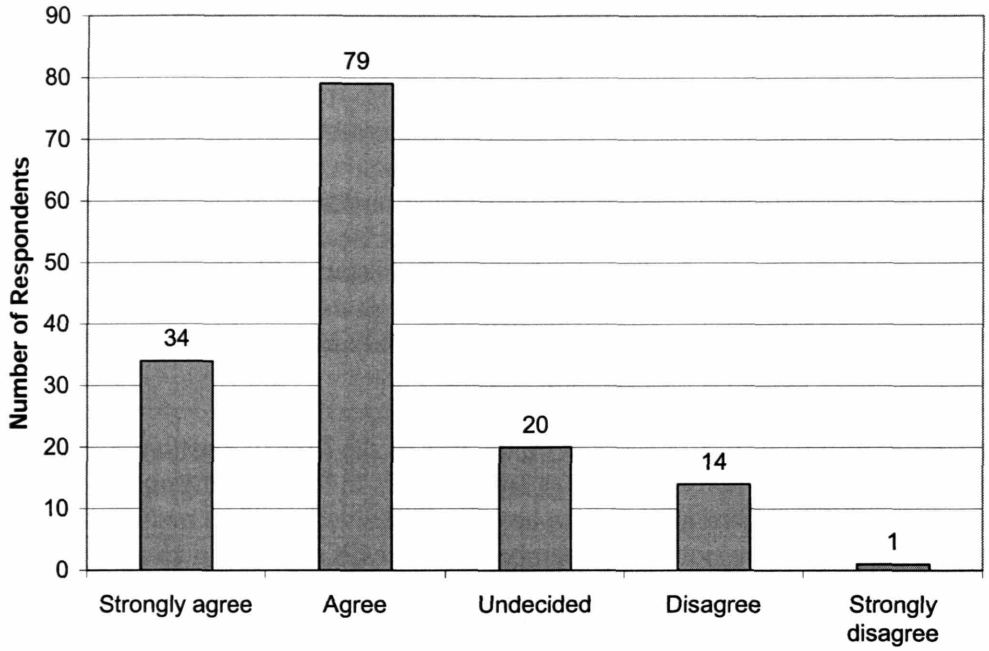

Figure 7.15: Question 13 - The role of the MPO in the decision-making process is to endorse the consensus reached by its members/participating stakeholders

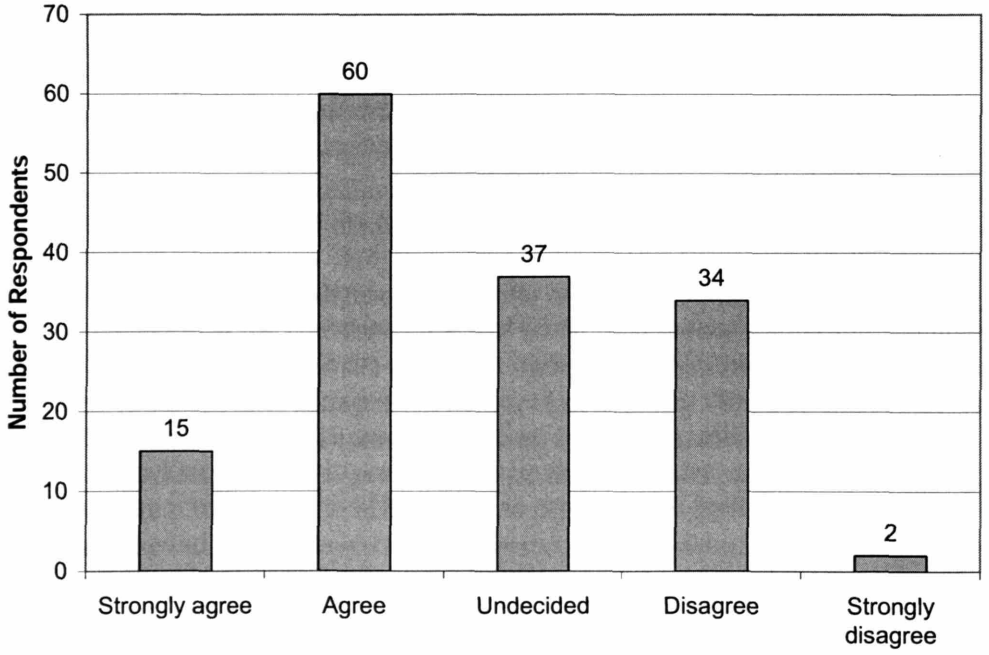

Figure 7.16: Question 14 - The role of the MPO in the decision-making process is to act as trustee on behalf of affected stakeholders (such as disadvantaged groups) without necessarily following majority views on important issues

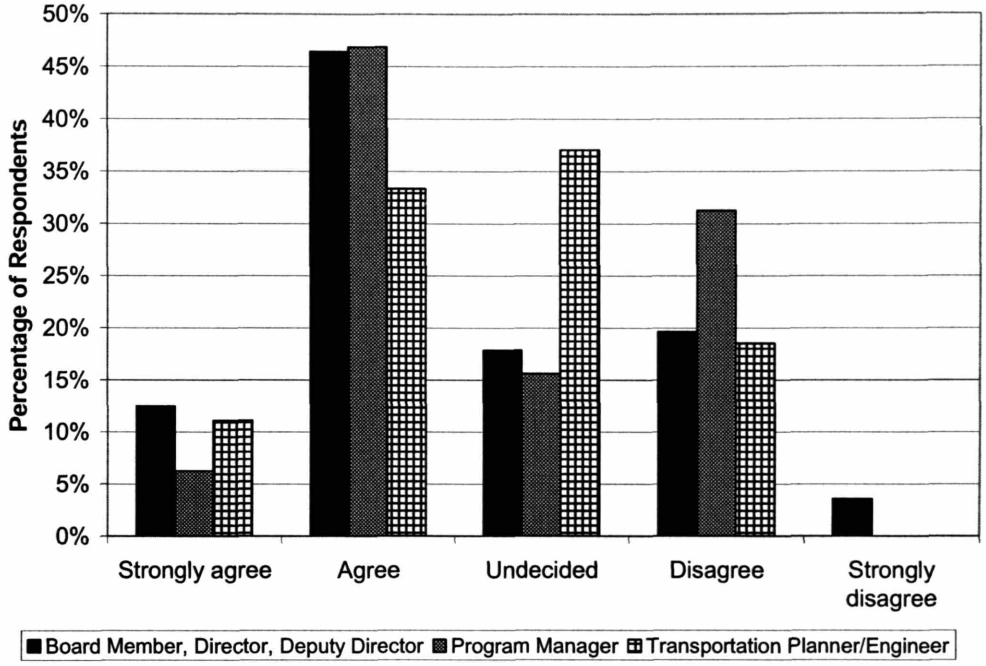

Figure 7.17: Extent to Which Respondents (grouped by position in MPO) Agree That the Role of the MPO in the Decision-Making Process Is to Act As Trustee on Behalf of Affected Stakeholders Without Necessarily Following Majority Views on Important Issues

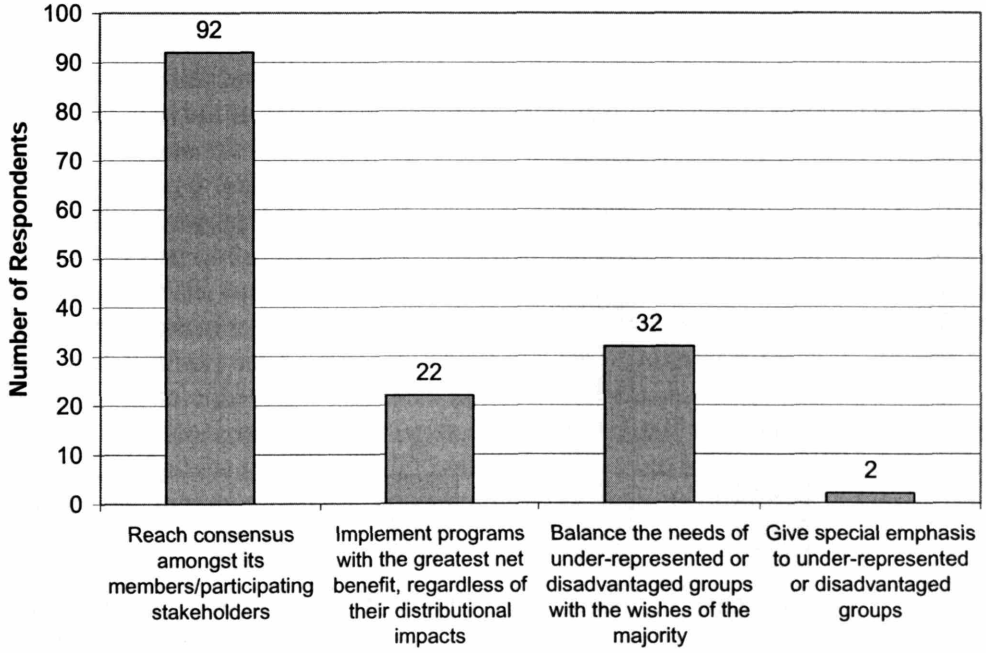

Figure 7.18: Question 15 - The primary role of the MPO in the decision-making process is to:

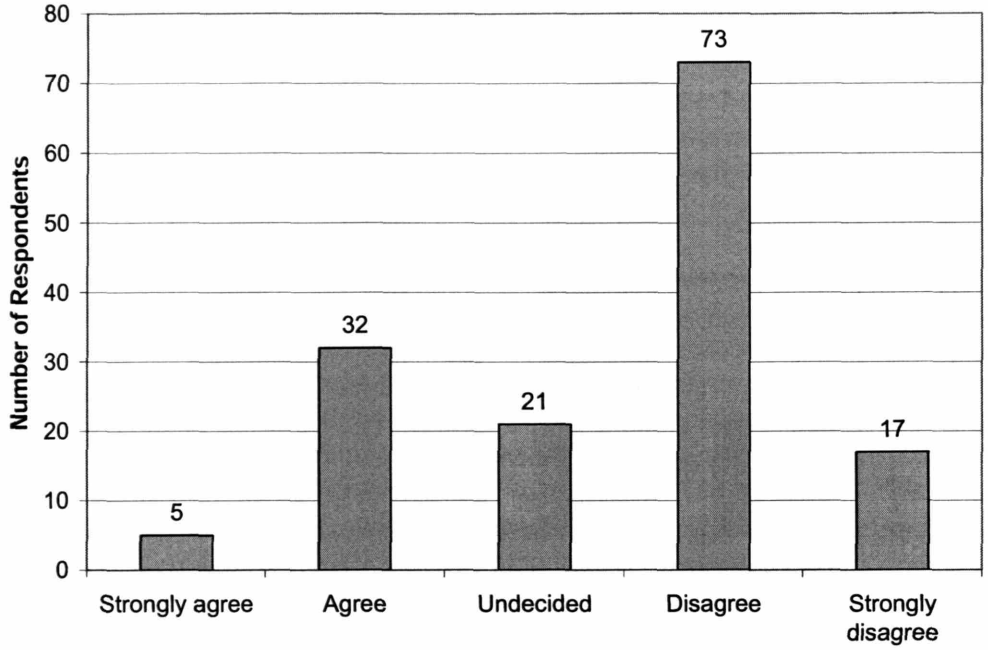

Figure 7.19: Question 16 - The stakeholder groups/MPO member entities engaged in the planning/decision-making process are only interested in realizing their own objectives

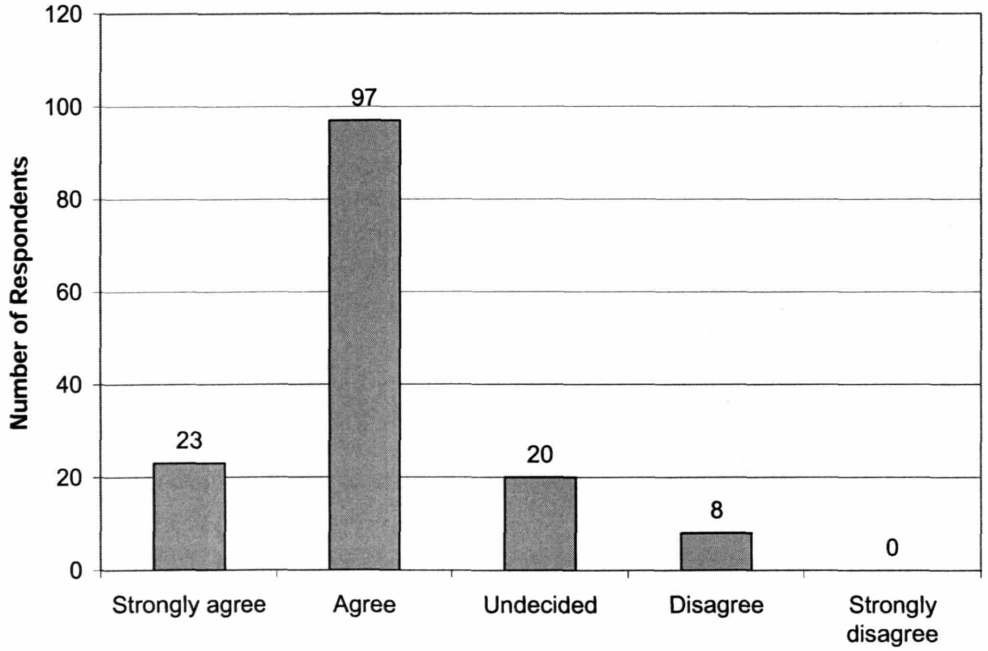

Figure 7.20: Question 17 - The stakeholder groups/MPO member entities engaged in the planning/decision-making process are willing to consider the issues of others, beyond their own interests

7.2.3.3 Discussion

While the MPO questionnaire cannot provide a direct answer to whether the consensus reached through the transportation planning process is utilitarian or communitarian, Questions 13 to 17 do provide some indirect measures of whether the planning/decision-making process is likely to achieve a Rawlsian outcome.

The results from Questions 16 and 17 indicate that the majority of stakeholders in the transportation decision-making process either adopt a communitarian posture or endorse communitarian perspectives. The results from Question 16 show that 61% of the respondents either 'Disagree' or 'Strongly disagree' with the statement that stakeholders engaged in the planning/decision-making process are only interested in realizing their own objectives (i.e., that the stakeholders adopt a utilitarian perspective) (Figure 7.19). Interestingly, not an insignificant number of respondents (25%) either 'Strongly agree' or 'Agree' with the statement. This indicates that in some metropolitan areas the planning and decision-making process might be dominated by local needs with regional priorities falling second.

The results from Question 17 are more conclusive (Figure 7.20). They show that 81% of the respondents either 'Strongly agree' or 'Agree' with the statement that stakeholders engaged in the planning/decision-making process are willing to consider the issues of others, beyond their own interests. This outcome is perhaps the strongest indication that the *perception* of the majority of MPO respondents is that stakeholders adopt a communitarian posture or endorse communitarian perspectives.

One potential problem with Questions 16 and 17 was the use of the terms *stakeholder groups* and *MPO member entities*. These two phrases were used to make the question as general as possible, but in hindsight they may have been confusing. Discussions with the FHWA and FTA and the feedback obtained from questionnaire respondents highlighted the following issue. If MPO staff are asked what the position of stakeholders/member entities is in the planning/decision-making process, they are likely to respond in reference to either both or one of the two groups. If both groups adopt the same approach there is no problem. However, since the MPO member entities (such as local, state, and federal agencies, transit agencies, airport authorities, maritime and port operators, rail-freight operators, and Amtrak) have a more involved role in the planning/decision-making process, [735] it is likely that their approach might be quite different to that of the less integrated non-member stakeholders (such as environmental groups). For example, it would not be in the best interest of MPO member entities to adopt an uncompromising stance, since this might negatively affect them in future decisions.[736]

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[735] It is important to recognize that an MPO member entity is not necessarily a voting member of the MPO.

[736] However, the results to Question 16 do indicate that some groups engaged in the planning/decision-making process are perceived to only be interested in achieving their own objectives. Given the general nature of the question, it is not possible to determine whether these are MPO member entities or non-member stakeholders. While the actions of MPO member entities - specifically locally elected officials - will be guided by what is best for their local area/constituents, the extent to which this dominates their actions is likely to be a function of individual projects and the nature of the planning/decision-making process itself.

Given the ongoing working relationship between the MPO and its member entities, it is likely that the results from Question 16 and 17 reflect the MPO board/staff members' perception of how their member entities act rather than how the broader group of stakeholders acts. Therefore, it might have been better to have referred only to the MPO member entities in these questions. However, even this solution would have presented problems since one respondent indicated that his/her MPO was not made up of 'members.' Thus, the diversity of MPO organizational structures makes it difficult to construct general questions.

Despite the potential confusion discussed above, since both the MPO member entities and the non-member stakeholder groups can all be considered as 'stakeholders,' the results to Questions 16 and 17 are still meaningful.

A more detailed analysis of these questions reveals that the results are uniform across the respondents' position in the MPO and the population served by the MPO. Hence, Directors, Program Managers, and Transportation Planners/Engineers all responded in a similar way and the size of MPOs had no significant effect on the responses.

Questions 13 to 15 focus on the role of the MPO in the decision-making process. The results from these questions indicate that while a strong majority of respondents agreed that the role of the MPO is to facilitate consensus among stakeholders (Figures 7.15 and 7.18), a significant number also agreed that the MPO has a role as trustee of stakeholder interests (Figure 7.16).

Question 13 shows that 76% of the respondents either 'Strongly agree' or 'Agree' with the statement that the role of the MPO in the decision-making process is to endorse the consensus reached by its members/participating stakeholders (Figure 7.15). This result is reinforced by Question 15, where 62% of the respondents indicated that the 'primary role' of the MPO is to reach consensus amongst its members/participating stakeholders (Figure 7.18).[737] However, the results to Question 14 are somewhat contradictory. Just over half (51%) of the respondents 'Strongly agree' and 'Agree' with the statement that the role of the MPO is to act as trustee on behalf of affected stakeholders without necessarily following majority views on important issues (Figure 7.16). The remaining responses were divided equally between those who disagree with the statement (24%) and those who were undecided (25%). The large number of people who selected 'Undecided' might be an indication that the question was poorly worded and hence many did not know how to respond. Interestingly, the Rawlsian approach to decision-making implied by Question 14 received more support from Directors and Program Managers than Transportation Planners/Engineers (Figure 7.17). This outcome might indicate that

[737] Several respondents felt that Question 15 was inappropriate since the options were not relevant to their situation and they were unable to provide an alternative response. Others argued that the MPO does not have a primary role. While these points are well taken, the question was designed to reveal the extent to which respondents perceived their MPO's approach to decision-making to be Rawlsian or non-Rawlsian (although these terms were not used). The range of possible answers was limited to force respondents to make a difficult choice.

those in charge of the MPOs and their programs are more attuned to the political necessity of considering the needs of disadvantaged groups, but it is not clear whether this concern is translated into practice by Transportation Planners/Engineers.

The results to Questions 13 and 15 are not surprising since a core function of the MPO - as stated by the U.S. DOT - is to "[e]*stablish and manage a **fair and impartial** setting for effective regional decisionmaking in the metropolitan area*" (FHWA and FTA 2003, p. 4, emphasis added). This requirement aligns with the 'cooperative' element of the 3-C planning process. The results from Question 15 imply that MPOs have not interpreted 'fairness' in a Rawlsian sense and are not exercising a Rawlsian view. The need to remain 'impartial' is perhaps the constraining factor that limits the MPO's ability to advocate for disadvantaged groups. However, the MPO is required "*to extend public participation to include people who have been traditionally underserved by the transportation system and services in the region*" (FHWA and FTA 2003, p. 2). The rationale is that "[n]*eglecting public involvement can result in proposed solutions that do not address the community's needs, unnecessary delays, litigation, and can erode public trust*" (ibid, p. 2). Hence, the MPO does have a trusteeship role to ensure that the 'voice' of all stakeholders is heard - especially those who are underrepresented or underserved - although it is to remain impartial and cannot advocate for certain affected groups.[738] An interesting question is whether this trusteeship role can be enhanced in a Rawlsian sense to strengthen the MPO's ability to represent underserved groups. Unless MPOs are able to give *preferential* consideration to underserved groups, this presents a significant barrier to adopting a Rawlsian approach to decision-making.

One area where an MPO does have the ability to influence the planning and decision-making process is through its principles or policy goals.[739] The following statement by an MPO Director in response to the questionnaire raises the importance of the MPO's principles and provides some useful insight into the MPO's decision-making process.

> "[T]*he MPO is seen as the place the consensus is forged around the MPO's principles. ... Our MPO has worked hard to ensure that both consensus-building and representation of a broad array of concerns are possible by establishing and respecting principles for operation that seek regional - not parochial - benefits and remind members to advocate for parties not at the table. As a result, we generally seek agreement on programs from members who have received no parochial gain*

[738] Of course, MPOs are required to comply with federal laws on discrimination (such as Title VI of the Civil Rights Act) and the Presidential Executive Order on Environmental Justice, but these call for 'equal' or 'nondiscriminatory' treatment and not for making the most disadvantaged members of society relatively better off under new policies, programs, or projects.

[739] While the MPO's principles or policy goals are likely to influence the transportation planning process, an interesting research question would be to assess how effective they are in practice. One can imagine a situation in which the principles or policy goals are sufficiently general to enable any type of project to be justified. Hence, an important question is whether projects/policies are initially designed or altered during the planning process to accommodate the regional/metropolitan transportation vision of the MPO, or whether they proceed by paying lip service to the MPO's objectives without making any substantive changes to problematic areas. Part of the answer is likely to depend upon the MPO's authority and whether it can prevent projects from moving through the decision-making/political process that are perceived to run counter to the regional effectiveness of the transportation system.

from the set of studies or projects selected" (MPO questionnaire feedback - anonymous).

The above feedback was made in reference to Question 13 and the statement that the role of the MPO is to 'endorse' the consensus reached by the MPO's members/participating stakeholders. The respondent's primary concern was that the MPO does not 'endorse' consensus. Instead, it 'facilitates' the consensus-building process that is guided by the MPO's principles or policy objectives.

The above discussion provides some insight into how the contradictory results from Questions 13 and 14 can be rationalized. While MPOs generally see their role as the facilitator of consensus (Question 13, Figure 7.15), many also see themselves having a trusteeship role (Question 14, Figure 7.16).[740] What is apparent, however, is that this trusteeship role is non-Rawlsian (Question 15, Figure 7.18).

If stakeholders are operating in a communitarian fashion (which is supported by the results from Questions 16 and 17) and the MPO adopts a consensus (i.e., non-Rawlsian) approach to decision-making, these two factors are likely to combine to promote communitarianism. Hence, the critical question is whether this combination is likely to result in Rawlsian outcomes. While it is not possible to know whether, and to what extent, communitarian stakeholders will develop Rawlsian outcomes - since the perception of a 'fair outcome' is likely to differ between communities - one would imagine that the strong emphasis on pursuing the greater social good (or common purpose) might prevent or minimize the marginalization of disadvantaged groups.[741] In this regard, it is *likely* that a Rawlsian outcome could be achieved. [Note: If the stakeholders had adopted a utilitarian posture and the role of the MPO remained the same, the chance of arriving at a Rawlsian outcome would have been *unlikely*. Therefore, the stakeholder posture is an important factor that contributes to the likelihood of arriving at a Rawlsian outcome.]

The discussion in this section indicates that the current regional transportation planning environment in the U.S. falls into the bottom two right-hand cells of Table 7.5 (Section 7.2.3.1). This observation means that the chance of arriving at a Rawlsian outcome from the transportation planning/decision-making process is either 'Likely' or 'Possible' - depending on the strength of the stakeholder posture. Hence, if a Rawlsian outcome is desired, the current (non-Rawlsian) role of the MPO will need to be reevaluated to determine the most effective way to address the needs of the most disadvantaged.

[740] This outcome is more pronounced for Directors and Programs Managers of MPOs than Transportation Planners/Engineers (Figure 7.17).
[741] The extent to which disadvantaged groups are considered and made better off from the transportation planning and decision-making process is the focus of the next section.

7.2.4 Extent to Which Specific Groups are Considered in, and Receive Benefits from, the Transportation Planning and Decision-Making Process

7.2.4.1 Rationale for Questions 18, 19, 20, and 21

While Questions 13 to 17 identify the *likelihood* of reaching a Rawlsian outcome given current transportation planning and decision-making processes, they provide no insight into the *actual* outcomes. Therefore, a second set of questions (18 to 21) was created to try to identify the extent to which specific groups are considered in the transportation planning and decision-making process and the perception of whether these groups receive any preferential treatment.

The first question, Question 18, asked respondents how often their MPO and its member entities considered certain groups in the transportation planning process. The groups identified in the question were:

- children/youth K-12;
- commercial beneficiaries of transportation (e.g., shopping centers);
- ethnic or minority groups;
- freight companies;
- low-income groups;
- physically disabled; and
- the elderly.

Five of the seven groups listed - excluding commercial beneficiaries of transportation and freight companies - might be considered as a disadvantaged or minority group or a group that requires special consideration.

Question 19 moved the focus from the 'consideration' of certain groups in the planning process to the perceived 'benefit' that these groups receive from transportation policies and programs. Specifically, it asked whether certain groups actually receive greater, the same, or less benefit than the average customer from an MPO's policies and programs. The average customer was considered to belong to middle-income groups. Since this question was likely to be difficult to answer, an option of 'cannot be determined' was provided. In addition, two of the groups from Question 18 - i.e., commercial beneficiaries of transportation and freight companies - were replaced with 'high-income' and 'middle-income groups' to ensure that the full range of transportation customers were represented. The change was also made to make it easier for respondents to compare their answers.

Questions 20 and 21 aimed to identify how frequently the groups listed in question 18 were the intended beneficiaries of specific projects included in an MPO's most recent transportation improvement program (TIP). Hence, the purpose of these questions was to identify whether certain groups were identified to receive specific attention.[742]

[742] Note: The results to Questions 20 and 21 are not shown in the following section since the questions had several problems; these are discussed in Section 7.2.4.3.

In conclusion, Questions 18 to 21 try to identify the extent to which specific groups are considered in, and receive benefits from, the transportation planning and decision-making process.

7.2.4.2 Results for Questions 18 and 19

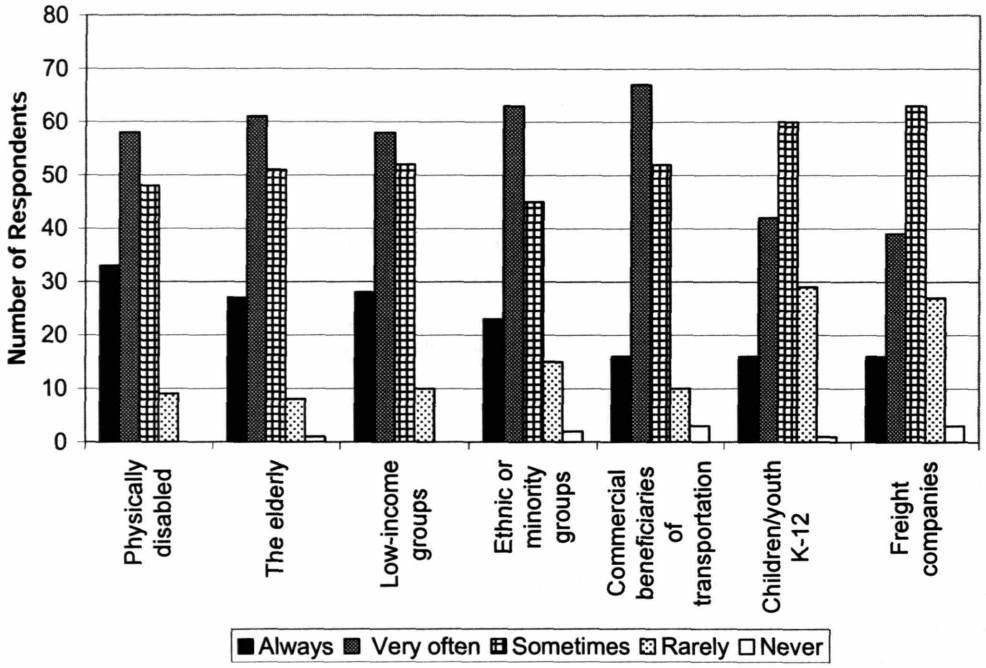

Figure 7.21: Question 18 - How often does your MPO and its member entities consider the following groups in the transportation planning process?

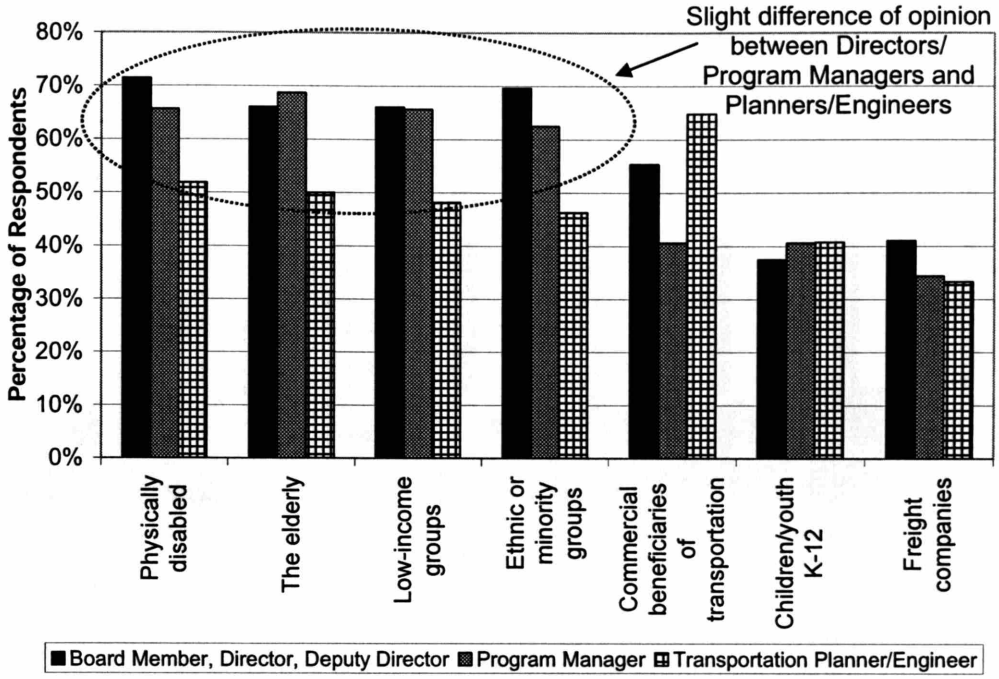

Figure 7.22: Percentage of Respondents (grouped by position in MPO) That *Always* or *Very Often* Consider the Groups Specified in Question 18 in the Transportation Planning Process

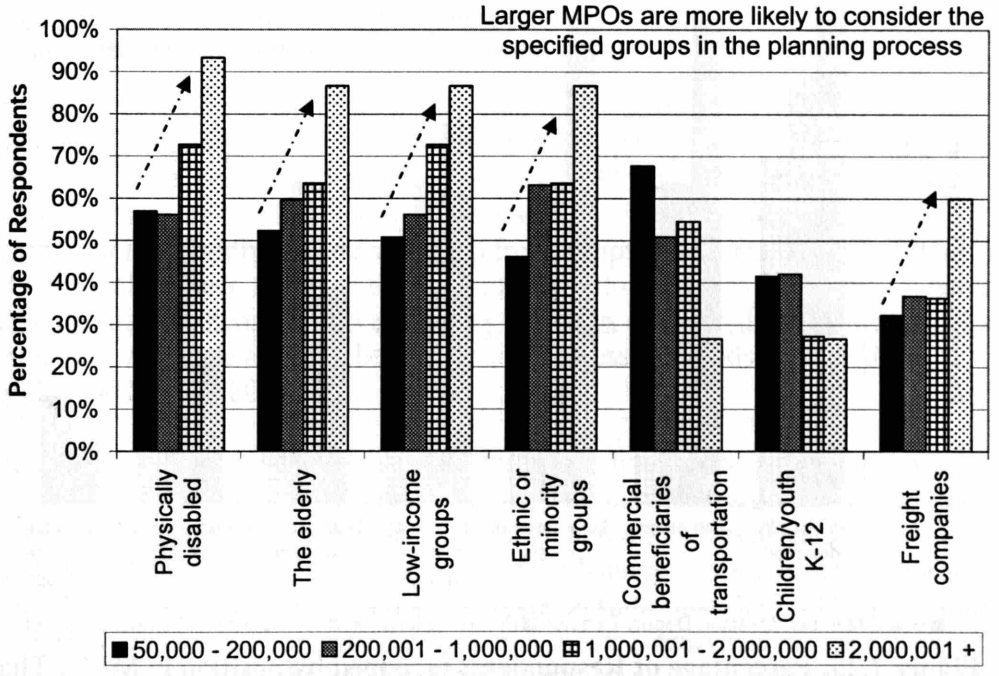

Figure 7.23: Percentage of Respondents (grouped by population served by the MPO) That *Always* or *Very Often* Consider the Groups Specified in Question 18 in the Transportation Planning Process

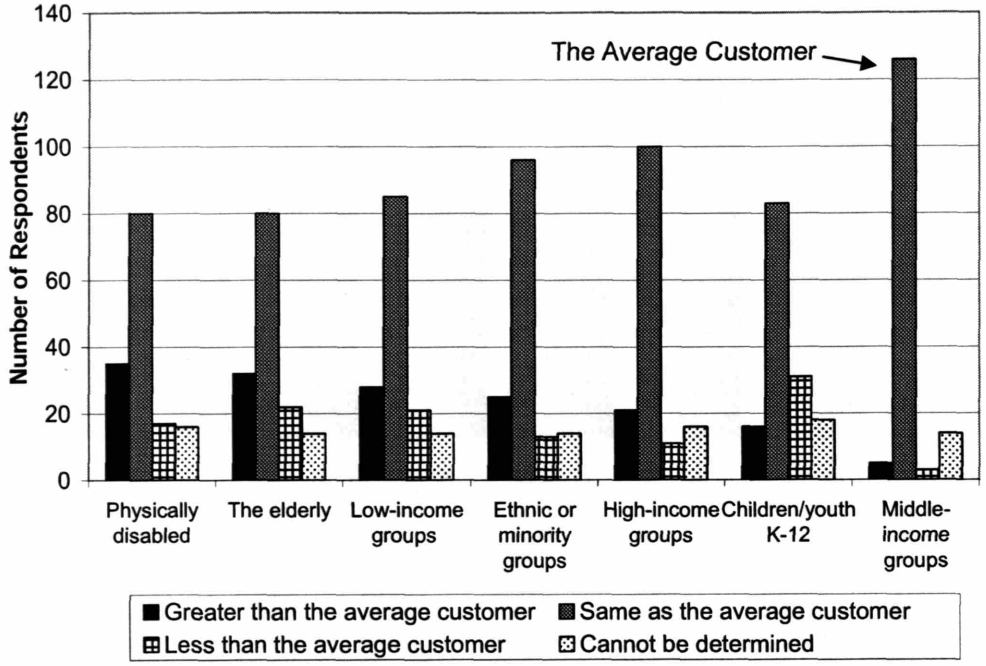

Figure 7.24: Question 19 - On average, to what extent do the customers in the following groups benefit from your MPO's transportation policies and programs?

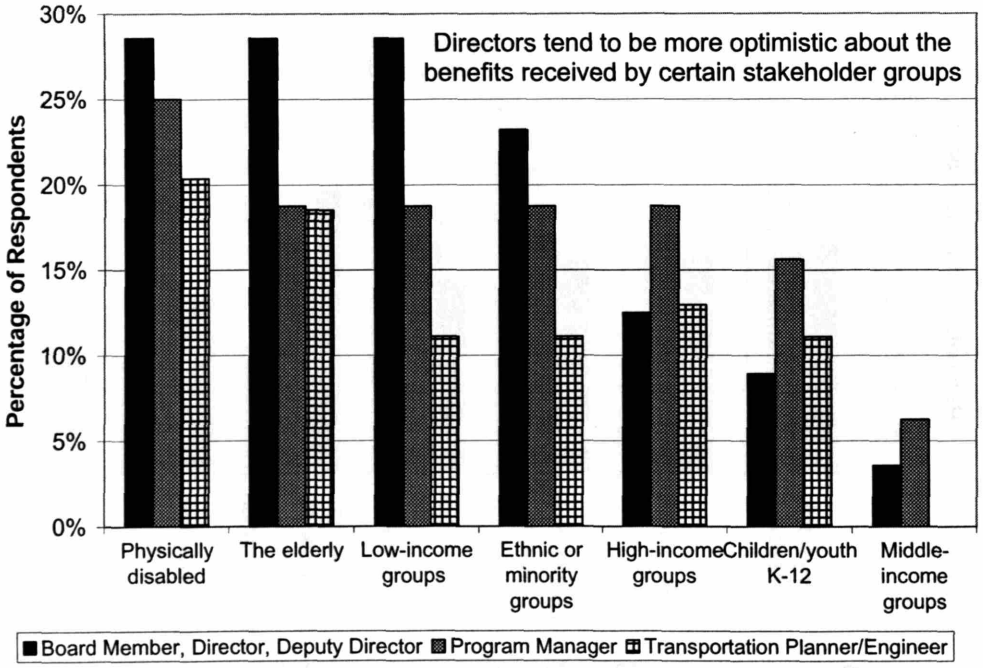

Figure 7.25: Percentage of Respondents (grouped by position in MPO) That Consider the Groups in Question 19 to Receive *Greater Benefit* Than the Average Customer from Their MPO's Transportation Policies and Programs

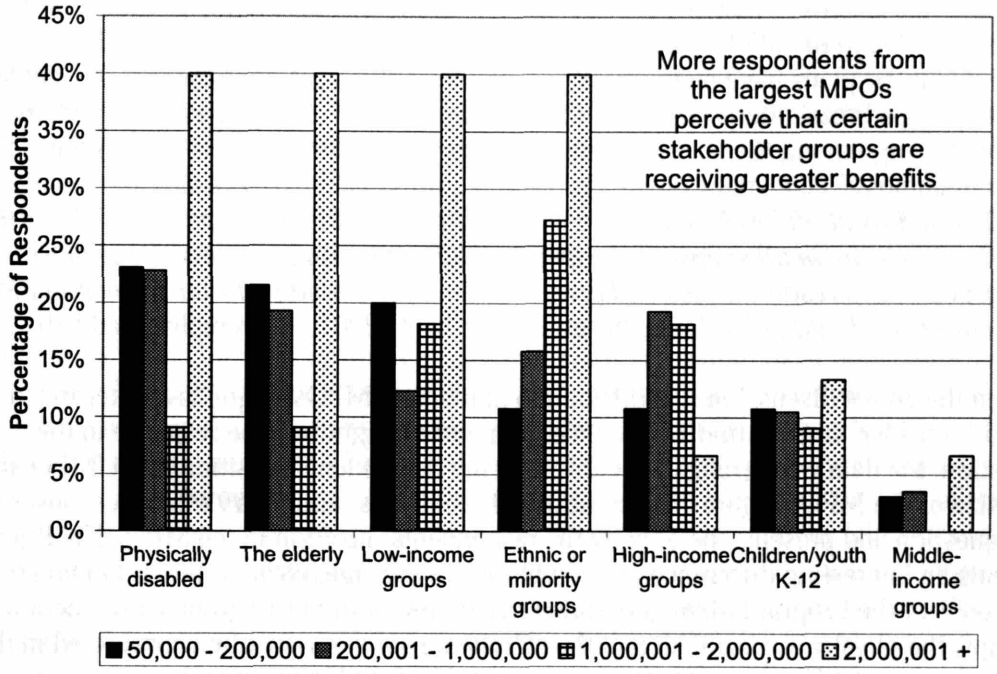

Figure 7.26: Percentage of Respondents (grouped by population served by the MPO) That Consider the Groups in Question 19 to Receive *Greater Benefit* Than the Average Customer from Their MPO's Transportation Policies and Programs

7.2.4.3 Discussion

The results to Question 18 indicate that the four most considered groups in the transportation planning process are ethnic or minority groups, low-income groups, the physically disabled, and the elderly (Figures 7.21, 7.22, and 7.23). The two least considered groups are children and freight companies. Commercial beneficiaries of transportation fall slightly outside of the top four groups. These results follow what one might intuitively expect, although the high consideration given to the elderly is perhaps the most debatable outcome. A recent survey of MPOs conducted by the MIT AgeLab indicated that very little action is being taken to address the needs of the elderly (Coughlin and Deonas 2005).

A potential difficulty with Question 18 is interpreting how the respondents viewed the word 'consider.' For example, it is relatively easy to 'consider' a group, but whether this consideration translates into real action is something quite different. In addition, the point at which stakeholder groups are considered in the planning process is also important. The current SAFETEA-LU planning guidance for MPOs states that the LRTP and TIP must be developed "*in cooperation with the State and public transportation operators*" (23 U.S.C. § 134 (c)(1)). Once the LRTP (or transportation plan) has been developed, the

stakeholders groups[743] must then be given "*a reasonable opportunity to comment on the transportation plan*" (23 U.S.C. § 134 (i)(5)(A)). Hence, stakeholders are to be consulted once the initial plans have been developed. Some MPOs have gone beyond this guidance by adopting a broad interpretation of the 3-C process. For example, a memorandum of understanding among the core planning agencies in the Montachusett Region states that the 'cooperative' element of the 3-C process requires "*effective coordination among public officials at all levels of government, inviting the wide participation of all parties, public or private, **at all stages of the transportation planning process**. A key objective of the process is to resolve issues and controversies by providing a forum for negotiation and consensus building*" (Montachusett Region MPO 2001, p. 4, emphasis added).

Given the above discussion it is difficult to know how MPOs might have interpreted the word 'consider' in Question 18. To help gain more insight into the response to this question, the data was arranged according to the respondents' position in the MPO and by the size of the MPO. Figure 7.22 combines the 'Always' and 'Very often' responses to the question and presents the data by the respondents' position in the MPO. The figure reveals an interesting difference in perception. On average, 68% of the MPO Directors and 66% of the Program Managers stated that ethnic or minority groups, low-income groups, the physically disabled, and the elderly are always/very often considered in the planning process. This is in contrast to about 49% of the Transportation Planners/Engineers. This difference in perception might be explained by the fact that Directors, Program Managers, and Transportation Planners/Engineers are likely to be involved in, and responsible for, different aspects of the planning process.

Figure 7.23 combines the 'Always' and 'Very often' responses to Question 18 and arranges the data according to the population served by the MPO. The analysis shows that as the size of the MPO increases, so does the likelihood that most of the stakeholder groups will be considered in the planning process. One possible explanation for this trend is that larger metropolitan areas are more likely to have established stakeholder groups that can actively advocate on behalf of their members.[744] In the smaller metropolitan regions, disadvantaged groups might not have the critical mass to capture their MPO's attention. If true, this hypothesis raises the importance of the MPO adopting a trusteeship role on behalf of disadvantaged groups that are unable to represent themselves in the planning process.

Question 19 builds upon Question 18 and is designed to determine whether particular stakeholder groups are perceived to benefit to a greater, the same, or lesser extent than

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[743] In SAFETEA-LU, stakeholder groups include "*citizens, affected public agencies, representatives of public transportation employees, freight shippers, providers of freight transportation services, private providers of transportation, representatives of users of public transportation, representatives of **users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled**, and other interested parties*" (23 U.S.C. § 134 (i)(5)(A), the emphasized text highlights stakeholder groups that were added to those included in TEA-21).

[744] This explanation might also explain why children and commercial beneficiaries of transportation do not follow the same trend since they are not cohesive and active stakeholder groups. However, individual commercial beneficiaries of transportation are likely to be very active on localized issues that directly affect their business.

the average customer from MPO transportation policies and programs. The results show that, on average, 63% of the respondents perceive that each group receives the same benefit as the average customer from its MPO's policies and programs. This outcome seems to indicate a strong egalitarian approach to the delivery of transportation services. Also, the fact that middle-income groups were seen as the 'average customer' (i.e., they received the highest number of votes for the 'Same as the average customer' option) helps validate the question. Hence, the logic respondents used to answer the question is as follows: compared to middle-income groups, group 'X' receives greater, the same, or less benefit.

The outcome from Question 19 reveals a slight Rawlsian leaning, most noticeably towards the physically disabled and the elderly. On average, about 15% of the respondents answered Question 19 by selecting 'Greater than the average customer.' While care must be taken when looking at such a small percentage of the sample, if the data is arranged according to the respondents' position in the MPO and the size of the MPO, two interesting observations can be made. First, the perception of Directors (and to a lesser extent Program Managers) in this subset of data (Figure 7.25), and the largest MPOs (Figure 7.26), is that ethnic minority groups, low-income groups, the physically disabled, and the elderly are receiving greater benefit from the MPOs' policies and programs than the average customer.[745] Second, just behind these four groups are high-income groups. This result indicates that the wealthy are perceived to gain almost as much as disadvantaged or minority groups from transportation services. This outcome is to be expected - and is not inherently bad - since the wealthy have the resources to take advantage of transportation services. If more market-oriented policies are developed to control congestion, one might expect this perception to increase as the wealthy can afford to buy the right to drive during congested times. However, if the benefit received by this group becomes significantly greater than that received by disadvantaged groups, this outcome would raise concerns for equity across income groups.

Notwithstanding the above observations, transportation planning seems to be led by egalitarianism. An important question, therefore, is whether delivering equal benefits is a sufficient outcome. For example, running buses and trains on time is an egalitarian approach to transportation services that does not appear to raise questions relating to Rawlsian fairness. However, the accessibility of these services to disadvantaged groups is a Rawlsian concern. Hence, one could argue that the operation and maintenance of the transportation system should be approached from an egalitarian perspective and the design of services should be subject to Rawlsian considerations. This observation has important implications for the creation of a more sustainable transportation system.

When the initial results to Questions 18 and 19 were discussed with senior members of the Government Accountability Office (GAO) and the Congressional Research Service (CRS), there was a certain amount of skepticism about whether they were an accurate

[745] Interestingly, three of the top four groups that receive *greater* benefit than the average customer (i.e., the elderly, low-income groups, and the physically disabled) are, along with children, the top four groups perceived as receiving *less* benefit than the average customer from the MPOs' policies and programs (Figure 7.24).

portrayal of real life situations. The general comment made was that if each of the stakeholder groups included in the questions were asked how well their needs are being served, it is likely that they would give a very different response to that indicated by the questionnaire results. For example, the CRS was skeptical of whether any real consideration is given to freight companies in the transportation planning process.[746] While the absolute values expressed by respondents might be an overrepresentation, the general patterns/distributions of the data are believed to be valid.

Questions 20 and 21 were designed to try to obtain some real numbers to support or dispute the results from Questions 18 and 19. The intent was to identify the percentage of projects that were selected for the TIP with certain groups in mind. While many respondents did try to answer Questions 20 and 21, the overwhelming response was that they could not be answered in a meaningful way and any results would not be representative of their MPO's decision-making process. For example, several respondents indicated that, as a general rule, their MPO does not consider projects in relation to the benefits received by specific groups. Instead, funding is distributed among 'categories' such as rehabilitation/operational improvements, transit, rideshare, bicycle and pedestrian facilities, etc. rather than stakeholder groups. Others commented on how their MPO's projects have multiple user benefits that impact groups in different ways, preventing them from answering the questions. Given the concerns expressed by the respondents, it would not be appropriate to draw any conclusions from these two questions.

In conclusion, the data obtained from Questions 18 and 19 support the conclusions drawn from Questions 13 to 17. While there is a general concern for the well-being of disadvantaged groups in the transportation planning process, the predominant approach to decision-making is one of consensus building and the equal distribution of transportation benefits to customers. However, if individuals receive an equal opportunity to use a transportation service, an important question is whether they have the capability to realize the benefits from this service.[747]

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[746] However, one might argue that this situation is likely to change as increasing levels of congestion and a lack of system capacity begin to threaten economic growth.

[747] See Sections 2.2.3 and 6.2.4.4 for a detailed discussion of the difference between *equality of opportunity* and *equality of capabilities*.

7.2.5 Extent to Which Core Elements of the Hybrid Trade-off/Positional Analysis Framework are Considered in the Transportation Planning/Decision-Making Process

7.2.5.1 Rationale for Questions 11, 12, 22, 24, and 27

One of the central elements of the sustainable transportation decision-support framework is the hybrid trade-off/positional analysis framework.[748] This framework is intended to support the analysis of existing, and the development of new, transportation policies and programs and was created as an alternative to tools such as benefit-cost analysis. The framework also provides an environment within which the Rawlsian/utilitarian decision-making philosophy can be applied.

It is important to recognize that while the hybrid trade-off/positional analysis framework is seen to support the core objectives of sustainable development, many MPOs might be using different approaches that also aim to transition the transportation system towards sustainable development. Thus, if the questionnaire results show little support for the proposed analysis framework, this does not mean that MPOs are not taking proactive steps to develop a more sustainable transportation system. It simply means that they are not using the approach envisioned in this research.

The hybrid trade-off/positional analysis framework is described by the six steps summarized in Table 7.6. Since it was not practical to ask questions about all of the steps, the MPO questionnaire focused on three. The relevant questions from the MPO questionnaire are identified within brackets in Table 7.6, some of which have been discussed in previous sections.

Table 7.6: The Six Steps of the Hybrid Trade-off/Positional Analysis Framework

Step	Description
1	**Describe the problem in an institutional context** Identify stakeholder groups and their associated roles. [*No question has been asked.*]
2	**Identify the problem** Describe the societal or technical problem in need of attention (e.g., unmet needs or technical/institutional failure) [*Question 22*] and identify any prior attempts to resolve the problem.
3	**Represent the initial problem using a trade-off matrix** [*Question 11*] Identify the extent to which the problem affects each stakeholder group and highlight any inequalities.

[748] For a discussion of the hybrid trade-off/positional analysis framework, see Sections 4.2.1.4 to 4.2.1.7.

Step	Description
4	**Develop alternatives** Make a creative effort to formulate several alternatives to address the problem [*Questions 12, 22, and 27*], paying special attention to distributional inequalities [*Questions 18, 19, 20, and 21*]. The alternatives should be developed in consultation with the stakeholder groups [*Question 24*] and should be formulated using the Rawlsian/utilitarian decision-making philosophy [*Questions 13, 14, 15, 16, and 17*].
5	**Analysis** Use the trade-off matrix to qualitatively and quantitatively assess (in a comparative manner) the likely outcomes from each alternative proposed. Evaluate the likelihood that an alternative will solve the problem under different future scenarios. Particular attention should be paid to whether distributional inequalities are adequately addressed and whether the alternative is sufficient to encourage a system transformation towards sustainable development. [*No question has been asked.*]
6	**Select option and implement** Inform the decision-maker(s) of different values and/or ideological orientations - e.g., ideas of development and progress - that are relevant to the situation under analysis and identify how these might create barriers to the implementation of a specific alternative. Identify strategies to address value conflicts, recognizing that political coalition-building is likely to play an important role in shaping the final policy. [*No question has been asked.*]

The second step of the hybrid trade-off/positional analysis framework is important since it defines the scope of the analysis. If a problem is inadequately identified at this stage, it is likely that any solution to the problem will fail to address its root cause. Question 22 of the MPO questionnaire was designed to identify the breadth of issues that MPOs consider when developing a new transportation policy/project (which is directly related to the problem definition). The question asked respondents to indicate the extent to which efforts are made to improve the following areas:

- Unmet transportation needs and demands;
- The adequacy of incentives designed to encourage a desired travel behavior;
- The adequacy of existing public/private institutions at managing/operating the transportation system;
- The adequacy of existing (federal/state/regional) legislation;
- The extent to which existing (federal/state/regional) legislation is implemented; and
- The adequacy of existing transportation technologies.

This list identifies what are believed to be the full range of potential areas where problems/solutions can arise - i.e., [1] economics and markets; [2] legislation and political process; [3] public/private sector management; and [4] technical system capabilities. Hence, the rationale behind Question 22 was to identify the extent to which the full range of options is considered when defining a problem.

The third step of the hybrid trade-off/positional analysis framework is to represent the initial problem using a trade-off matrix. Therefore, the purpose of Question 11 was to determine which type of analysis tool an MPO or its member entities use when assessing the potential impacts of a transportation policy or project. The respondents were provided with the following four options:

- A benefit-cost analysis is used - i.e., environmental and social impacts are translated into a monetary value for comparison;
- Environmental, social, and economic factors are left in their natural units (e.g., environmental effects are expressed in terms of damage to ecosystems, health and safety effects are expressed in terms of morbidity, and economic effects are expressed in monetary terms) and compared/traded-off against one another;
- An analysis of impacts is rarely undertaken; and
- Other (please specify).

The second option above provides a generic description of the trade-off analysis framework.

The fourth step of the hybrid trade-off/positional analysis framework is perhaps the most important since it is where policy alternatives are developed to address the identified problem. Several questions in the MPO questionnaire combine to address the adequacy with which MPOs develop and consider alternatives in their planning and decision-making processes. First, Question 12 was created to gain some insight into how often more than one alternative is considered when selecting a transportation project for an MPO's transportation improvement program (TIP). Since the consideration of alternatives is required as part of the 'New Starts' program, respondents were asked to disregard alternatives related to this program in their answer.[749]

Second, Question 22 (discussed above) provides some insight into the breadth of issues that an MPO considers when developing alternatives. If the range of potential alternatives/solutions to a problem is limited, this reduces the likelihood that a problem will be adequately addressed.

Third, an important argument made in Chapter 6 is that transportation policies (and alternatives) need to be integrated (with one another and with other policy areas) to achieve a more purposeful movement towards sustainable development. Therefore, Question 27 was developed to try to determine the extent to which transportation plans are integrated, coordinated, or not connected with the following policy areas:

- Urban/regional development plans;
- Health and human services;
- Environmental regulation;
- Employment policy;
- Economic policy;
- Energy policy; and
- Trade policy.

[749] Note: The results to Question 12 are not shown in the following section since the question had several problems that are discussed in Section 7.2.5.3.

Fourth, the fourth step in the hybrid trade-off/positional analysis framework is where the Rawlsian/utilitarian decision-making philosophy can be used in the design of alternatives. Sections 7.2.3 and 7.2.4 provide the rationale behind the questions that were designed to explore the likelihood of achieving a Rawlsian outcome [Questions 13, 14, 15, 16, and 17] and the extent to which distributional impacts are considered [Questions 18, 19, 20, and 21] in the transportation planning and decision-making process, respectively. No additional questions on the Rawlsian/utilitarian decision-making philosophy were asked since this topic had already been covered extensively.

Finally, in situations where a community is able to reach a consensus on the type of transportation system it would like in the future, it may be helpful to develop alternatives (i.e., transportation policies/programs) using a backcasting methodology.[750] To assess the extent to which backcasting is used, Question 24 asked whether MPOs use a visioning process to develop their long-range transportation plans in which decision-makers and stakeholders first identify a desirable future and then work backwards to identify pathways to that future. Respondents were provided with some additional information stating that backcasting should not be confused with scenario analysis, which develops several future scenarios to evaluate how well current transportation policies might perform under each scenario. This information was provided since there is an important distinction between the two approaches - i.e., backcasting attempts to shape the future, whereas scenario analysis does not.

In conclusion, about half of the questions in the MPO questionnaire were designed to explore the differences between the current transportation planning and decision-making process and the process articulated by the hybrid trade-off/positional analysis framework (which includes the Rawlsian/utilitarian decision-making philosophy).

[750] For a discussion of backcasting and how it is different from other visioning techniques such as scenario analysis, see Section 4.2.6.

7.2.5.2 Results for Questions 11, 22, 24, and 27

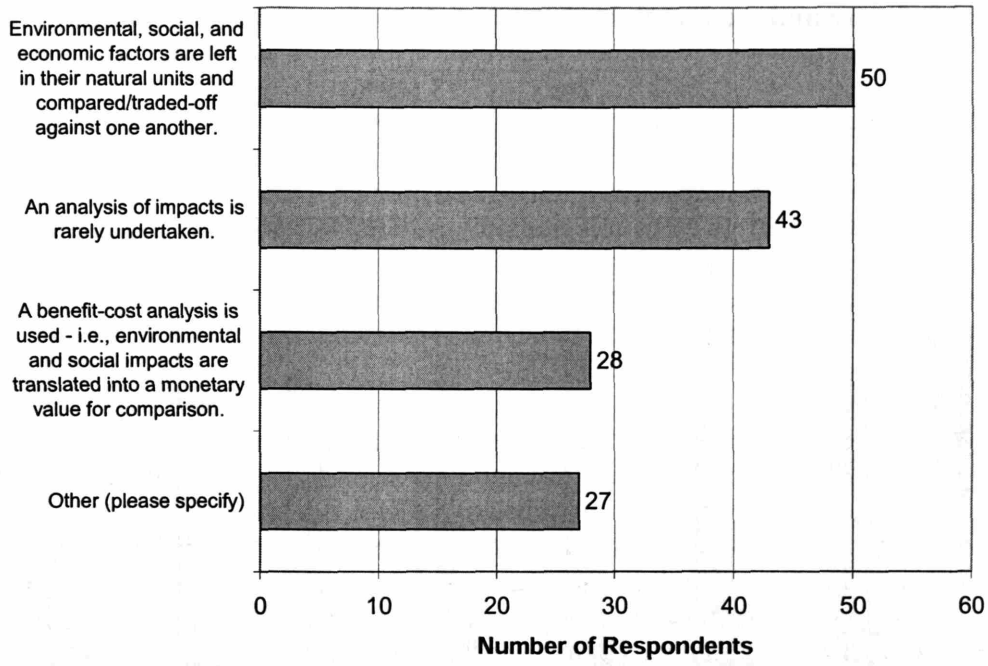


Figure 7.27: Question 11 - How does your MPO or its member entities assess the potential impacts of a transportation policy/project?

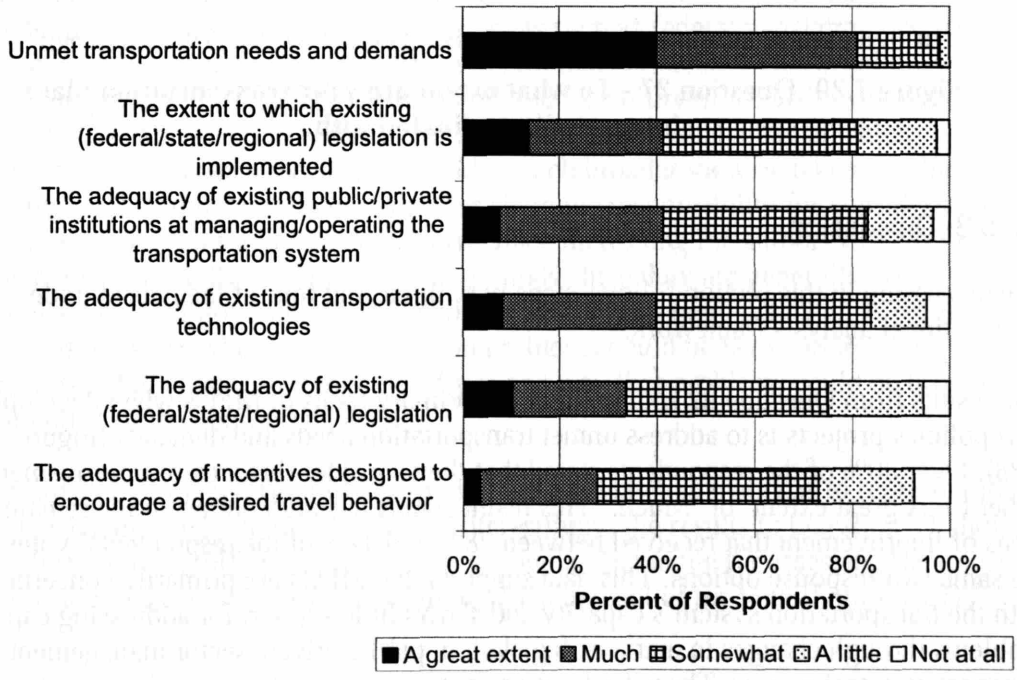


Figure 7.28: Question 22 - When developing new transportation policies/projects, to what extent are efforts made to improve the following areas?

Table 7.7: Question 24 - Does your MPO use a visioning process to develop its long-range transportation plan in which decision-makers and stakeholders first identify a desirable future and then work backwards to identify pathways to that future?

Yes	**73 (49%)**
No	**75 (51%)**

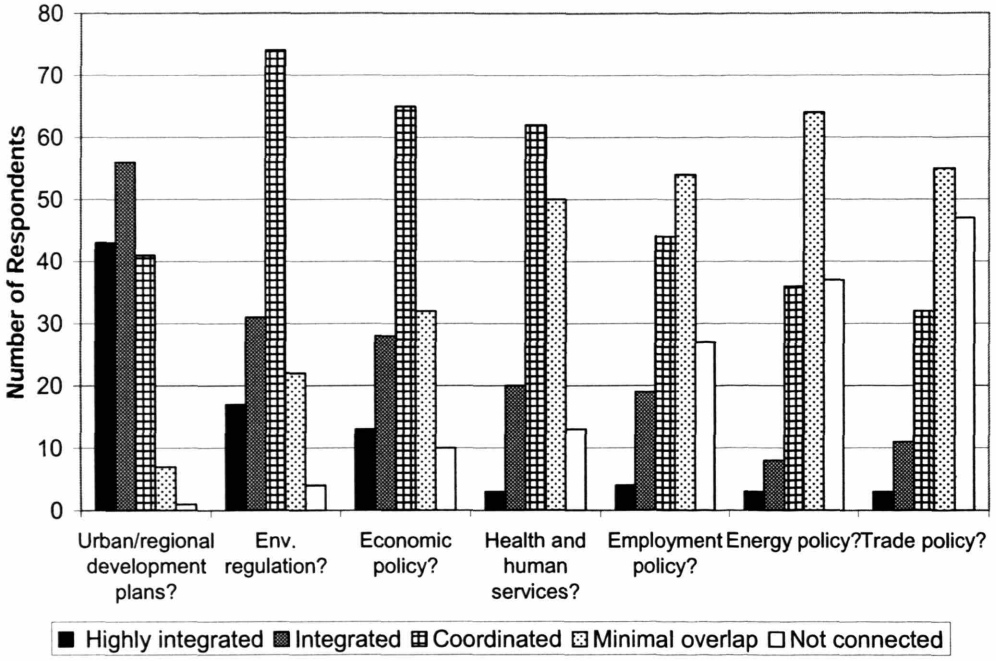


Figure 7.29: Question 27 - To what extent are your transportation plans integrated/coordinated with:

7.2.5.3 Discussion

The discussion in this section follows steps two, three, and four of the hybrid trade-off/positional analysis framework.

The results from Question 22 indicate that the primary focus of MPOs when developing new policies/projects is to address unmet transportation needs and demands (Figure 7.28). Over 80% of the respondents stated that they consider this area of improvement either to 'A great extent' or 'Much.' This result stands in stark contrast to the remaining areas of improvement that received between 28% and 41% of the respondents' votes for the same two response options. This data suggests that MPOs are primarily concerned with the transportation system's capacity and shows little support for addressing capacity problems through changes in markets, legislation, public/private sector management, and transportation technology. These findings are not surprising when considered in the

context of MPO planning guidance and authority. For example, the FHWA and FTA encourage MPOs to consider a number of steps in the planning process. These are:

- "*Monitoring existing conditions;*
- *Forecasting future population and employment growth;*
- *Assessing projected land uses in the region and identifying major growth corridors;*
- *Identifying problems and needs and analyzing, through detailed planning studies, various transportation improvements;*
- *Developing alternative capital and operating strategies for people and goods;*
- *Estimating the impact of the transportation system on air quality within the region; and*
- *Developing a financial plan that covers operating costs, maintenance of the system, system preservation costs, and new capital investments*" (FHWA and FTA 2003, p. 3).

The rationale behind this planning guidance seems to be very much in the realm of predicting and responding to problems through transportation improvements. Given this direction, it is not surprising that MPOs showed little support for addressing problems using alternative policy instruments. The lack of support for policies/projects aimed at addressing travel behavior or improving transportation technologies in Question 22 (Figure 7.28) provides some indication of a potential bias towards the traditional approach to addressing transportation problems (i.e., through capacity enhancements).

The results to Question 22 are problematic for the second step of the hybrid trade-off/positional analysis framework. If the breadth of issues that MPOs consider when developing a new transportation policy/project is constrained by planning guidance, funding, or the ability of MPOs to address areas such as federal legislation, the likelihood of adequately addressing the root cause of a problem is reduced. This point raises two important questions: [1] should the authority and capability of MPOs be dramatically increased to enable them to consider the full range of potential areas in which problems/solutions can arise, or [2] should a much broader view be taken in which local, state, regional, and federal bodies/agencies share the responsibility for considering the full range of problems and their solutions? Since increasing the authority of MPOs is problematic, especially on constitutional grounds since they are generally not a recognized level of government, the second option seems more practical. A requirement for MPOs to assess whether transportation problems could be better addressed by changes that fall outside of their authority is one way that problems could be brought to the attention of the appropriate agency.

The third step of the hybrid trade-off/positional analysis framework is to represent the initial problem using a trade-off matrix. Interestingly, the results to Question 11 show that a form of trade-off analysis is the most popular technique for assessing the impacts of a transportation policy/project, receiving 34% percent of the vote (Figure 7.27).[751] A

[751] One possible reason why trade-off analysis received the most support is that it closely mirrors the political process in which decision-making occurs through consensus building and negotiation. Since

relatively high number of respondents selected the option that an analysis of policies/projects is rarely undertaken (29%) and about one fifth of the respondents (19%) indicated that a benefit-cost analysis (BCA) is used. The remaining respondents (18%) provided an alternative response (Box 7.1).

Box 7.1: A Representative Selection of the Open-Ended Responses to Question 11

- "[A]re you talking about a project in the long-range plan, a project selection process for the TIP, or the actual project development by the sponsor agency? The level of analysis would vary depending on the project stage."
- "Varies by program, performance measure and/or project selection criteria. For example, in the transportation plan aggregate impacts of system changes on air quality, capacity deficiencies, speeds, accessibility or a variety of other measures may be used. At the programming stage, specific impacts such as safety or pavement condition associated with the project may be used. We identify performance measures and project selection criteria and short- and long-term investments strategies in the transportation plan for 25 different program categories or project types as we redesign the process to be more performance based and strategic over the longer term."
- "An either/or choice in this question is not helpful. We deal with quantitative analyses including standard economic evaluation. We also use full cost calculations that address monetary costs of social and environmental impacts. We also emphasize non-monetary quantitative values (such as a level-of-compatibility measure of traffic impact on residential quality of life.) Further, we deal with a range of qualitative considerations including consistency with local land use plans."
- "Our long range plan is more driven by fiscal constraint than 'need' for facilities. Most of our plan consists of 'legacy' projects that we have planned for years, or decades, but have not built sooner due to funding constraints."
- "The analyses are generally tightly dictated by the federal funding stream requirements."
- "We look at the effects upon the existing and future transportation system, and environment, as well as considering goals in major corridor studies and master plans and the impacts/benefits to pedestrian and bike access."
- "Long Range Plan is prioritized based on how well ... projects address the TEA-21 Planning Factors. The plan's priorities, however, are largely ignored by [the state] DOT, which ultimately decides project selection and implementation schedules."

The broad range of responses to Question 11 can partly be explained by the fact that since MPOs are typically not project sponsors - a role that generally resides with state DOTs and transit agencies - they do not tend to be responsible for identifying and evaluating new policies/projects. While the question tried to capture this fact by referring to an MPO's member entities, the large number of respondents that stated that an analysis is rarely undertaken indicates that many were probably responding in reference to the MPO. The open-ended responses to Question 11 also indicate that it would have been helpful to have refined the question to focus on the analysis tool(s) used to evaluate projects developed for the LRTP. Finally, if MPOs have the capacity to sponsor projects, they are likely to use a range of analysis techniques rather than relying on one.

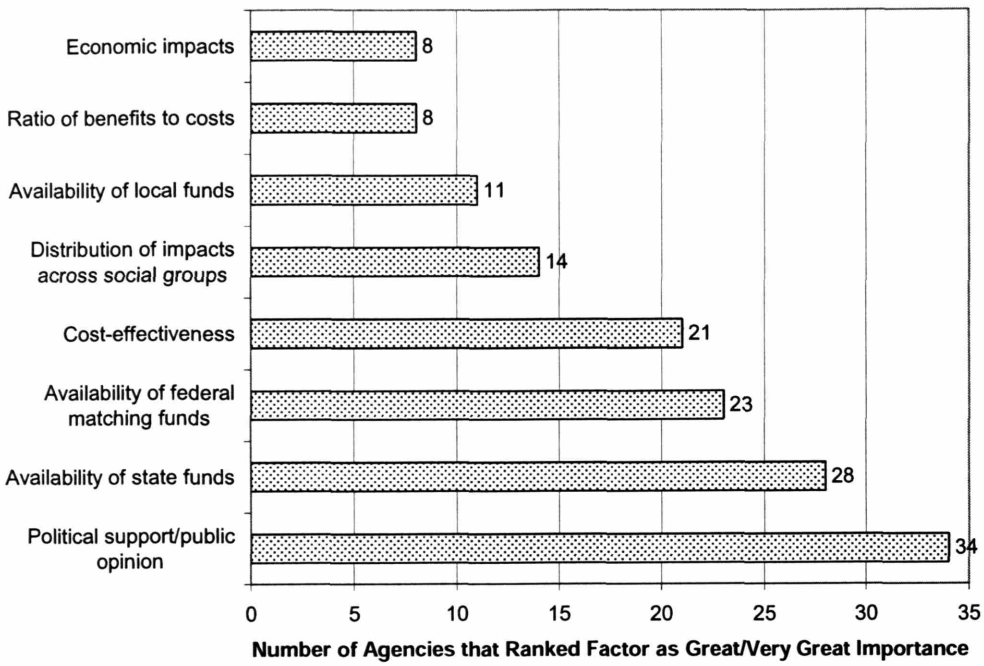
MPOs shape the environment in which these activities occur, the significant support for trade-off analysis seems plausible.

During a discussion of the MPO questionnaire with the GAO, several staff members indicated that the results to Question 11 were relatively consistent with what they had found from studies looking at how transportation investment decisions are made (GAO 2004; 2005b). However, a word of caution was provided. In the GAO studies, state DOTs and transit agencies were initially asked whether BCA was used, most stated that they undertook BCA on large projects. However, when pressed on the structure of the models and what the BCA analysis included, the discussions quickly broke down. While there was a general sense that BCA was undertaken, in reality only a few agencies conducted what might be considered to be a formal analysis. Hence, it is likely that the same situation would occur with the response to Question 11 for both the BCA and trade-off analysis options. For example, while over one third of the respondents stated that their MPO considered trade-offs, it is unlikely that these trade-offs are made using the analysis framework envisioned in Sections 4.2.1.4 and 4.2.1.5.

A closer look at the GAO's (2005b) study of how state DOTs and transit agencies consider the benefits and costs of new highway and transit investments, respectively, provides some insight into the importance that these 'MPO member entities' place upon certain analysis techniques. Figures 7.30 and 7.31 indicate that for both organizations the two major considerations that influence decisions to recommend projects are [1] political support/public opinion and [2] available funding. The influence of a formal economic analysis (i.e., BCA, cost-effectiveness, or economic impact analysis) or studies of the distributional impacts of a project across social groups[752] have much less influence on whether a project will be recommended. Interestingly, these analysis techniques are significantly less important for state DOTs than transit agencies, which is a reflection of the more onerous planning requirements for new transit projects.

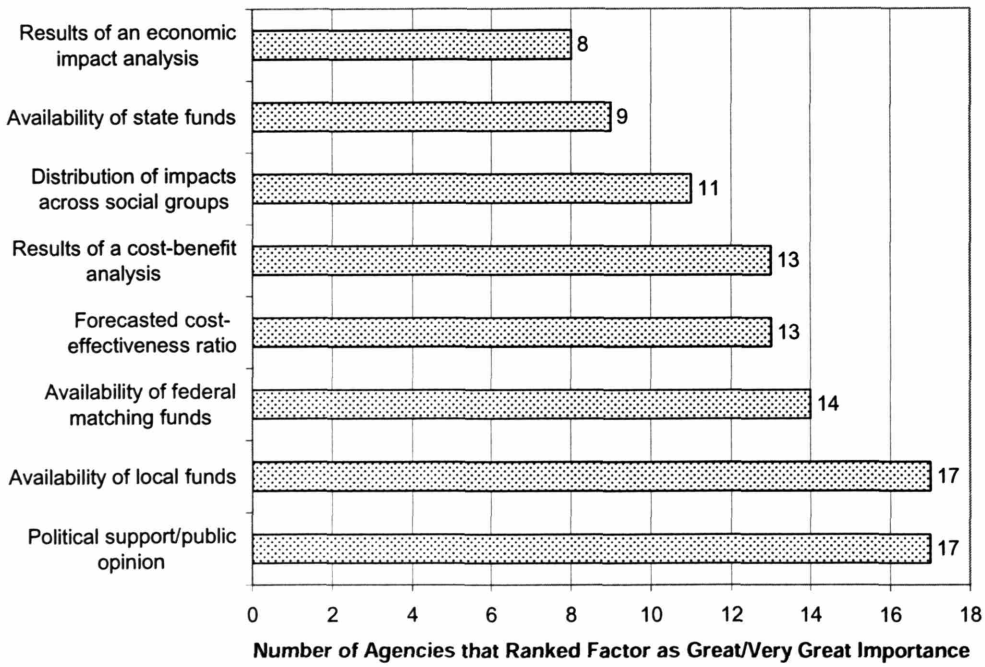
While the GAO (2005b) study does not identify the extent to which different analysis techniques (other than economic) are used, it does indicate that a decision-support tool that is more closely aligned with the political process is likely to be of real value to decision-makers. Since the hybrid trade-off/positional analysis framework essentially mirrors the political process, it should provide state DOTs, transit agencies, and MPOs with a useful way to present their decision-making process in a transparent and accountable manner.

[752] The distributional impacts of a project can be considered as a proxy for trade-off analysis; however, it is likely that the state DOTs and transit agencies were only considering the distribution of 'economic impacts' when responding to the GAO's question. Hence, to the exclusion of social and environmental impacts, only one third of the measures included in a trade-off matrix might have been considered.



Source: GAO (2005b, p. 28). [Note: Forty state DOTs responded to the GAO's survey.]

Figure 7.30: GAO Data - State DOTs' Survey Responses to Factors of Great or Very Great Importance in the Decision to Recommend a Highway Project



Source: GAO (2005b, p. 29). [Note: Nineteen transit agencies responded to the GAO's survey.]

Figure 7.31: GAO Data - Transit Agencies' Survey Responses to Factors of Great or Very Great Importance in the Decision to Recommend a Transit Project

The last three questions discussed in this section are related to the fourth step of the hybrid trade-off/positional analysis framework - i.e., the development of a wide range of alternatives to address transportation problems.

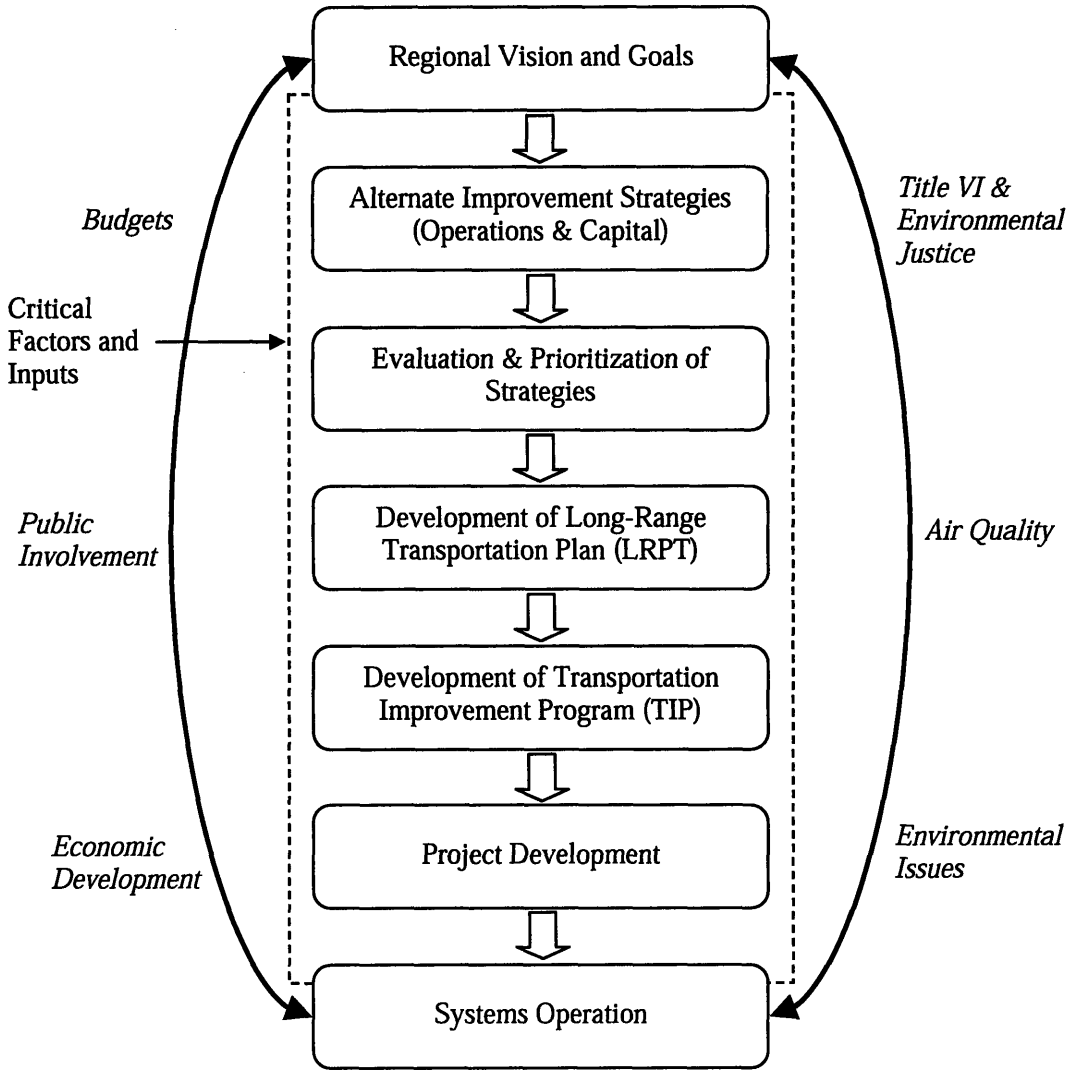
Question 12 was created to try to obtain some insight into the extent to which the respondents' MPOs consider more than one alternative when selecting projects to be included in their TIP. A problem with Question 12 was the decision to focus on the TIP. The question effectively asked whether MPO boards consider more than one 'alternative project or solution' when trying to find the best way to address a problem. However, discussions with the FHWA and FTA and feedback from the respondents highlighted the fact that an MPO board rarely has the opportunity to decide between two or more projects that could address the same problem. The real decision facing the MPO board is which problem to address given financial constraints. The decision of how to address a problem occurs much earlier in the planning process. An additional concern was that Transportation Planners/Engineers might have interpreted the question quite differently from MPO Directors and Program Managers. Since the former group is responsible for the analysis of alternatives at the conception of a project, it might have responded to the question from this perspective. For the above reasons, the results from Question 12 have not been included in the analysis.[753]

While the MPO is in a good position to consider the trade-offs associated with different alternatives, the requirement to consider alternatives in the NEPA process and New Starts programs pushes the development and evaluation of alternatives upstream. Hence, it is the MPOs' member entities (e.g., state DOTs or transit agencies) that are likely to be actively involved in the development and evaluation of alternatives. This observation means that care needs to be taken when developing strategies to broaden the scope of issues included in an alternatives analysis. While MPOs might not be responsible for developing the majority of transportation projects, they are in a good position to review whether the projects presented to them offer the best solution to the problem(s) being addressed. This point provides a good link to Questions 24 and 27, which identify the extent to which transportation plans are guided by a visioning process and important policy areas, respectively.

The replies to Question 24 indicate that half of the respondents' MPOs use some form of backcasting approach to develop their LRTP (Table 7.7). This outcome is not surprising since MPOs are encouraged to develop their transportation plan based upon a regional vision and goals (Figure 7.32). However, two questions can be raised in response to this result. First, do the MPOs' regional vision and goals support sustainable development/transportation? Second, if so, are the necessary and difficult steps being taken to realize this vision (in a strict backcasting sense), or are projects and policies only being guided by the vision and are unlikely to achieve it? While it is not possible to

[753] In hindsight, a better question would have been the following: When developing new transportation projects - with the exception of transit projects funded by 'New Starts' - how often is more than one alternative project or solution considered? Given the feedback received on Question 12, the leading response to this revised question would most likely have been 'Always' or 'Very often.'

answer these questions without further research, the level of support for backcasting should be viewed with these two questions in mind.



Source: Adapted from FHWA & FTA (2003, p. 3).

Figure 7.32: The Metropolitan Transportation Planning Process

Given that the transition towards a more sustainable transportation system is likely to present some difficult challenges, providing the MPO with sufficient authority to encourage/support/enforce the consideration of a broader range of alternatives would be a positive step forward. In addition to establishing the guiding principles for the development of projects for the transportation plan, the MPO needs to have a mechanism to veto projects that clearly run counter to the regional vision and goals. As mentioned previously, the MPO is also in a good position to inform the appropriate state and federal agencies of alternatives/solutions that lie outside of its authority.

Question 27 considers the development of transportation plans from a different perspective by asking respondents about the extent to which their plans are integrated/coordinated with other core policy areas. The results show a high level of integration with urban/regional development plans, a relatively high level of integration/coordination with environmental regulation and economic policy, and much less integration/coordination with the other policy areas (Figure 7.29).

Several respondents were critical of Question 27 since they were uncertain whether the question was referring to state or national policies and questioned whether some of the policy areas were relevant. Since the intent of the question was to gauge the full range of areas that an MPO might consider in its transportation plan, no policy level was provided to keep the question as general as possible. In addition, while policy areas such as employment, energy, and trade are generally considered to be the responsibility of the federal government, these issues also have regional significance, especially when placed in the context of sustainable development (or eco-development).[754] While it might have been better to have asked about general areas rather than policy areas, the results do present a useful gauge of relevance. For example, the relevance of the policy areas to the MPOs' transportation plans declines as one moves along the x-axis of Figure 7.29.

Interestingly, the relatively low relevance of health and human services supports the new requirement in SAFETEA-LU for MPOs to develop a 'public transit-human services transportation plan.' Since the Department of Health and Human Services (DHHS) is the largest provider of transportation services in the U.S. - spending more than $2 billion annually on transportation services (GAO 2003; Raub 2003) - it is vital that these services be integrated/coordinated with the regional transportation plan wherever possible.[755] In addition, as transit agencies respond to the Americans with Disabilities Act (ADA) the lines between the services provided by DHHS and transit agencies is becoming blurred, necessitating a more integrated approach to planning. Given their regional perspective of the transportation system, MPOs are in an excellent position to help coordinate these services.

In conclusion, it appears that the breadth of alternatives considered by MPOs when developing transportation projects is rather limited in scope. If the MPO is to adopt a more influential role in developing a sustainable transportation system, a potential strategy is to: [1] increase the MPO's authority to halt inappropriate projects; [2] enhance the MPO's capacity to identify the root cause of problems, whether under its control or not; and [3] require the MPO to broaden the scope of the policy areas that are explicitly considered when developing transportation plans.

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[754] Eco-development is defined as ecologically sound socio-economic development at the local and regional level. For a discussion of eco-development see Sections 3.3.3.3 and 3.3.4.

[755] One of the major problems with the current set of services is their lack of coordination - e.g., each service has its own application and vetting process for its users. Therefore, it is generally left to the individual to find out what services are available.

7.2.6 Importance Given to the Four Environmental Drivers of the Concern for Sustainable Development and Receptiveness to the Environmental Principle

7.2.6.1 Rationale for Questions 10 and 23

Questions 10 and 23 are both concerned with the emphasis that MPO staff place on environmental considerations.

In Chapter 3, the argument is made that different environmental groups and nations prioritize the four core environmental drivers of the concern for sustainable development in different ways. Political agendas are almost always focused on one or two of the four major environmental concerns to the exclusion of the others. One could argue that a more balanced approach to considering these concerns is likely to result in a better strategic approach to sustainable development. In an attempt to determine the emphasis that MPO staff place on the four major environmental concerns, Question 10 asked respondents how important they thought each concern was on a scale of very important to unimportant. The four major environmental drivers of the concern for sustainable development are:

1. the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being;
2. the rapid use of finite resources and energy supplies;
3. the direct impacts of toxic pollution on human health and the health of other species; and
4. the disruption of the global climate.

The second question, Question 23, is directly related to the suggested *Third Principle of Justice* - the environmental principle - which forms an integral part of the Rawlsian/utilitarian decision-making philosophy.[756] The Third Principle of Justice states that 'social arrangements are to be organized so that they (a) protect and continually improve the environment, especially for those individuals and species most heavily affected by environmental degradation/pollution, and (b) do not result in activities that exceed the ecological carrying capacity of the environment.'

Only the first part of the principle has been captured by Question 23. This question asked respondents to express their strength of agreement with the statement that it was feasible for their MPO to apply and adhere to a principle which states that the environment must be protected and continually improved in areas negatively affected by transportation-related pollution.

In conclusion, Questions 10 and 23 were included in the MPO questionnaire to try to obtain some insight into the perceived importance of environmental concerns and whether MPOs are likely to be able to adhere to a strict environmental principle.

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[756] For a detailed discussion of how the Third Principle of Justice extends Rawls's *Theory of Justice* to explicitly include environmental considerations, see Section 2.2.2.

7.2.6.2 Results for Questions 10 and 23

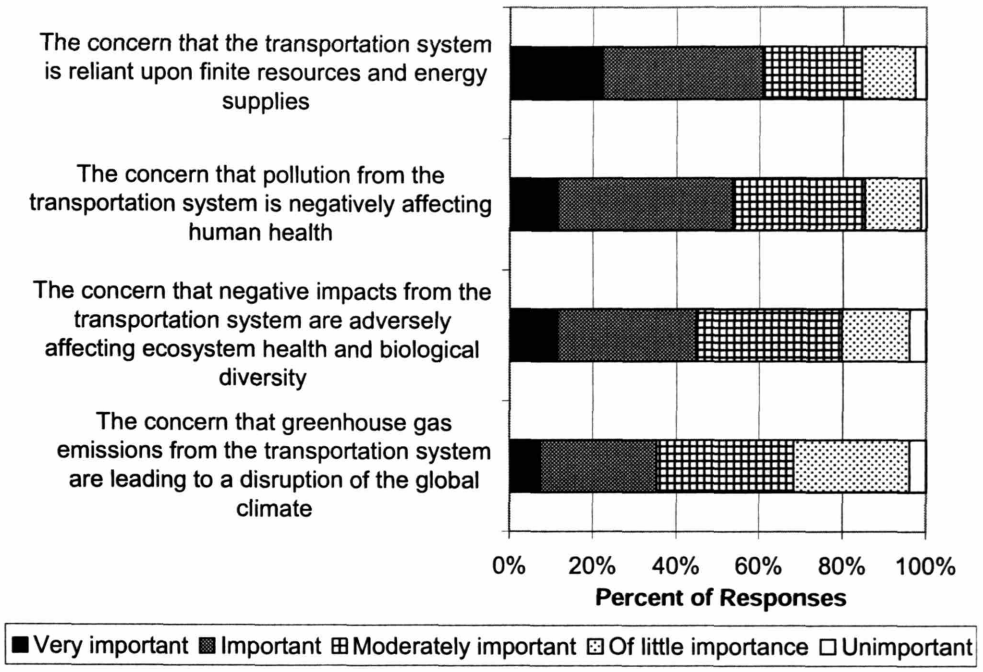

Figure 7.33: Question 10 - How important do you think the following concerns are in relation to transportation planning and decision-making?

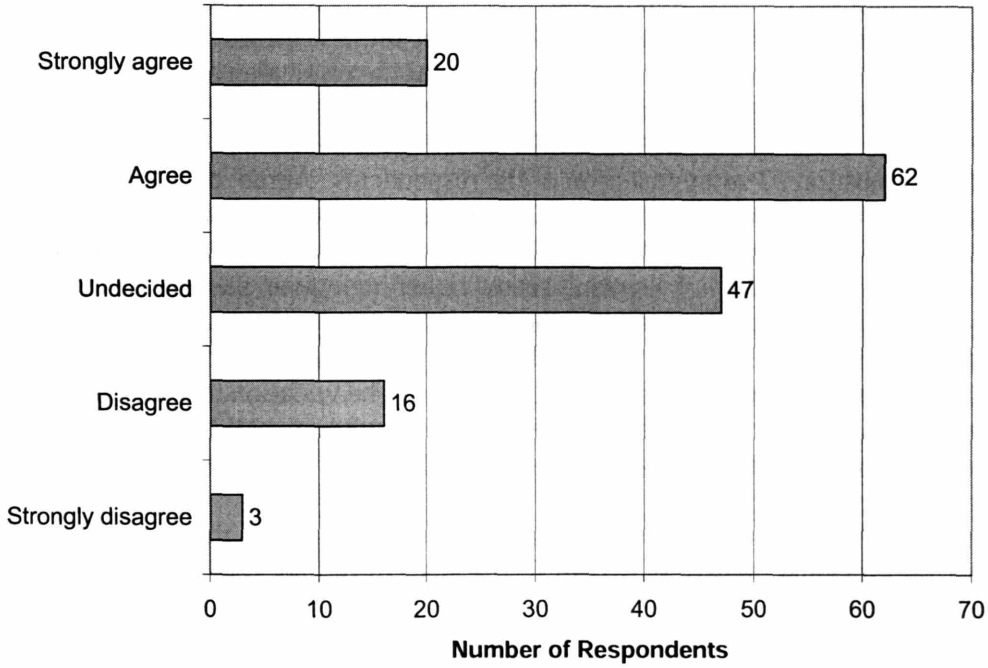

Figure 7.34: Question 23 - It is feasible for my MPO to apply and adhere to a principle which states that the environment must be protected and continually improved in areas negatively affected by transportation-related pollution

7.2.6.3 Discussion

The results from Question 10 show that over half of the respondents thought that the transportation system's reliance upon finite energy supplies (61%) and the negative impacts of transportation pollution on human health (53%) were either 'Very important' or 'Important' concerns (Figure 7.33). Similarly, just under half of the respondents (47%) put the same level of importance on the negative impacts of the transportation system on ecosystems and biological diversity. These results are not surprising given the recent turbulence in the price of oil and the emphasis placed on protecting human health and the environment in regulations such as the Clean Air Act and NEPA. For example, the CAA requirement that new transportation projects cannot create new violations of the National Ambient Air Quality Standards (NAAQS) and the NEPA requirement to assess the impacts of these projects on the human and natural environment means that these issues are constantly being addressed by MPOs and their member entities.

In contrast, 35% of the respondents thought that the greenhouse gas emissions from the transportation system were a 'Very important' or 'Important' concern. A similar percentage (32%) also thought that this environmental concern was either 'Of little importance' or 'Unimportant.' Such a low concern for global climate change (GCC) is not unexpected since the federal government has yet to formally acknowledge the issue. While many respondents might be personally concerned about GCC, since there are no federal requirements to reduce CO_2 emissions, it is unlikely to be a major consideration when developing new projects. However, the exceptions to this statement are those states in the U.S. that are developing their own regional limits to CO_2 emissions. The Northeast Regional Greenhouse Gas Initiative (RGGI) and California's legislation to reduce CO_2 emissions from motor vehicles are two good examples of these efforts. These bottom up approaches to GCC help explain why over one third of the respondents did view the issue as an important concern.

The results to Question 23 show that 55% of the respondents 'Agree' or 'Strongly agree' that it is feasible for their MPO to apply and adhere to the environmental principle (Figure 7.34). What is perhaps most interesting is that almost one third (32%) of the respondents were 'Undecided.' This result seems rather high given the fact that 80% of the respondents to Question 10 stated that the negative impacts of transportation on ecosystems and biological diversity were 'Moderately important' to 'Very important' to transportation planning/decision-making (Figure 7.33). The variation in questionnaire responses is likely to reflect the difference between an environmental 'principle' that requires action and an environmental 'concern' that does not.

When the results to Questions 10 and 23 were arranged according to the respondents' position in the MPO and the size of the MPO, the analysis did not reveal any significant variation in the responses.

7.2.7 The Perception of the Porter Hypothesis

7.2.7.1 Rationale for Questions 25 and 26

Questions 25 and 26 were created to explore respondents' perception of the Porter hypothesis - i.e., the notion that more stringent environmental regulation enhances competitiveness by stimulating innovation and the upgrading of technology.[757] While Porter's (1990) ideas focus on technological change, they can also be applied to changes (or innovations) in the planning and decision-making process. In this regard, Question 25 asked respondents whether the air quality standards established by the Clean Air Act led to any innovative (or non-traditional) planning activities. Respondents were able to select one of the following answers: a great extent; much; somewhat; a little; or not at all. Thus, the rationale behind Question 25 was to identify whether it is *perceived* that environmental regulation can lead to positive change.

The empirical evidence for the Porter hypothesis dates back to the late 1970s (Ashford 1993; Ashford et al. 1985; Ashford and Heaton 1983; Ashford et al. 1979; Strasser 1997). However, a more recent comparison of national competitiveness with good environmental governance and private sector responsiveness provides additional support for the Porter hypothesis (World Economic Forum et al. 2002). This study states that "*good economic management and good environmental management are related*" and that "*firms which succeed in developing innovative responses to environmental challenges benefit both environmentally and economically*" (ibid, p. 17).[758]

While Question 25 focused on whether environmental regulation had improved the planning and decision-making *process*, Question 26 was more concerned with the perceived *impacts* or *outcomes* from such regulation. Question 26 specifically asked respondents to indicate the extent to which more stringent air quality standards would lead to improvements in the environment, the economy, and transportation technology.

In conclusion, Questions 25 and 26 were developed to gain some understanding of the impact that more stringent environmental regulation might have on the planning and decision-making process and to gauge the likely reaction of MPOs to such regulation.

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[757] For a discussion of the difference between the 'weak' and 'strong' forms of the Porter hypothesis, see Section 4.2.3.4.

[758] Also see the research undertaken by Dixon (2002) and Flatz (2002).

7.2.7.2 Results for Questions 25 and 26

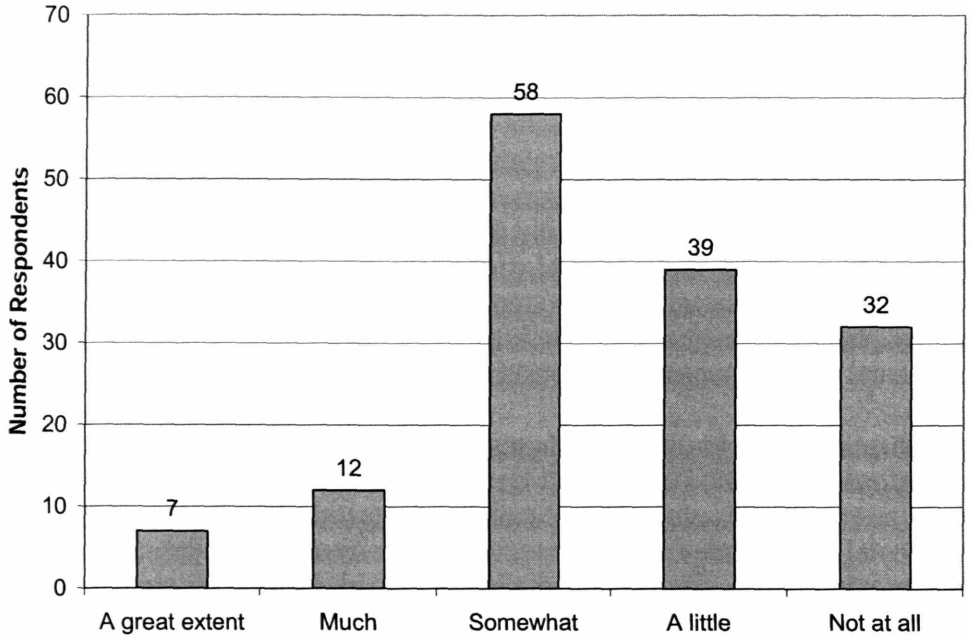

Figure 7.35: Question 25 - In your experience, to what extent have the air quality standards established by the Clean Air Act led to any innovative (or non-traditional) planning activities?

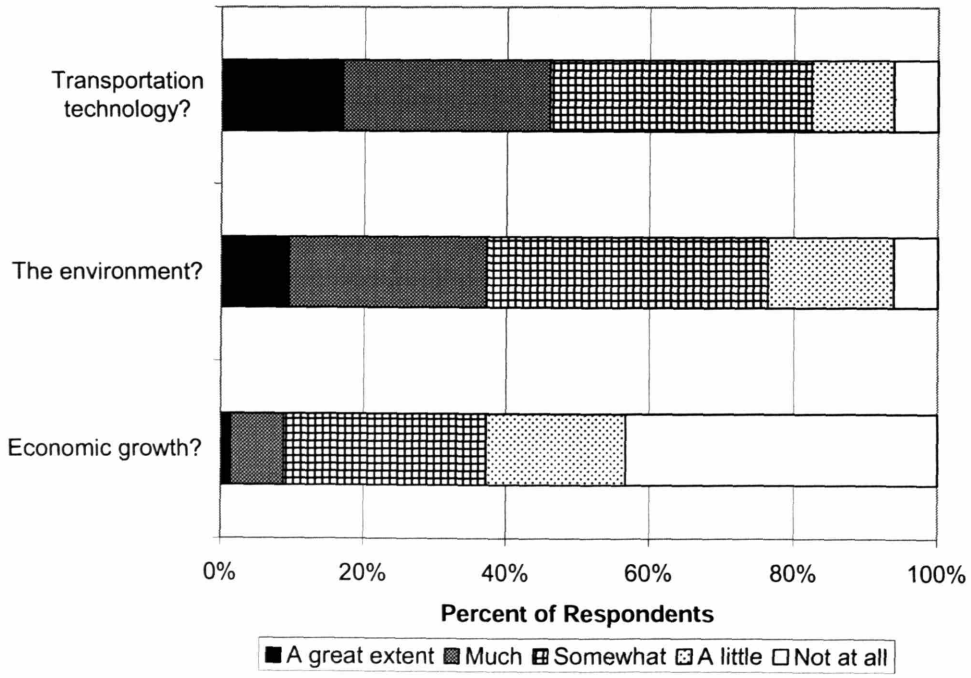

Figure 7.36: Question 26 - To what extent do you think more stringent air quality standards would lead to improvements in:

7.2.7.3 Discussion

At first glance, the results to Question 25 indicate that the air quality standards established by the Clean Air Act (CAA) have not led to any significant changes in the MPOs' planning activities. Some 39% of the respondents stated that their planning activities had changed 'Somewhat,' but the majority (some 48%) indicated that the air quality standards had little or no effect on their activities (Figure 7.35). However, this response needs to be considered with care since the vast majority of respondents were from regions in compliance with air quality standards (see Figures 7.12 and 7.13). Thus, it is unlikely that their MPOs would have made any significant changes to their planning activities if there was no external requirement to stimulate change.

Of the 19 respondents who stated that the air quality standards had influenced their planning activities to 'A great extent' or 'Much,' about two fifths (8) were from an area in nonattainment.[759] While this sample size is too small to draw any firm conclusions, it would be interesting to investigate whether the CAA has altered the planning activities in nonattainment areas.

The results to Question 26 reveal an interesting perception about the general impacts of more stringent air quality standards. They show that almost half of the respondents (48%) believe that more stringent standards would improve transportation technology to 'A great extent' or 'Much,' while 37% selected the same two response options for improvements to the environment (Figure 7.36). However, only 9% of the respondents believe that more stringent air quality standards would lead to substantial improvements in economic growth. The majority (63% of the respondents) believe that more stringent standards would have little or no effect on economic growth. This outcome is the opposite of what one would expect from the Porter hypothesis, which argues that more stringent environmental standards will lead to economic growth through technological change and upgrades. Thus, the results indicate that while many respondents have made a connection between more stringent environmental standards and technological change, they have not made a similar connection to economic growth. This outcome means that any attempt to increase the stringency of environmental regulations is likely to face significant resistance due to the perception that more stringent regulations will negatively impact the economy - even if these perceptions are potentially incorrect.

Another problem with most respondents' perception of the Porter hypothesis is that it views environmental policy through the lens of development rather than environmental protection. In this regard, environmental protection is considered as a positive externality since the real objective of increasing the stringency of environmental regulation is to stimulate economic development and improve national/regional competitiveness. This focus on development presents a potential challenge for changing regulation such as CAA that was originally designed to protect human health and the natural environment. While tightening the air quality standards is likely to stimulate change, a problem with CAA is that it might not reward a region for taking action. For example, a state might have drastically reduced emissions from its own region, but be unable to prevent non-

[759] Note: In total, 53 (36%) of the questionnaire respondents were from a nonattainment area.

compliance since the source of the problem is elsewhere. This means that the incentives and structure of the CAA would need to be redesigned to penalize the source of the problem and reward innovation.

A potential problem with Question 26 is that respondents from MPOs in attainment might not be concerned about increasing the stringency of air quality standards if they are unlikely to be affected. An analysis of the responses to whether increasing air quality standards would lead to substantial improvements in technology, the environment, and the economy revealed that the air quality in the respondents' region did not influence their response.

Finally, when the answers to Questions 25 and 26 were viewed according to the position of the respondent in the MPO and the size of the MPO, the analysis did not reveal any significant variation in the overall responses.

7.2.8 Attention to Transportation Policy Goals

7.2.8.1 Rationale for Question 9

Every few years the U.S. DOT updates its strategic plan that outlines the Department's approach to the development of policies and programs designed to improve the nation's transportation system. The structure of the last two strategic plans has been guided by the U.S. DOT's five strategic goals. While the description of these strategic goals varies between plans, their overall intent has remained relatively consistent (Table 7.8).

Since the objective of the U.S. DOT's strategic plan is to shape the development of the nation's transportation system, Question 9 was developed to see how much attention MPOs give to the following list of transportation policy goals:

- Economic growth;
- Equity and public participation (e.g., Title VI and environmental justice);
- Environmental protection/stewardship;
- Mobility;
- Safety;
- Security; and
- System efficiency/intermodality.

The two policy goals that were added to the U.S. DOT's five strategic goals in this question are equity and public participation and system efficiency/intermodality. The former was included since equity and public participation are important elements of the new surface transportation legislation - i.e., the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU). In addition, the 1994 Presidential Executive Order on environmental justice also requires federal agencies to ensure that the public is part of the decision-making process and that the outcomes of policies and programs are equitable - particularly among minority and low-income populations. The second goal was included since establishing an efficient and intermodal

transportation system has been an objective of the DOT ever since the 1991 *Intermodal Surface Transportation Efficiency Act* (ISTEA).

Table 7.8: U.S. DOT's Strategic Goals from the 2000-2005 and 2003-2008 Strategic Plans

U.S. DOT Strategic Goals 2000 - 2005 (U.S. DOT 2000a)	U.S. DOT Strategic Goals 2003 - 2008 (U.S. DOT 2003)
Safety - *Promote the public health and safety by working toward the elimination of transportation-related deaths and injuries.*	**Safety** - *Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.*
Mobility - *Shape an accessible, affordable, reliable transportation system for all people, goods and regions.*	**Mobility** - *Advance accessible, efficient, intermodal transportation for the movement of people and goods.*
Economic Growth - *Support a transportation system that sustains America's economic growth.*	**Global Connectivity** - *Facilitate a more efficient domestic and global transportation system that enables economic growth and development.*
Human and Natural Environment - *Protect and enhance communities and the natural environment affected by transportation.*	**Environmental Stewardship** - *Promote transportation solutions that enhance communities and protect the natural and built environment.*
National Security - *Ensure the security of the transportation system for the movement of people and goods, and support the National Security Strategy.*	**Security** - *Balance homeland and national security transportation requirements with the mobility needs of the Nation for personal travel and commerce.*

In summary, Question 9 was included in the questionnaire to try to identify MPOs' satisfaction with their efforts to achieve certain transportation policy goals.

7.2.8.2 Results for Question 9

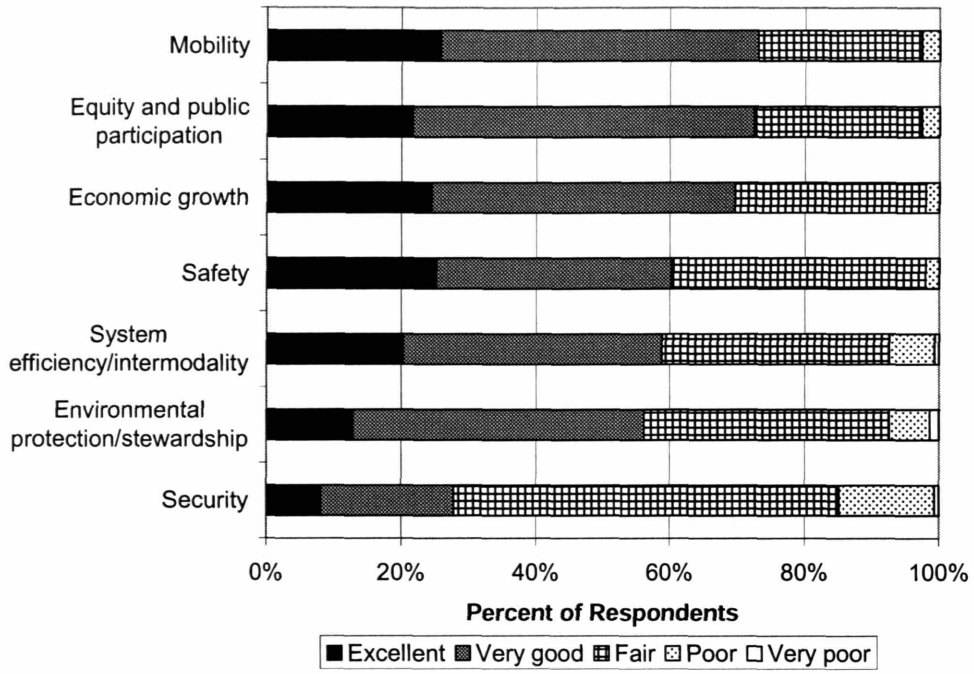

Figure 7.37: Question 9 - How would you rate your MPO's attention to the following transportation policy goals?

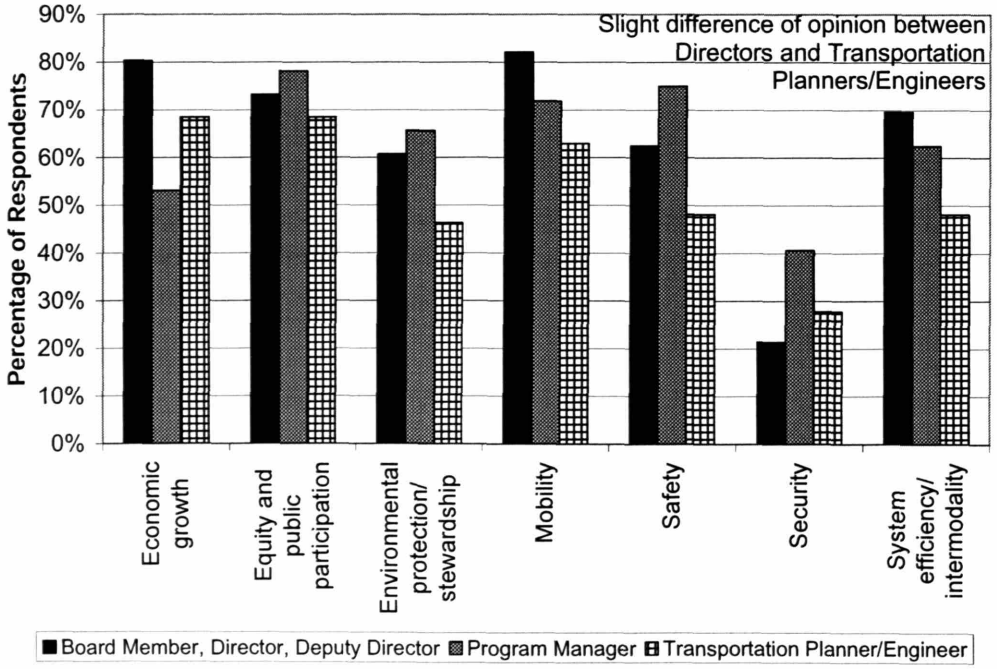

Figure 7.38: Percentage of Respondents (grouped by position in MPO) That Thought Their MPO's Attention to the Transportation Policy Goals (in Question 9) Was Either *Excellent* or *Very Good*

7.2.8.3 Discussion

The responses to Question 9 indicate that the three policy goals that receive the highest attention from MPOs are Mobility, Equity and public participation, and Economic growth (Figure 7.37). Approximately 70% of the respondents indicated that their MPO's attention to these policy goals was either 'Excellent' or 'Very good.' The next three policy goals - Safety, System efficiency/intermodality, and Environmental protection/stewardship - received slightly less attention, but around 60% of the respondents ranked their attention to these goals as either 'Excellent' or 'Very good.' The policy goal that received the least attention from MPOs was Security. On average, this policy goal was ranked as receiving less than half of the attention given to the other goals.

When the results from Question 9 were arranged according to the respondents' position in the MPO, the analysis revealed a slight difference of opinion between MPO Directors and Transportation Planners/Engineers (Figure 7.38). With the exception of Security, the Directors are slightly more optimistic of their MPO's attention to the policy goals than Transportation Planners/Engineers. When the same data was arranged according to the size of the MPO, the analysis did not reveal any consistent trends in the responses.

While the results to Question 9 are useful, they should be considered in the context of the unique pressures that MPOs face. For example, during a discussion of the responses to Question 9 with NARC, the point was made that a broad question about whether policy goals are being met is largely irrelevant in areas of rapid growth such as Las Vegas, Phoenix, or Dallas where the primary policy goal is to move freight and people. By way of contrast, in regions where growth is stable or even declining, the attention MPOs give to certain policy goals is likely to be very different. Further, the FHWA and FTA commented that while MPOs have an important role to play in the planning and decision-making process, it is not clear whether they have been given sufficient authority to be able to adequately address issues such as safety. These comments highlight the difficulty of drawing general conclusions from the survey data and reinforce the importance of considering how policy initiatives might impact MPOs.

7.2.9 Conclusions

The purpose of the MPO questionnaire was to identify potential gaps between the current approach to transportation planning and decision-making and the approach embodied in the sustainable transportation decision-support framework. The results from the questionnaire are mixed. In some areas there is a substantial contrast between the proposed 'sustainable' framework and current planning/decision-making practices. In others, the ideas put forward are already being used by MPOs. The purpose of this section is to consolidate the major findings from the questionnaire and explore the nature of any potential barriers to implementing the ways of thinking captured in the proposed sustainable transportation decision-support framework. In addition, suggestions are presented to show how the current MPO planning/decision-making process might be altered to support the concept of sustainable development/transportation.

Before reviewing the conclusions from the questionnaire, it is important to recognize that differences in the size, structure, and capability of MPOs across the U.S. will impact the relevance of some of the results. Wherever possible, these factors have been taken into account in the discussion.

The results from the questionnaire indicate that MPOs have a strong interest in the natural environment, both in terms of protecting and continually improving areas negatively affected by transportation-related pollution and coordinating their transportation plans with environmental regulation. In addition, MPOs appear to be generally concerned with a broad range of environmental and human health issues. The one exception to this observation is their lack of concern regarding the impacts of transportation emissions on global climate change. This result, however, may not indicate a failure on the part of MPOs since their actions are heavily influenced by the federal government. It seems relatively clear that MPOs show concern for those environmental issues that they are required and able to address or influence. In the case of global climate change, the lack of any federal regulation *and* funding to address the issue makes it difficult for MPOs to act effectively. However, there is evidence that regional action is being taken, and in these regions, MPOs are likely to be highly involved in identifying ways to address self-imposed greenhouse gas constraints.

An issue relevant to the above discussion is how MPOs are likely to react to the creation of more stringent environmental regulations. The results indicate that any attempt to use environmental regulation to stimulate development is likely to face staunch resistance from MPOs with regard to its perceived impact on the economy. However, it is interesting how many respondents made a positive connection between more stringent air quality standards and technological improvements. In fact, the general perception was that increasing the stringency of air quality standards would lead to greater improvements in technology than in the environment. Hence, there is a tacit appreciation for the Porter hypothesis but a failure to connect technological improvements to economic and competitive advantage. This conclusion suggests that more research is needed to highlight the potential development and environmental benefits of applying the 'strong' form of the Porter hypothesis.

One important task of the questionnaire was to try and determine the perceived role of the MPO and the posture of the stakeholders in the planning/decision-making process. The results indicate that the MPO is seen as the facilitator of consensus among stakeholders and that the majority of stakeholders are perceived to either adopt a communitarian posture or endorse communitarian perspectives. These outcomes combine to make the chance of arriving at a Rawlsian outcome 'Possible' or 'Likely.' While the MPO does have a trusteeship role to ensure that the 'voice' of all stakeholders is heard, the current MPO planning guidance requires MPOs to create a fair and impartial setting for the planning and decision-making process.

The questions that focus on the perceived outcomes from an MPO's policies/programs reveal a strong egalitarian approach to the delivery of transportation services. This result

mirrors a commitment to fairness on the part of the MPOs and reinforces the moderate likelihood of arriving at a Rawlsian outcome. However, there is a general perception that a few disadvantaged and minority groups are receiving slightly greater attention and benefit from the MPO's policies/programs than the average customer. This perception appears to be more pronounced among MPO Directors and Program Managers and those respondents from MPOs serving larger populations. The difference in perception between small and large MPOs is a good indicator that the planning/decision-making environment in which they operate might be quite different. It also raises the question of whether smaller MPOs need to be more aware of disadvantaged groups if these groups are unable to represent themselves in the planning process.

The above results indicate that the MPO is unlikely to be able to adopt a Rawlsian position in the decision-making process given the current MPO planning guidance and general egalitarian approach to the delivery of transportation services. One possible way to address this problem would be to change the planning guidance to encourage MPOs (and their member entities) to adopt a Rawlsian approach when developing new policies/projects. For example, such guidance would state that disadvantaged groups that have been underserved by transportation services should receive *preferential* consideration in the transportation planning/decision-making process. The extent to which these groups receive preferential treatment would be determined by local circumstances and is likely to be decided during the consensus-building process. What is not so clear is how MPOs would respond to the Rawlsian approach and whether they could advocate a Rawlsian position as part of a 'fair and impartial' planning process. The answer to this question is not straightforward and requires further research to fully consider the implications of requiring an MPO to adopt a Rawlsian approach.

With regard to the suggested Third Principle of Justice (the environmental principle), the majority of respondents indicated that they could support the first part of the principle, which is to protect and continually enhance the environment. This finding is not unexpected since the principle is essentially the same as the environmental planning factor in TEA-21 and SAFETEA-LU.

One instrument that MPOs can use to influence the transportation planning/decision-making process is their regional vision and goals. However, it is not clear whether MPOs are able to leverage this instrument to prevent the development of projects that do not comply with their regional vision. Given the general scope of many regional vision statements and goals, one can imagine that it would be possible to justify almost any type of project. If an MPO's ability to encourage/support/enforce the consideration of its regional vision and goals were to be enhanced, creating a 'Rawlsian goal' for the provision of transportation services might be one way for the MPO to adopt a Rawlsian approach.

With regard to the hybrid trade-off/positional analysis framework, results from the questionnaire indicate that a significant number of MPOs use a form of trade-off analysis when assessing the impacts of a transportation policy/project. This response is encouraging since it means that there is likely to be interest in a tool that can help bring

structure to this type of decision-making process. In addition, since trade-off analysis mirrors the process of political decision-making (more so than other techniques such as benefit-cost analysis), it is likely to be a useful decision-support tool at both the project development level and MPO board level.

A potential barrier to the full implementation of the proposed framework is the MPO's limited authority and narrow planning guidance and the structure of federal transportation programs that effectively constrain the scope of alternatives considered when addressing problem areas. Another way to describe this situation is that the current planning and decision-making environment bounds the rationality of MPOs. This means that MPOs (and their member entities) primarily focus on enhancing the transportation system using traditional transportation options and are less likely (or able) to make improvements by trying to change markets, legislation, public/private sector management, and technology.[760] While it may not be the responsibility of the MPO to address some of these areas, a failure to consider the full range of issues when defining and addressing a problem is likely to enable the underlying problem to persist. The challenge, therefore, is how to increase the capability and mandate of the MPO (and its member entities) to enable it to consider a much broader range of issues. This challenge is directly related to the need to increase the integration/coordination of transportation plans with other core policy areas.

When considering how best to integrate/coordinate planning for sustainable development/transportation at the regional level, an important question is whether one should focus on the role/capability of the MPO or on other aspects of the process. For example, should the role of the MPO be enhanced or should its responsibilities be passed onto the COG? Given that removing the federal requirement to establish MPOs might lead to a loss of regional transportation planning capabilities - since there is no guarantee that other agencies would have the funding or capacity to absorb all of their functions - maintaining the structure of MPOs would be a wise option.[761]

The results of the MPO questionnaire indicate that it might be easier for larger MPOs to implement the hybrid trade-off/positional analysis framework since they are more likely

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[760] The questionnaire results and feedback indicated that the majority of transportation projects appear to be developed/sponsored by state DOTs and transit agencies rather than MPOs. This means that it may be more useful to target the 'project level' application of the hybrid trade-off/positional analysis framework at these agencies. Note: The hybrid trade-off/positional analysis framework can be applied at multiple levels of decision-making from the initial analysis of project proposals, to the analysis of projects to be included in a TIP, up to the analysis of federal transportation programs.

[761] It is recognized that the COG's ability to consider issues such as transportation, land use, water and sanitation, employment, economic development, environmental protection, etc. put it in an excellent position to address the concept of sustainable development. Thus, while it is believed that the federal requirement for MPOs should be retained, serious consideration needs to be given to whether the current transportation planning/decision-making architecture is optimal. This question cannot be answered without further research into the effectiveness of MPOs and COGs at pursuing sustainable development/transportation.

to have close connections with COGs and/or regional planning agencies.[762] Thus, the MPO could utilize the unique skills of other organizations during the problem definition and alternatives generation steps of the analysis framework. This approach would build upon existing communication networks/relationships and ensure that problem areas are considered by a range of officials working together. This approach would also inform the appropriate agencies of actions they need to take to support initiatives in other areas. In some cases an integrated approach across policy areas might even be required.

In the situation where an MPO does not have the support of a COG or regional planning agency, the task of increasing the MPO's ability to consider a broad range of issues is more complicated. The challenge is to know how the recommended changes might impact MPOs given that they operate in a wide variety of circumstances. Providing MPOs with more authority over funding sources and increasing flexibility in how federal funds can be used would be one way of broadening their planning scope. This change would need to be accompanied by guidance on how the traditional approaches to problem solving can be expanded. In this regard, the MPO would become the advocate of new ways of thinking that might open new cooperative relationships among agencies interested in moving towards sustainable development/transportation. An important component of any initiative designed to increase the range of alternatives considered by MPOs is the structure of federal funding programs. In general, MPOs, state DOTs, and transit agencies develop projects in response to available federal funding. Thus, if the majority of federal programs are delineated by mode (i.e., highway, transit, etc.), this makes it more difficult for these organizations to integrate their transportation projects and limits the breadth of issues they are able to consider.

If a radical approach were to be taken to empower MPOs by directing the vast majority of eligible federal transportation funds to their control, a number of important questions would arise. For example, what kind of political dynamic would be created if the MPO was the arbitrator of billions of dollars? How would the MPO be structured? Would the MPO have elected members, and if so, how would the board of elected officials be structured? Would the elected officials be based upon regional populations? With regards to sustainable development, how would an official be elected who is standing for long-term change that is likely to deliver no direct benefit for many years? Would the MPO and its governing body have a strong technical capacity? What would happen to the authority and role of state DOTs and transit agencies? These are very difficult questions that fall beyond the scope of this research. However, the overriding concern is that any ill-conceived changes to the power of MPOs might exacerbate existing problems. It is hoped that this research will lay the foundation for future work that can take a more focused look at how changes to the regional transportation planning/decision-making architecture might better support movement towards sustainable development/transportation.

[762] While the trade-off matrix is likely to be a useful tool for smaller MPOs, it is unclear whether they would have the capacity, or need, to consider a wide range of (non-traditional) alternatives when addressing a particularly troublesome problem.

Finally, the results from the questionnaire reveal some interesting differences in perception between MPO Directors and Transportation Planner/Engineers. While the analysis of the questions could only postulate why these differences might have occurred, the feedback received from respondents proved to be a valuable source of additional information. One respondent provided a particularly interesting response that was motivated by a concern that the questionnaire failed to capture the real differences between how MPO boards and staff view or approach similar issues. The following is an excerpt from that response.

> "*I think that you should ... distinguish between MPO Boards and their policies and actions and MPO staffs and their takes on the same items. And I also think you need to separate policies from plans, and both from programs; there is an evolution from planning to implementation, and any number of plans morph as they become projects. Furthermore, I ... think you should distinguish between planning agencies and implementing ones, as they may have anything from concurrent to mildly divergent to quite different missions, and that of course affects how plans are eventually implemented.*
>
> *Do not underestimate the politicization of the transportation planning process, especially where subareas are specifically represented as they are on our Board. There is more than a certain amount of both NIMBYism (such as definition and subsequent development of truck routes) and ME-TOOism (such as where major transit capital investments should be made, regardless of lines needing to meet or exceed New Starts criteria) on matters of particular interest. ...*
>
> *Transportation planning is a technically complex but policy- and process-wise rather straightforward affair at staff level, and exactly the opposite at the Board level. What we say, what we do, what we recommend as staff may be continued, ignored, or indeed reversed when it comes to the Board. So while I can point out our MPO prospectus ... and our LRTP Goals & Objectives ..., and recite how things are supposed to procedurally ensue, the truth is transportation planning can be a very messy business*" (MPO Questionnaire Feedback, anonymous).

Other respondents made similar comments that effectively described the MPO as a creature of the political process. Hence, while the MPO can be a strong advocate of smart growth, environmental protection, economic development, etc., the reality is that the political process is what guides transportation investment. For example, a major issue described by one respondent is that jurisdictions within an MPO's region can spend a significant amount of money on attracting jobs and development, which can limit their interest in a regional perspective. These jurisdictions will then take the necessary steps to secure growth for their area, even if this growth divides the region. The result of dynamics such as this is that those regions experiencing rapid growth become more politically powerful, making it very difficult for other regions to compete for funding and address their own problems.

The above comments highlight the complex nature of the transportation planning/decision-making process at the regional level and the importance of careful and well structured research that can determine the best way to improve the current transportation planning/decision-making architecture. An encouraging aspect of the results and feedback from the questionnaire is that there is a real need for new ways of thinking and tools that can support decision-making for sustainable development/transportation.

7.3 The D.C. Consensus: Barriers to, and Opportunities for, the Sustainable Transportation Decision-Support Framework

In addition to the MPO questionnaire, several meetings were held with senior members of key organizations and agencies in Washington, D.C. to discuss the questionnaire and important elements of the sustainable transportation decision-support framework.[763] Through the course of the conversations, several recurring themes emerged that demonstrate the complexity of transportation planning and decision-making in the U.S. The purpose of this section is to present a synthesis of the ideas shared during these meetings; this synthesis does not necessarily represent the views of any specific individual or organization/agency.

Two Barriers to Sustainable Development/Transportation

It was clear from the meetings in Washington D.C. (hereafter called the 'D.C. meetings') that the concept of sustainable development/transportation has virtually no traction in Congress. Political interest in sustainable development was not seen to fit well with the conservative wing of the Republican Party and is not an issue that has been a core focus of the liberal wing of the Democratic Party (however, the concept was seen to be more attractive to this latter group). From the perspective of the moderates in both parties, sustainable development was not considered to be an important agenda item.

The structure of the U.S. government was also described as a barrier to the concept of sustainable development. The structure is unique in that it can have five layers - i.e., county, city, regional, state, and federal - that each has authority over specific areas. However, since the 'regional' MPOs are quasi-governmental bodies, they are generally not considered as an 'official' level of government even though they are able to make decisions on behalf of a region.[764] This multilayer governmental structure makes it

[763] Meetings were held with the Association of Metropolitan Planning Organizations (AMPO), the Congressional Research Service (CRS), the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), the Government Accountability Office (GAO), the Metropolitan Washington Council of Governments (MWCOGs), the National Association of Regional Councils (NARC), and the Office of the Secretary of Transportation (OST).

[764] The OST described that when the federal government first created MPOs, it was sued for usurping the power of the state and for creating a new level of 'regional' government. The basic argument was that there are two levels of government, federal and state, and there is nothing in the U.S. Constitution that allows the federal government to create a regional body. In fact, the U.S. Constitution does not recognize the

difficult to address sustainable development since sustainable development requires the integration of policies and decision-making across sectors and jurisdictional lines.[765]

Both the lack of Congressional support and the structure of the U.S. government present significant barriers to the sustainable transportation decision-support framework. Since it is difficult to alter the structure of government, a practical way forward is to focus on ways to gain Congressional support for the core ideas of the proposed framework.

One way to capture the interest of members of the House and Senate would be to repackage the core aspects of the proposed framework from different perspectives. For example, rather than pushing for environmental protection, the focus could be on enhancing national competitiveness through policy instruments that stimulate innovation and increase the rate of ecological modernization. Another example would be to advocate a major shift in the U.S. reliance on oil, not from the perspective of natural capital or finite non-renewable resources, but from the perspective of national security. However, the problem with such a strategy is that it places the importance of global/national sustainable development second to short-term, agenda-driven politics.

The 'Strong' Porter Hypothesis

With regard to the policy instruments that could be used to stimulate innovation, there was general agreement that it would be very difficult (in the current political climate) for the federal government to apply more stringent environmental standards. In addition, several people questioned the effectiveness of adopting a regulatory approach where states must meet federal environmental standards or risk losing their allocated funding. This approach forces states to ask whether they need the federal funding and whether the standards are enforceable by the courts. If the money in question is not significant and the standards are not enforceable, states might choose to set their own standards and forgo the federal funds (e.g., the 55 mph speed limit standard is a good example of where some states selected their own speed limits and lost some federal transportation funding). Other people were critical of how billions of dollars have been invested in the transportation system to comply with air quality standards and questioned whether the money was well spent. While the Clean Air Act (CAA) has changed the dynamics of the transportation planning and decision-making process, the majority of air quality improvements have occurred as a result of more efficient vehicle and fuel technology and not from operational or system design improvements (although these have helped). Furthermore, in the situation where a state is in nonattainment and needs federal funding, one person

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county/district or city. Thus, there is a careful balancing act with regard to what is an acceptable institutional structure for transportation planning that does not undermine the authority of the states.

[765] A good example of an existing problem of governance is the state governor's veto power over the transportation improvement program (TIP). While the TIPs prepared by metropolitan areas must be incorporated into the state TIP (intact), the governor of the state has a veto authority that can be used to undermine the integrity of the planning process. Hence, an MPO could have developed a TIP by developing consensus among a wide range of stakeholders, but be forced to change the TIP in response to political pressures. This broader aspect of the planning process is often overlooked, but it can have a major impact on the effectiveness of MPO planning and decision-making processes.

described how the political process can often be used to extend deadlines until the problem is averted, bringing into question the efficacy of the legislation.

The above discussion touches upon the interesting fact that the U.S. DOT does not set any environmental standards. Thus, the environmental regulations that exist focus on specific issues that have an 'indirect' - although potentially very influential - impact on the transportation sector.[766] This observation means that while legislation such as SAFETEA-LU shapes transportation decision-making, so too does the regulation crafted by the Environmental Protection Agency (EPA) and other executive agencies that address the negative environmental and social impacts from transportation and other sectors. Hence, the U.S. DOT's (2000b) transportation policy architecture must be considered within the broader regulatory picture (see Section 8.4).

The general consensus from the D.C. meetings was that a better way to influence the development of the transportation system would be to provide incentives or penalties rather than develop more stringent regulations. The rationale for this position was that few people are likely to lobby government to reduce particulate levels (or, more generally, regional environmental concerns), whereas a significant number will take action to reduce taxes or support programs from which they will receive a direct benefit. For example, one person described how allowing hybrid vehicles to use HOV lanes has encouraged many conservative groups to support these vehicles for reasons other than environmental protection or energy security. Thus, the best way to encourage change was seen to be the creation of financial incentives rather than regulating behavior.

Given the clear predisposition against more stringent environmental regulation, it seems that the only way that the 'strong' Porter hypothesis is likely to succeed is if it is accompanied by a package of financial incentives. However, the danger of such a combination is that it might provide incumbent firms with an advantage over new entrants, thereby limiting the chances of realizing a disruptive technological change (see Section 2.3.1).

The Planning Factors

One question posed to all the organizations and agencies was how influential they thought the seven planning factors were in TEA-21. While there was general agreement that the federal government is not able to dictate how decisions should be made - which means that planning guidance is the only real option - there was less consensus on the effectiveness of the guidance. Part of the problem is that it is very difficult to know how all state DOTs and MPOs apply the planning factors. In general, MPOs do not select

[766] Note: the Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks - established by the Energy Policy Conservation Act (EPCA) in 1975 - is perhaps the closest piece of regulation designed to directly change specific elements of the transportation system. While the EPCA is an energy conservation law - and not an environmental law - it does have direct environmental impacts. The National Highway Traffic Safety Administration (NHTSA) is responsible for setting the CAFE standards and the Environmental Protection Agency (EPA) is responsible for calculating the average fuel economy for each manufacturer. Thus, the U.S. DOT is able to influence the development of vehicle technology (and 'indirectly' improve environmental performance) by increasing the stringency of the CAFE standards.

projects based upon the planning factors, which means that information on how influential they are is difficult to find. Another problem is that the planning factors are a relatively blunt instrument that takes a long time to produce results. Their general nature means that no one can be against them in principle, and making a connection between the planning guidance and what actually happens in practice is very difficult. The main problem is that, in addition to legislative guidance, there are a wide range of factors that influence transportation investment decisions (GAO 2004).

While MPOs do not generally select projects based on the planning factors in TEA-21, there was general agreement that MPOs do *consider* these planning factors. Since there is no formal requirement to follow the factors to the letter, they tend to function more like a set of guiding principles. In addition, there was concern that the number of factors that need to be considered might actually reduce the potential benefits from a project. In effect, the planning factors were seen by some to establish a 'design by committee' approach to planning that makes it difficult for MPOs to make optimal decisions. Furthermore, if the planning factors were to be extended to include new considerations, the concern was that this action might have a reverse psychological impact and make MPOs averse to implementing them.

With regard to sustainable transportation, several people suggested that while the seven planning factors cover many aspects of the concept, the weight that decision-makers give to these factors might not move the transportation system towards sustainability.[767] Several people also commented that care needs to be taken when identifying those regions that are seen to be pursuing sustainable transportation since it might not be possible to transfer their planning and decision-making practices to other regions due to very different operating and political environments.

Finally, the U.S. DOT stated that the planning guidance does help structure the planning process, which it believed would otherwise be an uncoordinated affair. The challenge is to strike the right balance between too much and too little regulation/guidance. Even though some MPOs are not as effective as the federal government would like, it is believed that they are making a difference. The question (addressed below) is how to enhance the MPO planning process.

Certification of the MPO Planning Process

A second question relating to the planning factors focused on the effectiveness of the FHWA's/FTA's certification of the MPO planning process. TEA-21/SAFETEA-LU states that MPOs that serve a population of less than 200,000 are allowed to self-certify. For MPOs that serve more than 200,000 people, an FHWA/FTA certification team is sent to evaluate their planning process every 3 years. The certification team is required to write a report on the MPO's processes to highlight areas of best practice and identify corrective actions where federal requirements are not being met. In this regard, the

[767] An interesting project would be to try and identify ways to influence the weight given to planning factors in the decision-making process, with the ultimate objective being to change the decision-making process to support sustainable development.

evaluation process is subjective. It is designed this way to allow for the fact that states can be very different. For example, what is appropriate for Texas is not necessarily appropriate for Florida. This is one reason why the FHWA has a field office in every state - to bring the administration closer to what is happening and to better identify what states need.

Several general criticisms were made of the current certification process by different organizations. First an MPO's planning process cannot be reviewed in court - i.e., no legal action can be taken if an MPO is not conforming to the federal planning guidance. Second, in the GAO's (1996) experience, it is unusual for the FHWA/FTA to deny certification as a result of non-conformity. Third, there was a concern that the FHWA field offices might be too close to the MPOs and state DOTs to enable them to provide an unbiased evaluation of their planning processes. Fourth, differences in how the federal government interprets its own planning guidance can lead to an uneven evaluation of planning processes. What one certification team identifies as reasonable work, another team might not.

When the organizations/agencies were asked about how the certification reviews could be improved, two different approaches were identified. The first approach suggested was to normalize certification reviews across the U.S. by enhancing the training and guidance provided to the certification teams. To support this objective, the U.S. DOT has developed a certification review handbook for its field offices to address the problem of consistency and to instruct new FHWA/FTA staff on how to conduct a certification review. The handbook highlights the types of questions that need to be asked and sets parameters around the certification review to try and ensure a more uniform evaluation of MPOs across states.

The challenge facing the FHWA/FTA certification teams is that MPOs have many requirements that need to be considered and how much attention they pay to any particular requirement is by and large left to the MPO to decide. The certification teams must try to evaluate whether the MPOs are taking the necessary steps to meet the federal requirements given their operating environments. To assist with the certification review, the FHWA field offices establish minimum levels of performance as well as identify areas of best practice that are then shared among state DOTs and MPOs. The best practices become useful targets when trying to raise the minimum performance levels. However, as mentioned previously, an effective planning process in one region might not be feasible in others, highlighting the difficulty facing the certification teams when trying to establish a uniform review process.

The second approach to improving the certification process is more radical and essentially revolves around moving the certification process into the legal realm. The basic idea is that if MPOs are not making decisions in accordance with federal guidance, they could be sued for noncompliance. The legal precedent for this approach has been set in the areas of air quality and environmental justice, which could be expanded to cover the planning process. While this would be a much more heavy-handed approach, it would not require any major changes to the current legislation and would give the U.S. DOT

more power to influence the system. The problem, however, is how to prove that a planning process is in noncompliance with the broad nature of the federal guidelines. For this approach to be effective, it is likely that the federal government would need to be more prescriptive in its guidance, which raises the issue of federal versus state authority. Thus, it seems that the first option is the only practical approach given that states and MPOs are likely to strongly resist any increase in the federal government's control over their actions. This issue of state versus federal influence over transportation planning and decision-making is explored further in the discussion of surface transportation funding.

Indicators of Sustainable Development/Transportation

Each organization and agency was asked for its perspective on the likelihood that the U.S. government will develop a set of sustainable development/transportation indicators. In general, one of two responses was given to this question: [1] the Key National Indicators Initiative (KNII)[768] is currently developing a national indicator system to assess the state of the nation; and [2] the creation of a set of national indicators is unlikely, especially if the federal government and the states have to agree on the indicators. What is interesting about these responses is that the latter is really an opinion on whether initiatives such as the KNII will be successful.

The KNII describes itself as an "*ongoing effort to explore prospects for a United States indicator system.*"[769] In this regard, a decision has not been made, or consensus has not yet been reached, as to whether such a comprehensive indicator system is feasible. The few who answered the question by referencing the work of the KNII seemed optimistic that the initiative would provide a set of national indicators of sustainable development. However, the majority who answered with the second response were less optimistic and identified two obstacles to the creation of a set of national indicators. First, the structure of the federal system was seen as an insurmountable barrier to the creation of a set of 'meaningful' national (or headline) indicators. The separation of power between the federal government and states means that reaching consensus on what should be measured and why was seen to be very difficult. Second, the failure of ISTEA's requirement that state DOTs develop six performance management systems[770] to evaluate the transportation system was seen as a warning against the development of a new set of

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[768] See the Key National Indicators Initiative, http://www.keyindicators.org/ (accessed on 04/09/06)

[769] Source: supra note 768.

[770] ISTEA stated that one year after its date of enactment, "*the Secretary shall issue regulations for State development, establishment, and implementation of a system for managing each of the following:*
(1) Highway pavement of Federal-aid highways.
(2) Bridges on and off Federal-aid highways.
(3) Highway safety.
(4) Traffic congestion.
(5) Public transportation facilities and equipment.
(6) Intermodal transportation facilities and systems.
In metropolitan areas, such systems shall be developed and implemented in cooperation with metropolitan planning organizations. Such regulations may include a compliance schedule for development, establishment, and implementation of each such system and minimum standards for each such system" (23 U.S.C. USCA § 303(a)). For an interesting analysis of why one of the key provisions in ISTEA failed to materialize, see Lindquist (1999).

national transportation indicators. The reason ISTEA's provision failed was that in many states the proposed indicator systems conflicted with systems that had already been developed. Because states were not willing to change their systems to conform to the national standard, the 'performance management systems' requirement was subsequently removed in TEA-21.

The above responses indicate that the major challenges to establishing a set of indicators of sustainable development/transportation are [1] achieving consensus on the set of indicators at the state and federal level and [2] ensuring that any proposed set of indicators builds upon the existing indicator systems already in place.

Integration of Decision-Making across Government Organizations

A critical aspect of decision-making for sustainable development is the ability to coordinate and (at best) integrate policies across different government organizations. Therefore, an important question raised during the D.C. meetings was how the federal government could better integrate its policies or decision-making processes.

Several people who responded to this question cautioned that while a number of government organizations might state that their actions are coordinated or integrated with other bodies, there is likely to be significant variation in what their activities actually involve. Therefore, it is difficult to comprehend the problem since there is sometimes a perception that there are no real coordination problems. This observation highlights the need to define what good coordination or integration for sustainable development/transportation might be.

Two interesting responses to the integration question referred to historical events from the 1970s. First, following the 1970s oil crisis, the U.S. Department of Transportation (DOT) and Department of Energy (DOE) were described as making a concerted effort to integrate their activities. However, once the crisis was averted the interest in integration gradually disappeared and the departments were seen to revert to their normal (non-integrated) practices. Hence, this observation indicates the potential inability of institutional structures to change themselves in the absence of a critical and sustained event.

The second event discussed occurred in 1973 when President Nixon put forward the idea of a 'super cabinet' that would direct domestic policy from offices in the White House. A driving force behind the idea was the fact that many problems facing government were cutting across sectors and could not be easily resolved by sector-oriented departments. In an insightful review of twentieth century federal executive reorganization, Balogh et al. (2002, p. 46) describe how President Nixon's plan "*sought to abolish the departments of Agriculture, Interior, Commerce, HEW, HUD, Labor and Transportation, and include the functions of those departments, as well as related independent regulatory commissions, within new departments of Human Resources, Community Development, Natural Resources, and Economic Affairs.*" The basic philosophy was to weaken the strength of the clientele-related departments and better integrate the decision-making

authority of the executive branch. President Nixon's reorganization plan never materialized, however, due to the Watergate incident and his subsequent resignation.

While President Nixon's plan would have faced strong opposition from Congress (Balogh et al. 2002), it indicates that a dramatic reorganization of the executive branch to better address a critical issue such as sustainable development is, at least, thinkable. Perhaps what is most interesting about the idea of a super cabinet is that it emerged from a Republican Administration that was sympathetic to the need for environmental protection. Given that the Republican Party of today is much less concerned with the environment, any hope of reconfiguring the executive branch to address an issue such as sustainable development is likely to rest with the Democratic Party and a Democratically-controlled Congress.

Finally, several people made the argument that while it is important to focus on coordination and integration between government organizations, there is also a need to focus on integration between the agencies within an organization or department, such as the FHWA and FTA within the U.S. DOT. A problem with the current structure of the U.S. DOT was seen to be the balkanized thinking encouraged by its federal programs and administrations. For example, the airport program cannot be used to fund transit or highway projects that fall outside of airport boundaries. Likewise, highway and transit programs constrain the development of innovative transportation projects that might lead to radical changes in the provision of transportation services. Another problem is that the railway system in the U.S. is by and large private, whereas as the road system is public. This situation makes it difficult (financially and institutionally) to integrate highway and railway projects since they are operated as different systems.

In conclusion, while the idea of reorganizing the executive branch to integrate decision-making has merit, it is unlikely to occur unless the Administration in power has the willingness, capability, and opportunity to change the system. One might speculate that the political environment of the 1970s - where environmental concerns were high on the political agenda - was very different to that of today. Any reorganization of the executive branch today is unlikely to occur in response to a concern for the environment or sustainable development. This conclusion means that the challenge of better coordinating/integrating policies and decision-making lies with Congress and the government organizations themselves. The question of how the U.S. DOT might change its federal programs and/or administrations to support sustainable development/transportation is the focus of Chapter 8.

Surface Transportation Funding

Before discussing issues relating to the size and control of funding for the surface transportation legislation, it is important to set the national context within which future debates over federal transportation funding will occur. In a recent evaluation of the foundations and purpose of the federal government, the GAO (2005a) provided a stark account of the pending financial crisis facing the U.S.

"[T]*he fiscal policies in place today will - absent unprecedented changes in tax/or spending policies - result in large, escalating, and persistent deficits that are economically unsustainable over the long term. ...*

... [T]*he nation's growing fiscal imbalances stems primarily from the aging of the population and rising health care costs. These trends are compounded by the presence of near-term deficits arising from new discretionary and mandatory spending as well as lower revenues as a share of the economy. ...* [T]*hese long term deficits will encumber a growing share of federal resources and test the capacity of current and future generations to afford both today's and tomorrow's commitments. Continuing on this unsustainable path will gradually erode, if not suddenly damage, our economy, our standard of living and ultimately our national security.*

Addressing the nation's long-term fiscal imbalances constitutes a major transformational challenge that may take a generation to resolve. Given the size of our projected deficit we will not be able to grow our way out of this problem - tough choices will be required. In addition, traditional incremental approaches to budgeting will need to give way to more fundamental and periodic reexaminations of the base of government, ultimately covering discretionary and mandatory programs as well as the revenue side of the budget. The nature and magnitude of the fiscal, security, and economic and other adjustments that need to be considered are not amenable to 'quick fixes;' rather they will likely require an iterative, thoughtful process of disciplined changes and reforms over many years" (2005a, p. 1).

The emphasis the GAO places upon long-term 'transformational' changes aligns directly with the approach to development articulated throughout this research. The GAO also paints a rather pessimistic picture of the future environment in which the transportation sector might have to fight for a much reduced allotment of federal funding. If one accepts that the fiscal underpinnings of the U.S. are unsustainable, it dramatically shifts one's view on the future of the surface transportation legislation.

During the D.C. meetings, two general themes arose when discussing the funding of the surface transportation legislation. These were [1] concern over the continual growth in funding and scope of the surface transportation legislation and [2] debate over the federal government's control of/influence over transportation funds. These two themes are discussed below.

The growth in the funding and scope of the surface transportation legislation

The recent passage of SAFETEA-LU has left many in Washington D.C. questioning the future viability of the current model of surface transportation legislation. There was a general concern that the transportation legislation cannot continue to grow in both size and scope during each reauthorization. One of the drivers behind these trends was seen to be the growing number of special interest groups that lobby Congress for transportation

funding. As the number of stakeholders expands, the effectiveness of the legislation is undermined by the need to satisfy a larger number of interests. This trend has the effect of shifting the debate away from national transportation policy towards one that revolves around the division of transportation funds. The rapid increase in 'pork barreling' was also seen to be a major problem. While many congressional members argued that the 6,371 'high priority' or 'designated' projects' in SAFETEA-LU (some $24 billion or 9% of the total spending) were essential for the economy, few in Washington D.C. held such a view.

The growing number of stakeholder groups was also seen to increase the federal government's involvement in local issues. The new 'Safe Routes to School' program was put forward as a good example of how $612 million of federal funds will be invested over five years to address what is, in effect, a local issue. Therefore, one must ask whether programs such as this are the best use of scarce federal money.

The growing scope of the surface transportation legislation is leading to another problem; the general public is unlikely to continue to support a transportation program that it can no longer easily understand. Whereas the 1956 interstate highway program had a clear objective, the current transportation legislation was described by several people as lacking a coherent focus.

Given the fiscal crisis facing the U.S., it is likely that before a new transportation bill is authorized in 2009 (or later), the federal government is going to have to make some difficult decisions. It appears that either the scope of the federal transportation program will have to be reduced or a large new source of funding will need to be identified. Since there is a strong resistance to increasing the gasoline tax[771] it seems that the stage is set for a real policy debate about the future role of the federal government in surface transportation. In this regard, this research is timely and should help stimulate the debate on how the federal government might address the issue of sustainable development/transportation.

The federal government's control of/influence over transportation funds

The central outcome from the D.C. meetings was the consensus that the federal government's role in guiding transportation planning needs to be reevaluated. As a result of the two-year delay in the surface legislation, a more than double increase in the number of earmarked projects, and the intense donor-donee debate, there is increasing pressure to stop sending state transportation money to the federal government. While the formation of MPOs and the planning guidance provided by the federal government are seen to be helpful, several people questioned the benefit that states receive from having

[771] There was a genuine sense of frustration in Washington D.C. that during the debates on the reauthorization of TEA-21 the President and many members of the House and Senate were opposed to any increase in the gasoline tax. Several people argued that the failure to keep the gasoline tax consistent with inflation over the past decade has now created a situation where the public perceives that the transportation system can be maintained at no extra cost. In addition, the recent fluctuation in the price of fuel in the wake of several major hurricanes along the Gulf Coast has led to a general perception that the gasoline tax should be reduced.

such an involved federal government. One interesting comment was that the level of 'minimum guarantee' is a useful barometer of whether the federal government has pushed states too far with the requirements in previous legislation. Hence, the recent increase in SAFETEA-LU of the minimum guarantee to 95% of state funds indicates that many states are pushing back against the federal transportation bureaucracy.

It is likely that any reevaluation of the federal role in the transportation system is likely to revolve around issues of interstate commerce and national security - the two core reasons why the federal government is involved in transportation. However, since changing the performance and structure of the national transportation system is analogous to changing the direction of a supertanker, it is likely that a dramatic change in the structure of the transportation policy architecture will take decades to yield results. This fact raises the issue of the rate at which movement towards the concept of sustainable development/transportation can be achieved. It seems that the GAO's assessment that it will take a generation to address the nation's long-term fiscal imbalances is also applicable to the 'transformational challenge' facing the transportation sector.

7.4 Conclusion

The major conclusion of this chapter is that while there are significant barriers to the adoption of the proposed sustainable transportation decision-support framework (hereafter called the 'ST framework'), there appears to be a genuine interest in reevaluating the current structure and intent of surface transportation legislation. The factors driving this interest are the unsustainable growth in both the size and scope of the legislation and the concern that the reauthorization process is primarily a debate over how to divide (and earmark) funding rather than how best to develop the national transportation system. Hence, it appears that the stage is set for a real debate over the future role of national transportation policy which should provide an opportunity to introduce the core ideas of the ST framework. Given the lack of Congressional interest in sustainable development, a better approach than pushing the ST framework in a unified manner might be to repackage and promote the various elements of the framework individually.

With regards to the MPO questionnaire, the results were mixed. In some cases the ideas included in the ST framework fell outside the MPOs' current planning and decision-making processes; in others, the MPOs were using similar ideas/concepts to those in the framework. The major barriers to introducing the proposed ST framework were seen to be [1] the MPO's limited authority and [2] the structure and focus of federal transportation programs and MPO planning guidance that effectively constrain the scope of alternatives considered when addressing problem areas. In addition, it is not obvious how the MPOs might respond to several of the core ideas in the proposed framework. For example, further research is required to identify whether an MPO could legally or pragmatically adopt a Rawlsian approach to planning/decision-making as part of a 'fair and impartial' planning process.

In those cases where an MPO's activities align well with the ideas included in the ST framework, there is a clear connection between the MPO's actions and government legislation. This observation indicates that a useful way to encourage MPOs to address specific issues or adjust their planning/decision-making process would be to change the relevant legislation. However, any increase in the requirements placed upon, or freedoms given to, MPOs must be carefully considered to ensure that they have the necessary resources and authority to achieve the desired objectives. A potential problem with any legislative change is that the diversity in the size, structure, and authority of MPOs across the U.S. means that their ability to address a new requirement will vary significantly. In addition, since the MPO is a creature of the political process, the success of any new requirement is largely dependent upon whether it is politically feasible. In this regard, the concept of the hybrid trade-off/positional analysis framework might gain support since elements of the framework mirror the political process.

Finally, while MPOs indicated that their transportation plans are relatively integrated/coordinated with urban/regional development plans, environmental regulation, and economic policy, respondents reported much less integration/coordination with other key policy areas. This outcome highlights a need to identify instruments to enhance policy integration among sectors.

In conclusion, this chapter provides a preliminary evaluation of the potential barriers to, and opportunities for, applying the ST framework to the MPO transportation planning and decision-making process. The following chapter takes a much broader view and looks at ways in which the ST framework might provide opportunities to rethink the current surface transportation legislation.

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8 The Federal Role in Achieving Sustainability in Transportation

Chapters 2, 4, 5, and 6 presented a theoretical framework for conceptualizing and addressing problems related to sustainable development/transportation. The approach to these chapters was not to be intellectually constrained by politics or 'real world' logic, but to ask the question of '*if there were no constraints, what should be done to make development more sustainable?*'

However, in Chapter 7, the focus shifted to identifying potential gaps between what *should* be done and what *could* be done in practice. This chapter highlights potential barriers to the implementation of the proposed sustainable transportation decision-support framework. While the results from Chapter 7 are promising, the analysis identifies several areas where Metropolitan Planning Organizations (MPOs) are likely to have difficulty in applying a particular tool or principle to achieve a desired sustainable development goal. In general, these difficulties stem from the transportation decision-making environment that defines the authority and capabilities of MPOs. This environment is shaped by local/regional geopolitical characteristics and by federal mandates and guidance.

While Chapter 8 continues to explore the transportation decision-making environment, the focus shifts from the regional to the federal level. In addition, rather than just considering the role of the U.S. Department of Transportation (DOT), the chapter presents a more comprehensive view of the federal government. The reason for this broad focus is that if sustainable development/transportation is to become a national objective, it is important that one understands the structural or systemic problems that need to be overcome. Thus, this chapter adopts a '*given the prevailing circumstances, how can it be done*' approach to the creation of a national strategy for sustainable development/transportation.

The chapter begins by taking a broad look at the role of the federal government in the delivery of transportation services from the 1930s until today. Section 8.1 also includes a discussion of how the federal government's role has evolved in response to changing national circumstances and changes in the transportation system itself.

Section 8.2 takes a closer look at the structure of the federal government. It provides an overview of the federal transportation decision-making environment by highlighting the principal federal bodies and their role in the creation of transportation policy. The section concludes by presenting several different models that might enable a national sustainable transportation policy to be established in the U.S.

Section 8.3 looks at previous efforts to establish a national strategy for sustainable development/transportation.

Section 8.4 concludes the chapter by looking at the federal government's future role in achieving sustainability in transportation.

8.1 The Evolving Role of Federal Government in Transportation

> "*Transportation policy development in the United States has evolved in response to national challenges and opportunities, shifts in ideology on the role of government, and changes in the nation's transportation systems, networks, and technology, as our society has changed*" (U.S. DOT 2000d, p. 26).

The purpose of this section is to explore the evolving role of federal government in transportation to provide a context for current national transportation policy in the U.S. The rationale for adopting this approach is that if one hopes to contribute to the national debate on the development of the U.S. transportation system, it is important to understand the events that created the prevailing transportation legislation.

Today, the federal government is involved (to varying degrees) in virtually all aspects of transportation in the U.S. It provides funding for highways, railroads, mass transportation, waterways, airways, and pipelines and sets the regulatory environment within which these systems operate. Hazard (1988) describes how the transportation-related functions assumed by the federal government have increased over several centuries in response to the nation's six phases of spatial development - i.e., [1] exploration and discovery, [2] colonization and settlement, [3] frontier penetration (eastern); [4] overland expansion (western), [5] industrialization and urban development, and [6] the post-industrial services era. During each phase, the private sector and federal government faced new demands and opportunities to which they responded with varying degrees of success.

A critical juncture in the federal government's involvement in transportation was the 'Granger cases' of the late 19th Century (Hazard 1988; Lieb 1981). Due to poor rail service, high rates, and discriminatory practices by the railroads, farmers in the Midwest (supported by the Grange organization) lobbied their legislators to establish maximum railroad rates to protect their livelihoods. In response, the 'private' railroads brought six Granger cases before the Supreme Court that questioned the constitutionality of a state's right to regulate a private enterprise. The basis for these cases was the 14th Amendment to the U.S. Constitution, adopted in 1868 nearly ten years prior to the Granger cases. The amendment declares that no state shall "*deprive any person of life, liberty, or property, without due process of law.*" The most important Granger case was *Munn vs. Illinois* (1877), which revolved around the ability of the State of Illinois to regulate grain elevator rates in Chicago. The Supreme Court ruled that "[w]*hen ... one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good.*" Therefore, since the grain elevators were "*a business in which the whole public has a direct and positive interest,*" they could be regulated.

The authority of the states to regulate common carriers 'affected with a public interest' was soon circumscribed, however, by a Supreme Court ruling in 1886. In *Wabash, St. Louis, and Pacific Railway Co. vs. Illinois*, the court ruled that states could not regulate railroad rates for interstate commerce. Since about three-quarters of the railroads extended across state boundaries, this ruling severely limited the ability of states to address railroad monopoly abuses (Lieb 1981).[772] The Supreme Court decision effectively passed the responsibility for regulating railroads (and commercial carriers more generally) to the federal government. The authority of the federal government to regulate interstate commerce stems from the 'commerce clause' of the U.S. Constitution, which gives Congress the power to "*regulate Commerce ... among the ... States*" (Article 1, Section 8, Clause 3). While the federal government had initially considered the idea of establishing effective railroad competition by constructing and operating federal railroad lines (recommended by the Windom Committee in 1874), the *Wabash* ruling "*made it apparent that effective railroad regulation would necessitate federal intervention*" (Lieb 1981, p. 185). In response to *Wabash*, Congress established the Interstate Commerce Commission (ICC) - the first regulatory agency - with the passage of the Act to Regulate Commerce in 1887. Over the next century, the ICC became the most influential economic regulator until its abolishment in 1995 following a period of economic deregulation and privatization that began in the 1970s.

The early involvement of the federal government in the regulation and promotion of transportation has now created a situation in which the government has become "*a fully-fledged participant in the transportation process*" (Hazard 1988, p. 20). Hazard (1988, p. 20) describes the gradual expansion of the federal government's role in transportation as the acquisition of functions that tend "*to accrue without major cutbacks.*" In particular, he identifies eight major functions that the federal government has taken on over the past two centuries that are still relevant today. These are (Hazard 1988):

1. *Economic Regulation* [and Deregulation] - i.e., the monitoring of rates and services provided by common carriers and the entry/exit control of these carriers on important routes and services.
2. *Social Regulation* - i.e., the establishment of environmental and safety standards, employment rights, environmental justice, and civil rights.
3. *Plans and Operates the Ways* - i.e., the creation of policy to guide (or support) the development and operation of interstate and international ways (e.g., highways, railroads, waterways, airways, and pipelines).
4. *Coordination of Services* - i.e., the development of policy to coordinate the provision of transportation services. This function depends upon the ability of the federal government to influence the development of each transportation mode and encourage intermodal/multimodal planning.
5. *Financing and User Charges* (Revenue Raising) - i.e., the provision of federal funds to assist with the development of transportation modes. Historically, most of these funds are sourced from transportation-related user charges and taxes.
6. *Intervention in Services* - i.e., the assumption of responsibility for services or the provision of financial assistance to service providers during a time of war,

[772] The Supreme Court ruling did, however, allow states to regulate 'indirect' burdens such as safety.

national emergencies, financial crises, or labor/management disputes to ensure a continuity of service to protect social well-being.

7. *Research and Development* - i.e., the financing and support of research and development in policy, technology, and other related areas.
8. *Organization and Management* - i.e., the organization, management, and execution of the seven functions described above and the coordination of agencies responsible for the management of national transportation policies.

The importance the federal government gives to each of the above functions depends upon a wide range of interconnected factors that continually evolve over time (Cambridge Systematics 1996; U.S. DOT 2000d). First, the *extent* and the *condition* of the nation's transportation systems have long been an important catalyst for federal action. For example, the economic need to 'get the farmer out of the mud' led to federal highway legislation in 1916 that supported the construction of paved rural roads. In the middle of the twentieth century, the focus on rural roads gave way to the economic need to connect the nation via an interstate highway system. Today, the extensive core of transportation networks (e.g., highways, railroads, waterways, airways, etc.) has shifted the federal focus to the creation of a multimodal, interconnected, equity-based system and the preservation of this system (Downey 2005).

Each time a transportation mode/system receives support from the federal government, the dynamics of the transportation system can change. For example, the emphasis given to interstate highways (and highways in general) between the mid-1950s and the 1990s led to a decline in transit and railroad passenger and freight revenues and the subsequent need for federal support for these modes (Flink 2001; Gordon 1991; Weiner 1997). Thus, the expansion of highways was an important factor that led to the federal government's involvement in mass transit and passenger/freight railroad systems.

Second, and closely related to the above factor, are the *negative externalities* from the transportation system. While the promotion of a transportation mode/system might further certain societal objectives (such as improving mobility or accessibility), it can also result in negative externalities (such as air and water pollution, ecosystem disruption, and increased accident rates) that create the need to regulate the same mode/system to protect society and the environment. This example provides some insight into why the federal role in transportation has expanded over time, especially in the area of social regulation.

Third, the *performance* of the nation's private transportation service providers (i.e., the airlines, railroads, motor freight carriers, maritime/shipping companies, some transit operators, intercity bus and rail companies, and pipeline carriers) in the movement of people and goods has a direct impact on nation's economic and social well-being. As the transportation system has evolved over the past two centuries, the federal government's 'direct' involvement in the activities of private transportation service providers has mainly occurred in response to an industry's or firm's abuse of monopoly power or pending bankruptcy. In addition, the federal government has also had an 'indirect' impact on service providers by shaping the widely-varying market conditions under which they

operate. For example, the promotion of highways dramatically changed the ability of railroads to compete with motor freight carriers. Similarly, social regulations designed to protect human health and the environment can significantly impact the costs of providing a transportation service. However, one might argue that the internalization of negative externalities is simply correcting a market failure that was previously unnoticed or was allowed to persist to the benefit of the service providers and their customers.

Since the need to regulate, promote, or protect different transportation services 'affected with a public interest'[773] is likely to remain for the foreseeable future, it would seem that the federal government's role in protecting the public interest will continue to include responding to the changing fortunes and misfortunes of private enterprises. However, whether it chooses to address social problems in a direct or indirect manner will largely depend upon the prevailing ideology of government (discussed below). While this discussion focuses on the performance of private transportation service providers, the same principles apply to public transit agencies even though the government's response to performance problems is likely to be different.

Fourth, *technological innovation*, changing *demographics*, shifts in personal *lifestyle choices*, and the rise of *globalization* continually modify the challenges to which the transportation sector and federal government must respond. For example, the transportation needs of the aging population are likely to place new demands on transportation services and perhaps create new opportunities for services and technologies designed to help those who have 'aged-in-place.'[774] The federal government is already active in this area. For example, the Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) recently established the 'Elderly Individuals and Individuals with Disabilities Pilot Program.' This program expands the federal government's financial assistance for public transportation 'capital' projects developed "*to meet the special needs of elderly individuals and individuals with disabilities*" (49 U.S.C. § 5310(a)(1)) to include 'operational expenses' and 'new services.'

Since the role of government is to serve societal needs, its role will continue to evolve in response to the powerful trends shaping society such as the growing number elderly in the U.S. While responding to the needs of the aging population is likely to receive significant attention in the coming decades, the author suggests that the two factors which are most likely to shape the federal government's role in transportation during the twenty-first century are rapid technological change and globalization (see Sections 2.3 and 2.5).

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[773] While the federal government's initial concerns for the 'public interest' revolved around the affordability of transportation services, today a much broader range of social and environmental issues are considered. These are reflected by the government's extensive list of transportation-related functions.

[774] 'Aging-in-place' occurs when older people choose to remain in the same residences where they lived while rearing their children and holding jobs. When aging-in-place occurs in the suburban setting, the need to continue to drive to maintain one's mobility raises important questions about the safety of older drivers and that of other members of society.

Finally, the federal government's *shifting ideology* on its role in transportation has a significant impact on transportation policy and funding. During the eighteenth and most of the nineteenth century, the federal government adopted what might be called a quasi-laissez faire approach to transportation (Norton 1967). For example, while the railroads were private and free from economic regulation, they had received significant land grants from the federal government to assist with their development. A similar situation occurred with the promotion of canal and turnpike construction; however, most of the financial support for these systems came from the states (ibid).

During the late nineteenth century political ideology changed in response to the Granger movement. Public dissatisfaction with the cost and performance of transportation services led to a shift in government ideology away from a quasi-laissez faire approach towards the economic regulation of private interests to protect public interests. This ideology prevailed until the second half of the twentieth century. A series of changes in the extent, condition, and performance of regulated commercial carriers combined with a political desire for defederalization, resulting in the deregulation of the commercial carrier industries. Thus, the political ideology of today might again be described as quasi-laissez faire, but the extent of activities subject to social and economic regulation is far greater than that during the eighteenth and early nineteenth century. The main reason for this increase in regulation is modern society's growing awareness of how transportation activities can lead to negative social and environmental impacts (see Section 6.2.1). These added dimensions mean that the federal government is likely to continue the quasi-laissez faire approach to transportation, although within the overarching context of sustainable development (regardless of whether this concept is formally acknowledged).

Having introduced the core functions of the federal government and the factors that influence its approach to transportation policy, Table 8.1 provides a summary of the major issues that characterize the evolution of the federal government's role in transportation since the 1930s. What is most clear from the table is the significant growth in the breadth of transportation (and transportation-related) issues considered by the federal government.

The 1930s witnessed a dramatic expansion in the economic regulation of commercial carriers as well as a significant increase in federal funding for highways with the formation of the federal-aid highway program. Federal funding for highway projects was also used during this period to lessen the impacts of the economic depression.

In the early 1940s, the federal government became interested in the development of an interstate highway system; however, these plans were delayed by World War II (WWII). In the post-WWII period, suburban areas in the U.S. experienced rapid growth due to the large number of returning troops and low interest housing loans. The growth in housing initially outstripped the growth in highways, leading to increasing demands for new highway construction.

In the mid-1950s, the federal government embarked on the most ambitious public works program to date - building a 41,000 mile interstate highway system. The period between

1956 and the mid-1990s is now referred to as the 'interstate era,' which reflects the significant role that the federal government played in highway development.

In the 1960s, a major concern facing the federal government was declining transit ridership caused by significant growth in automobile ownership and suburban expansion. The federal government responded to this problem by first providing loans and then grants to states to enable them to take ownership of the failing private transit systems. This initial financial assistance marks the beginning of a growing federal role in urban mass transportation. More generally, the 1960s witnessed the rise of urban transportation planning to address the problems caused by the construction of highways passing through urban areas.[775] In addition, vehicle and highway safety captured the interest of the federal government following the publication of Ralph Nader's (1965) book *Unsafe at Any Speed.*

The 1970s were dominated by the rise of social and environmental concerns with the birth of the nation's environmental movement (see Section 3.2). These issues were fueled by the energy crises and public concern about the dominance and urban impacts of automobiles. While social regulation relating to transportation increased during the 1970s, the decade witnessed the beginning of a movement to remove economic regulation of commercial carriers.

In the 1980s, the role of the federal government in transportation declined following the Reagan Administration's push for defederalization and deregulation. This new federal focus on economic efficiency continued into the 1990s (Hahn et al. 2003).

In the 1990s, the federal government's role in transportation grew with the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) and the Clean Air Act Amendments (CAAA). ISTEA and CAAA revolutionized transportation planning by creating a strong linkage between transportation and air quality planning. These connections were continued and strengthened in subsequent reauthorizations of ISTEA. The federal government's concern for equity also became an important factor during the 1990s with the passage of the Americans with Disability Act and the emergence of environmental justice.

Finally, the terrorist attacks on September 11, 2001 led to a significant increase in the federal government's involvement in transportation security during the first half of the 2000s. During this same period, the future of the surface transportation legislation became unclear following the prolonged reauthorization of the Transportation Equity Act for the 21st Century (TEA-21) - the successor to ISTEA. In total, twelve extensions were required before the House and Senate were able to agree on a bill that was signed into law on August 10, 2005.[776] While the size of the legislation and the donor-donee debate

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[775] During the first ten years of interstate highway construction some 335,000 homes were demolished. Source: Surface Transportation Policy Project (STPP), *Transportation and Social Equity*, http://www.transact.org/library/factsheets/equity.asp (accessed on 04/09/06).

[776] Source: FHWA Reauthorization of TEA-21, *Extensions*, http://www.fhwa.dot.gov/reauthorization/extension.htm (accessed on 04/09/06).

were the main points of contention, the subtext to the debate was the failure of the surface transportation legislation to unite the stakeholders behind a clear mission. With a growing national deficit, federal funding for transportation is likely to become increasingly sparse without the creation of significant new revenue sources. Given the strong political resistance to increasing taxes, SAFETEA-LU tries to raise additional capital by encouraging public-private partnerships and the creation of value pricing programs. Both of these options revolve around the performance of the system. Given these trends, it is likely that the federal government will need to emphasize 'performance-based' (rather than 'process-based') planning in the future in an attempt to maintain the core functions of the national transportation system with limited financial resources.[777]

[777] Source: Personal communication with Edward Weiner (Senior Policy Analyst, Office of the Secretary of Transportation, U.S. DOT), December 5, 2005.

Table 8.1: Summary of the Major Events that Characterize the Evolution of the Federal Government's Role in Transportation

Transportation Issues	Federal Response	Relevant Legislation
1930s		
▪ 'Getting the farmer out of the mud' ▪ Economic depression/public works programs ▪ Growth of state highways into urban areas	▪ The federal government continues to support the development of highways that began in 1916 with the 'Federal-Aid Road Act.' This act created the basis of what became known as the federal-aid highway program and formed the federal-state relationship. ▪ The federal highway construction program expands in an effort to alleviate the effects of the economic depression by increasing the funding for public works.	1932 Emergency Relief and Construction Act 1933 National Industrial Recovery Act 1934 Federal-Aid Highway Act 1938 Federal-Aid Highway Act
▪ Growing interest in automobiles ▪ Traffic control	▪ Federal-aid highway funds are made eligible for the identification and development of future highway construction projects. The U.S. Bureau of Public Roads (now known as the Federal Highways Administration) and state highway departments begin developing 'statewide highway planning surveys' to identify and map the extent of the existing highway system, study traffic volumes, and determine the ability of states to finance the construction and operation of the highway system. ▪ Highway-related research and development begins to receive federal funding.	1934/38 Federal-Aid Highway Act
▪ 'Chaotic and destructive' competition among commercial carriers (excluding railroads)	▪ Expansion of economic regulation (from an early focus on railroads) to include virtually all commercial carriers.	1933 Intercoastal Shipping Act 1934 Air Mail Act 1935 Motor Carrier Act 1936 Merchant Marine Act 1938 Civil Aeronautics Act
1940s		
▪ World War II	▪ The federal government restricts the activities of state highway departments by limiting funding to the Strategic Network of Highways.	1941 Defense Highway Act
▪ National connectivity/modal coordination ▪ Suburban growth (post-World War II)	▪ The federal government continues to invest in highways and declares an interest in the Interstate Highway System.	1944 Federal-Aid Highway Act
▪ Aviation	▪ Federal funding for airports is initiated.	1946 Federal Airport Act

Transportation Issues	Federal Response	Relevant Legislation
1950s		
▪ Suburban growth (post-World War II) ▪ National connectivity/modal coordination	▪ Federal funding is authorized to encourage systemic urban planning to address problems associated with urban growth. This leads to the first major urban transportation analytic studies.	1954 Housing Act
▪ Passenger railroads	▪ Given the growing concern over the financial viability of a number of passenger railroads, the federal government allows the Interstate Commerce Commission (ICC) to consider petitions to discontinue failing passenger rail services.	1958 Transportation Act
▪ Economic development ▪ National defense ▪ Acknowledgement of growing problems in urban areas	▪ Federal funding is authorized for the construction of the interstate highway system. The government funds 90 percent of the construction costs. ▪ The Highway Trust Fund is established as the first dedicated funding source for highways. Federal taxes are increased on transportation fuels and equipment (e.g., tires) and weight taxes are imposed on heavy trucks and buses to help fund the interstate highway system.	1956 Federal-Aid Highway Act 1956 Highway Revenue Act
1960s		
▪ Urban transportation problems/declining transit ridership	▪ Federal funding is authorized for urban mass transportation development. ▪ The federal government establishes a requirement for the effective coordination of planning and construction of physical facilities in urban areas. OMB Circular A-95 provides a federal statement on the 'process' of planning. ▪ Declaration of a formal role for metropolitan planning agencies. ▪ Capital grants authorized for public transit systems to encourage cities to assume ownership of their failing (private) mass-transit systems.	1961 Housing Act 1964 Urban Mass Transportation Act 1966 Demonstration Cities and Metropolitan Development Act 1968 Intergovernmental Cooperation Act
▪ Urban transportation planning; growing interest in the creation of a 'balanced transportation system'	▪ Urban transportation planning is made a prerequisite for receiving federal funds. This requirement highlights the need for urban/metropolitan planning agencies that can carry out the required planning process. Planning agencies are required to use a 'continuing, comprehensive, and cooperative' planning process (the 3-C process).	1962 Federal-Aid Highway Act

Transportation Issues	Federal Response	Relevant Legislation
▪ Intergovernmental coordination of transportation programs ▪ Transportation/vehicle safety	▪ Creation of the Department of Housing and Urban Development (HUD), the U.S. Department of Transportation (U.S. DOT), the Urban Mass Transportation Administration (UMTA) - now the Federal Transit Administration (FTA) - and Safety Agencies (later absorbed into the U.S. DOT). ▪ The federal government develops safety standards for vehicles and requires states to develop highway safety programs.	1964 Urban Mass Transportation Act 1965 Housing and Urban Development Act 1966 Department of Transportation Act 1966 National Traffic and Motor Vehicle Safety Act 1966 Highway Safety Act
▪ Environment (transportation impacts on natural resources, historic sites, communities, and air pollution)	▪ The federal government sets the first emission standards for motor vehicles. ▪ Federal agencies are required to take into account the impacts of their actions on historic preservation and the natural environment. ▪ Federal requirement that all stakeholders are to be given a voice in the location and design of highways via a two-hearing process.	1965 Motor Vehicle Air Pollution and Control Act 1966 National Historic Preservation Act 1968 Federal-Aid Highway Act 1969 National Environmental Policy Act (NEPA)
1970s		
▪ Multimodal urban transportation planning and programming ▪ Community protection/ transportation disadvantage ▪ Freight mobility	▪ Dedicated funding is provided to metropolitan planning organizations (MPOs) for urban transportation planning. ▪ U.S. DOT issues joint highway/transit planning regulations that require states and (newly designated) MPOs to develop a long-range transportation plan (LRTP), a five-year transportation improvement program (TIP), and a multiyear unified planning work program (UPWP) that combine highway and transit projects. The planning process must be certified by the FHWA and UMTA (now the FTA) in order to receive federal funds. ▪ Extension of transit financial assistance to alleviate operating deficits. Certain highway authorizations (i.e., Highway Trust Fund allocations to the Federal-Aid Urban System) were allowed to be used for either highway or mass transit projects (first indication of 'funding flexibility'). ▪ The federal government establishes requirements that special efforts be made to serve the travel disadvantaged and for more community input in federally assisted transportation projects. ▪ Federal regulation begins to combine highway, transit, and safety into one piece of legislation (i.e., the 1978 STAA).	1970 Urban Mass Transportation Act 1970/73 Federal-Aid Highway Act 1973 Rehabilitation Act 1974 National Mass Transportation Assistance Act 1978 Surface Transportation Assistance Act (STAA)

Transportation Issues	Federal Response	Relevant Legislation
▪ Aviation growth	▪ The federal government recognizes that national airport and air control systems are inadequate and calls for the creation of a national airport plan. The Airport and Airway Trust Fund is established to finance the future growth of the system and (in theory) provide modal self-support.	1970 Airport and Airway Development Act 1970 Airport and Airway Revenue Act
▪ Railroad financial problems	▪ The federal government creates the National Railroad Passenger Corporation (Amtrak). Passenger railroad services are significantly reduced and an emphasis is placed upon high-speed corridor service. ▪ The federal government creates the Consolidated Rail Corporation (CONRAIL) to address the problems facing the financially distressed freight railroads.	1970 Rail Passenger Service Act Rail Reorganization 1973 Railroad Reorganization Act
▪ Deregulation/privatization	▪ The federal government adopts a new regulatory philosophy that competition is the best regulator of transportation and deregulates railroads and airlines.	1976 Railroad Revitalization and Regulatory Reform Act (4-R Act) 1977 Air Cargo Deregulation Act 1978 Airline Deregulation Act
▪ Environment (air quality, endangered species, and community preservation)	▪ Creation of the Environmental Protection Agency (EPA), the Council of Environmental Quality (CEQ), and the Office of Environmental Quality (under the CEQ). The formation of these bodies is the first reversal of the trend of decentralization of decision-making authority to state and local levels in over a decade. ▪ EPA promulgates national ambient air quality standards (NAAQS) and requires states to develop 'state implementation plans' (SIPs) to meet these standards. 1977 CAA amendments 'encourage' MPOs to develop the transportation component of a state's SIP, which includes the deployment of transportation control measures (TCMs). Sanctions can be applied (i.e., federal funds withheld) to states failing to meet the NAAQS. ▪ Federal law prohibits actions that contribute to the extinction of species in the U.S. The legislation has major implications for land use.	1970 Environmental Quality and Improvement Act 1970/77 Clean Air Act (CAA) Amendments 1973 Endangered Species Act
▪ Energy crisis (1973/74; 1979)	▪ Establishment of the 55 mph national speed limit, fuel economy standards for vehicles (i.e., CAFE standards), fuel price controls, and an emphasis on efficiency measures.	1974 Emergency Highway Energy Conservation Act 1975 Energy Policy and Conservation Act 1978 National Energy Act 1979 Emergency Energy Conservation Act

Transportation Issues	Federal Response	Relevant Legislation
▪ Efficiency and national and long-range transportation needs	▪ More stringent requirements for investment (alternatives) analysis; emphasis on improvements to existing system over new construction; and a series of national multimodal transportation studies are undertaken to evaluate the long-range transportation needs of the U.S.	-
1980s		
▪ Defederalization (led by the Reagan Administration)	▪ Federal government downsizing - reduction of budgets, roles, and regulations; major shift in authority back to the states, which are seen to be better positioned to make local decisions.	-
▪ Deregulation/privatization ▪ Efficiency/economy (reduce deficit, reduce costs to business, reduce regulation and reporting responsibility, encourage competition and private participation and investment) ▪ Concern that a reduced federal role will lower available transportation funds	▪ Regulations lifted on major transportation sectors including the interstate motor carrier, rail, bus, and maritime industries. The federal government adopts the position that transportation decisions should be guided by the marketplace rather than regulations and requirements. ▪ Privatization becomes a major theme. The role of stakeholders in the planning process is increased and private action, competition, and investment is encouraged. ▪ Increased emphasis on subjecting federal transportation investments to cost-benefit analysis.	1980 Motor Carrier Act 1980 Staggers Rail Act 1980 Household Goods Transportation Act 1982 Bus Regulatory Reform Act 1984 Shipping Act 1986 Surface Freight Forwarders Deregulation Act
▪ Urban transportation, planning, goods movement, and suburban congestion/mobility, paratransit, and rehabilitation of highways and transit	▪ Executive Order 12372 revokes OMB Circular A-95 and gives states more flexibility in how they conduct transportation planning. ▪ Joint urban transportation planning requirements are retained but the 'process' of developing the LRTP, TIP, and UPWP is left to the states and MPOs. ▪ Federal gasoline and other transportation-related taxes are raised to address concerns of deteriorating infrastructure and unmet demands. ▪ Urban transportation focus shifts to suburban growth and congestion; emphasis on self-help solutions and private sector participation. ▪ Paratransit policy is introduced. ▪ The Transit Account of the Highway Trust Fund is created to fund capital construction projects. Fixed guideway transit projects become subject to a more rigorous analysis of alternatives, engineering, and cost-effectiveness analysis. Transit operating subsidies are phased out.	1982 Surface Transportation Assistance Act (STAA) 1984 Public Works Improvement Act 1987 Surface Transportation and Uniform Relocation Assistance Act

Transportation Issues	Federal Response	Relevant Legislation
▪ Energy	▪ Energy controls lifted; state action plans requirement rescinded; states permitted to raise speed limits. ▪ Focus on global markets, international competitiveness, intermodal options, and technology.	-
1990s		
▪ National transportation policy ▪ Multimodality/connectivity, efficiency, safety, funding flexibility, environmental protection, national economy, and national defense	▪ The 1990 national transportation strategic planning study sets new direction for national transportation policy in a post-interstate era. The six themes of the proposed strategy are to: - maintain and expand the nation's transportation system; - foster a sound financial base for transportation; - keep the transportation industry strong and competitive; - ensure that the transportation system supports public safety and national security; - protect the environment and quality of life; and - advance U.S. transportation technology and expertise. ▪ ISTEA is passed. It provides major new funding for transportation; places emphasis on efficiency, intermodalism, and environmental protection; institutes requirements for ISTEA Performance Management Systems (later rescinded); strengthens the metropolitan planning process and expands the role of MPOs in project selection and transportation decision-making; creates planning factors to guide development of transportation plans; and increases flexibility in the use of highway and transit funds. ▪ A new National Highway System (NHS) comprised of some 160,000 miles of highway is defined and funding is provided for its preservation. ▪ ISTEA is reauthorized in 1998 as TEA-21. TEA-21 continues and strengthens ISTEA's focus on the environment and increases the planning and funding flexibility for state and local agencies to determine their own transportation investment strategies.	1991 Intermodal Surface Transportation Efficiency Act (ISTEA) 1995 National Highway System Designation Act 1996 Federal Aviation Reauthorization Act 1998 Transportation Equity Act for the 21st Century (TEA-21)

Transportation Issues	Federal Response	Relevant Legislation
▪ Environment (air quality)	▪ 1990 CAA Amendments set new air quality standards, call for SIP updates, and threaten sanctions. ▪ Each statewide transportation improvements program (STIP) is required to incorporate metropolitan TIPs and 'conform' to the state implementation plan (SIP). Areas classified as being in 'non-attainment' are eligible for federal funding under a new Congestion Mitigation and Air Quality Improvement Program (CMAQ) created by ISTEA.	1990 Clean Air Act (CAA) Amendments 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) 1998 Transportation Equity Act for the 21st Century (TEA-21)
▪ Equity	▪ Discrimination on the basis of disability in both the public and private sector is prohibited. Transit systems are required to become more accessible to disabled travelers and operators of fixed route transit systems are required to provide paratransit services for persons with disabilities. ▪ Presidential Executive Order 12898 on environmental justice stipulates that all federal programs and activities must not use criteria, methods, or practices that discriminate on the basis of race, color, or national origin. The requirement for environmental justice is incorporated into the environmental impact process required under NEPA.	1990 Americans with Disabilities Act
▪ Deregulation	▪ The federal government transfers the remaining (and limited) regulatory authority of the Interstate Commerce Commission (ICC) to the Surface Transportation Board (STB) that is affiliated with the U.S. DOT.	1995 Interstate Commerce Commission Termination Act
2000s		
▪ Aviation	▪ Federal support for airport development increases.	2000 Wendell Ford Aviation Investment and Reform Act for the 21st Century (Air-21)
▪ Security	▪ The Transportation Security Administration (TSA) is formed following the terrorist attacks on September 11, 2001; security becomes an important consideration in the transportation planning process.	2001 Aviation and Transportation Security Act

Transportation Issues	Federal Response	Relevant Legislation
▪ Highway safety, funding equity/minimum guarantee, innovative financing, efficiency, environmental streamlining, public participation, national economy, freight mobility, and global connectivity ▪ Lack of well-defined (or mission-oriented) transportation objective ▪ Growing federal deficit	▪ The federal government reauthorizes TEA-21 and continues the coordinated and comprehensive approach to surface transportation legislation developed during the 1990s. The core federal-aid highway programs are kept intact with several new (smaller) programs and programmatic frameworks are refined to better reflect transportation needs. ▪ New emphasis placed upon using private finance to develop the transportation system and on encouraging public-private ventures. While calls for increasing transportation-related taxes are rejected, there is growing support for 'value pricing' as it addresses the growing problems of revenue generation and congestion. ▪ In the post-interstate era, states question whether minimum guarantee is equitable. In response to the intense state donor-donee debate, the federal government raises the minimum guarantee under a new 'Equity Bonus' program.	2005 Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

Primary Sources: Weiner (1984; 1992; 1997) and Cambridge Systematics (1996).
Secondary Sources: Harper (1982), Hazard (1988), Lieb (1981), Mertins (1972), Norton (1967), and U.S. DOT (2000d).

In conclusion, since the beginning of the twentieth century, the focus of federal transportation policy has evolved from 'getting the farmer out of the mud,' to the interstate era, to the current focus on a multimodal/interconnected, equity-based system and the preservation of this system. During this period, the role of the federal government in transportation has evolved through a cycle of economic regulation and deregulation and growth in transportation-related social regulation (covering environmental and civil rights issues). What is evident from this period is that the functions of the federal government tend to be used in response to transportation problems rather than being deployed proactively to prevent problems from occurring. Hazard (1988, p. 20 and 3, respectively) goes as far as describing the federal role in transportation as a "*reluctant, retrospective, almost unconscious process*" that is guided by events rather than a "*conscious design.*"

Since a central element of sustainable development is to adopt a 'holistic systems approach' to policy and planning (see Section 6.3), one can argue that the historical approach of the federal government to transportation must change if significant progress is to be made towards realizing sustainable development/transportation. Thus, the federal government's role in transportation needs to be guided by a holistic view of the driving forces that shape the transportation system over the short- and long-term; this holistic view should inform the creation of *proactive* policies designed to prevent expected problems. Such an approach will require the development of a set of indicators that highlights areas where problems are arising and *preemptive* action can be taken. *Thus, if the federal government wishes to pursue sustainable development, its approach to transportation needs to transition from a 'reluctant and retrospective' to a 'proactive and preemptive' process. This approach is also likely to involve difficult short-term versus long-term tradeoffs that would be guided by a clear vision of how the national transportation system should develop.*

Finally, while the 'growing' role of the federal government in transportation has been referenced throughout this section, it is helpful to set this growth in a broader context. Since the 1960s, the total number of federal employees has remained relatively constant, which stands in contrast to the steady growth in state and local government employment (Bonser et al. 2000). In 2004, the federal government employed about 2.4 million people, whereas states employed 4.2 million and local government employed 11.6 million.[778] While total government employment has grown from around 13 million in 1966 to over 18 million in 2004,[779] as a percentage of the U.S. labor force total government employment has declined from its peak of 15.7% in the 1970s to 14.6% in 1996 (ibid). Therefore, the growth in total government employment is declining relative to private sector job creation. This trend is much more pronounced for the federal government given the lack of employee growth. When Bonser et al. (2000) considered these trends with the fact that government spending has maintained a steady share of around one-third of a growing GDP, they reached the following conclusion:

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[778] Sources: U.S. Census Bureau, Federal, State, and Local Governments, *Public Employment & Payroll*, http://www.census.gov/govs/www/index.html (accessed on 04/09/06).
[779] Supra note 778.

> "*Governments that spend large amounts of cash managed by few people serve as financial conduits for transfer payments, federal financial assistance to state and local government, large-scale contracts, and capital-intensive missions rather than labor-intensive, client-oriented services. Thus, the federal government buys national service delivery from state and local government through numerous grants, contracts, and cooperative agreements*" (Bonser et al. 2000, p. 45).

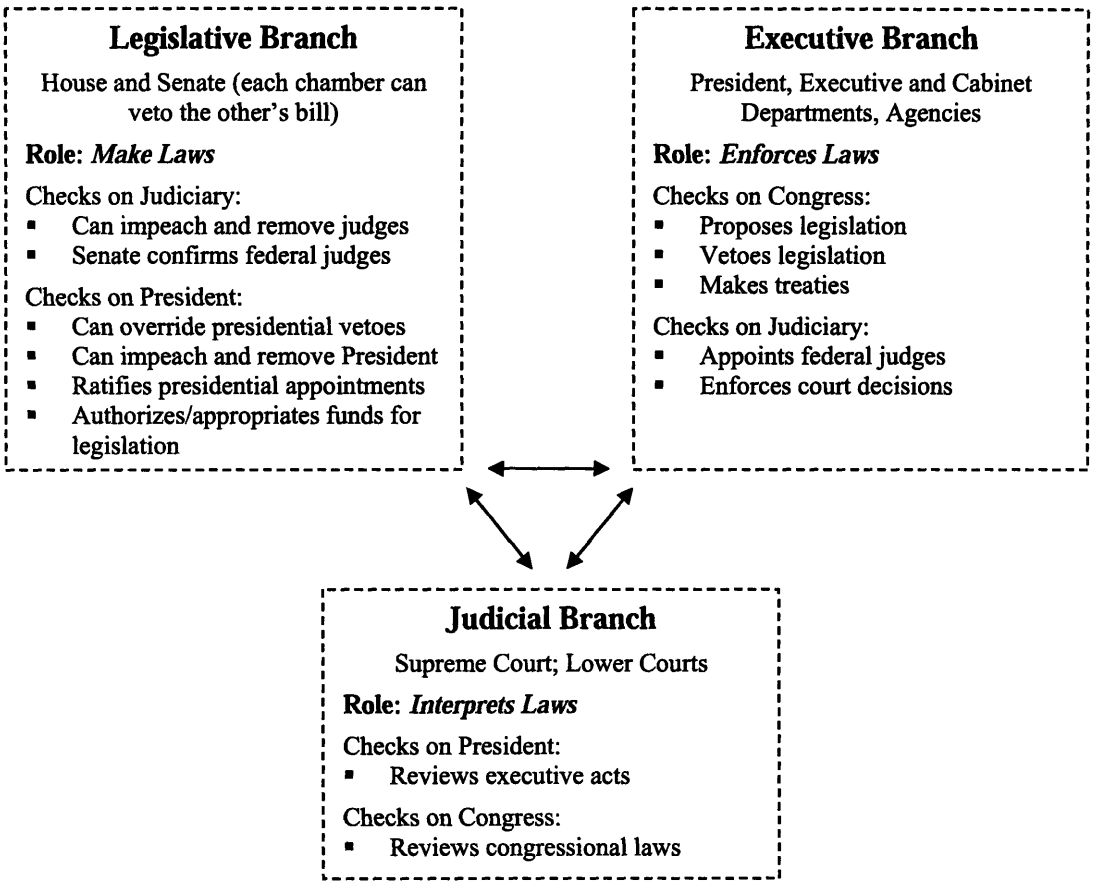
The above observations characterize the federal government's approach to surface transportation legislation. With the passage of SAFETEA-LU in 2005, Congress authorized $286.4 billion to be distributed to states via formula grants or discretionary funding over a six-year period (FY 04-09). While the federal government's role in transportation has increased, it is the state and local governments that have been given the responsibility to carry out the federal mandates. Thus, one must be cautious not to equate the growing role of federal government in transportation with a bourgeoning federal body - this is simply not the case. In addition, when compared to Sweden, France, Germany, Canada, Britain, and Japan, the U.S. government as a whole (i.e., federal, state, and local governments combined) spends the lowest percentage of its GDP on the public sector (Bonser et al. 2000).

8.2 Federal Government and the Transportation Decision-Making Environment

In the previous section, the federal government is only referred to in general terms. The purpose of this section is to provide a more detailed overview of the structure of the federal government and the decision-making environment within which transportation policy is developed. This section looks specifically at the legislative authority of the U.S. Department of Transportation (DOT) and how the agency fits within the federal system. The section concludes with a look at three different approaches that have the potential to guide transportation policy which promotes sustainable development/transportation through the Congressional review process.

The federal government consists of three separate branches - i.e., the legislative, executive, and judicial branch (Figure 8.1). Each branch has its own role and authority, although some powers are shared among them (Johnson et al. 1994). The legislative branch (i.e., Congress) is responsible for developing laws, the executive branch (i.e., the President and cabinet-level departments/agencies) executes these laws, and the judicial branch (i.e., the Supreme and lower courts) interprets whether laws are constitutional and have been administered as intended. The tripartite system is designed to limit the authority of any one branch to prevent abuses of power.[780]

[780] While the tripartite system is often referred to as separating the powers of government, Neustadt (1980, p. 33) notably challenged this perception by characterizing the federal system as "*a government of separated institutions sharing powers.*" This sharing of powers creates an environment of moderation, one that is often described as a "*system of checks and balances*" (Johnson et al. 1994, p. 46).



Source: Adapted from Johnson et al. (1994, p. 50).

Figure 8.1: Separation of Powers and Checks and Balances of the U.S. Federal Government

The word 'federal' is important since it indicates that more than one level of government shares responsibility for the same people in a region. In the U.S., the federal government sits above state governments, which in turn sit above county/regional and local governments. Interestingly, only the federal and state governments are recognized by the U.S. Constitution, which defines the authority of both. With regards to transportation, the authority of the federal government rests heavily on the 'commerce clause' of the U.S. Constitution, which grants Congress the power to "*regulate Commerce ... among the ... States*" (Article 1, Section 8, Clause 3). The Granger cases of the late nineteenth century (discussed in Section 8.1) established the foundation upon which Congress is able to regulate *interstate* transportation activities that affect the 'public interest.' However, since the initial focus on the economic regulation of railroads, Congress has used the commerce clause to justify a much broader range of economic *and* social regulation (Ashford and Caldart forthcoming 2007a). Whereas economic regulation tends to focus on a specific industry, social regulation (i.e., health, safety, and environmental regulation) is more general and cuts across industries and sectors.

If Congress passes a bill that justifies regulation on the grounds of the commerce clause, Congress must show that there is an adequate connection between a regulated activity and interstate commerce for the regulation to withstand judicial review. Since most social regulation is directed at activities that have a relatively clear economic and interstate connection (such as manufacturing, construction, energy production and use, and transportation), the courts have generally supported the expansion of Congressional oversight in this area. Two recent exceptions, however, were the Supreme court decisions in *United States vs. Lopez*, 514 U.S. 549 (1995) and *United States vs. Morrison*, 529 U.S. 598 (2000), where Congress was found to have exceeded its authority granted under the commerce clause. These cases provide evidence that the 'system of checks and balances' does prevent a single branch of government from exceeding its constitutional authority or straying too far from the political center of federal government, "*a key factor in the Constitution's survival, assuring evolution in government rather than revolution*" (Johnson et al. 1994, p. 48).

Prior to 1966 and the formation of the U.S. DOT, Congress's approach to transportation policy was fragmented and hampered by federal organizational problems (Hazard 1988; Mertins 1972). A major issue was the lack of overall leadership and coordination in the transportation sector. Transportation policies (or laws) developed by Congress were delegated to numerous government agencies to be administered and no one agency was responsible for coordinating and promoting the transportation sector as a whole. With the federal government's role in transportation increasing following World War II (see Section 8.1), it became evident (through a series of influential national transportation policy studies)[781] that no existing cabinet-level department had the capacity to assume this necessary leadership role. This conclusion highlighted the need for a new Department of Transportation that could coordinate and promote all transportation policies.

The process of creating the U.S. DOT was far from straightforward and plagued by the challenge of overcoming the vested interests of existing agencies and modal-oriented interest groups (Dilger 2003; Mertins 1972). Virtually all of the existing agencies - especially the Federal Maritime Administration that resisted moving into the U.S. DOT until 1981 - were concerned about losing their independence and authority. In response to these concerns, the final Department of Transportation Act of 1966 did not provide the new Secretary of Transportation or the U.S. DOT more generally with the authority

[781] One of the most influential studies was prepared by the Senate Committee on Interstate and Foreign Commerce (1961). The 'Doyle Report' provided a comprehensive analysis of the state of U.S. transportation policy and was particularly critical of Congress and its fragmented approach to transportation policy development. It concluded that the federal government lacked the capacity to effectively coordinate and promote transportation activities. The main recommendations of the report were to create the U.S. DOT (by combining all executive functions and agencies under one roof), consolidate the regulatory agencies (e.g., the ICC, CAB, and FMB) into a single Federal Transportation Commission, and establish a House and Senate Joint Committee on Transportation to coordinate national transportation policy. See Hazard (1988) and Mertins (1972) for a detailed discussion of the Doyle Report along with other influential national transportation policy studies.

initially envisioned (Hazard 1988).[782] For example, instead of the Secretary being able to 'initiate policy,' the final bill reduced the Secretary's power to 'recommending policy' (ibid, p. 29).[783] In addition, the modal agencies retained a reasonable level of autonomy, weakening the powers of the Office of the Secretary of Transportation. The end result was the creation of an 'umbrella agency' or 'holding company' rather than an integrated Department of Transportation (Mertins 1972).

While the compromises that led to the creation of the U.S. DOT clearly limited its ability to unite transportation policy, its significant and growing budget and extensive transportation knowledge/experience has given the Department an important role in transportation policy development. In this regard, the U.S. DOT could be described as a broker of federal funds and transportation knowledge that can be leveraged in the pursuit of specific programs or policies.

The authority of the U.S. DOT is defined by its 'enabling legislation' (i.e., the Department of Transportation Act of 1966) and all other Acts of Congress (i.e., 'statutory mandates') that authorize the U.S. DOT to administer specific transportation policies.[784] Upon its formation, the *purpose* of the U.S. DOT was defined as follows:

> "*(a) The national objectives of general welfare, economic growth and stability, and security of the United States require the development of transportation policies and programs that contribute to providing fast, safe, efficient, and convenient transportation at the lowest cost consistent with those and other national objectives, including the efficient use and conservation of the resources of the United States.*

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[782] The delegation of authority from Congress to an administrative agency is governed by the 'delegation doctrine' (Ashford and Caldart forthcoming 2007a; Lief 2004). Strictly speaking, Congress is not allowed to delegate its law-making authority to a nonlegislative entity, such as the U.S. DOT, since such action would violate the 'separation of powers' doctrine. However, given the vast array of policy areas that Congress must manage and the growth in the number and capability of administrative agencies, a certain amount of delegation has been permitted by the courts. The result of this action is that Congress is able to focus more on the 'fundamentals' of law, giving the administrative agencies the responsibility of 'filling in the gaps' by creating rules to administer the law (Lief 2004). However, a failure by Congress to provide reasonably clear and specific statutory standards to inform agency decision-making is likely to result in the legislation being struck down by the courts. With the creation of the U.S. DOT, the originating statute (or enabling legislation) limited the authority of the Secretary of Transportation, which alleviated any potential problems associated with the delegation of authority. Thus, Congress retained its power to initiate and set national transportation policy and the U.S. DOT was demoted to an advisory role.

[783] Congress limited the Secretary's policy initiating and investment authority by including the following provision in the Department of Transportation Act of 1966: "*Nothing in this Act shall be construed to authorize, without the appropriate action of Congress, the adoption, revision, or implementation of (a) any transportation policy, or (b) any investment standard or criteria*" (P.L. 89-670 § 4(b)(2)). This provision remains in place today (see 49 U.S.C. § 302(b)) and continues to prevent the Secretary of Transportation from acting without 'the appropriate action of Congress.' Thus, Congress retains full control over the development of national transportation policy; however, the U.S. DOT is able to influence Congress through its modal connections to Congressional committees (i.e., through the established transportation policy networks in Washington, D.C.).

[784] The implementation of statutory mandates is guided by 'procedural mandates' (such as the Administrative Procedural Act of 1946) that outline the process through which executive agency decisions should be made.

(b) A Department of Transportation is necessary in the public interest and to –
(1) ensure the coordinated and effective administration of the transportation programs of the United States Government;
(2) make easier the development and improvement of coordinated transportation service to be provided by private enterprise to the greatest extent feasible;
(3) encourage cooperation of federal, state, and local governments, carriers, labor and other interested persons to achieve transportation objectives;
(4) stimulate technological advances in transportation, through research and development or otherwise;
(5) provide general leadership in identifying and solving transportation problems; and
(6) develop and recommend to the President and Congress transportation policies and programs to achieve transportation objectives considering the needs of the public, users, carriers, industry, labor and national defense." (49 U.S.C. § 101)

In keeping with the federal government's historical role in transportation, the creation of the U.S. DOT was based upon protecting the 'public interest.' Congress defined the public interest by referring to national objectives of *security, economic growth and stability, general welfare,* and the *efficient use and conservation of natural resources.* What is perhaps most interesting about these objectives is that they reflect (to varying degrees) the five elements of sustainable development discussed throughout Chapter 3. These are: [1] peace and security; [2] economic development; [3] social development; [4] national governance that secures peace and development; and [5] environmental protection (Dernbach 1998). While the concept of sustainable development was formulated in the 1980s and 1990s, its roots can be traced back to the 1960s. Hence, Congress's selection of the above national objectives can be seen as a reflection of the growing concern for these issues. Thus, a broad interpretation of the U.S. DOT's originating statute might permit the development of transportation policies and programs that promote the public interest *and* sustainable development.

The originating statute also articulates the desired attributes of the transportation system - i.e., safety, efficiency, convenience, and affordability. If these attributes are considered along with the national objectives mentioned above, the intent of Congress aligns relatively well with the notion of sustainable transportation. For reference, in Chapter 6 a sustainable transportation system is defined as one that:

- "*allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;*
- *is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;*
- [in coordination with other sectors,] *limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of*

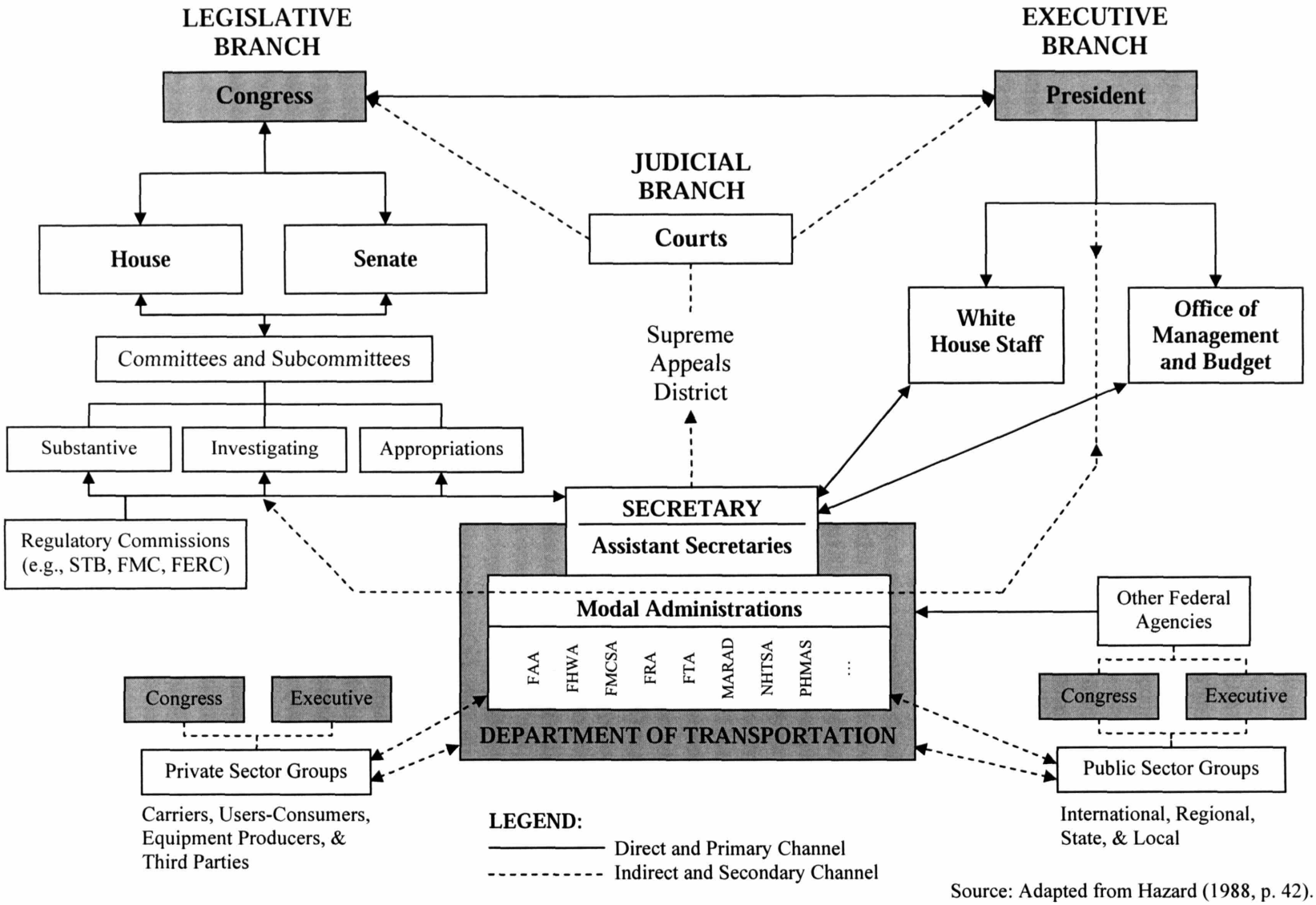
development of renewable substitutes while minimising the impact on the use of land and the generation of noise" (European Council 2001, pp. 15-16).

Previously, the U.S. DOT was described as a 'broker' of significant federal funds and transportation knowledge that can be leveraged to pursue desired programs or policies. Taking a closer look at how the U.S. DOT might use these functions to influence national transportation policy provides some insight into the transportation policy-making environment.

Figure 8.2 provides an overview of the primary and secondary policy channels that connect the three branches of the federal government. The figure also shows the lines of influence that stem from public and private sector groups (or special interest groups). Since the U.S. DOT is located within the executive branch of the federal government, the Secretary of Transportation is responsible for developing transportation policies that support the President's national agenda (Hazard 1988). Once the Secretary has received and translated the President's agenda into national transportation policy guidelines and priorities, the modal and operating administrations prepare the detailed policies and programs to implement this vision. The preparation of these policies and programs is likely to be influenced by public and private sector groups that work with, or lobby, the modal and operating administrations to promote the interests of their constituents/members. In general, these public and private sector groups fall into three major categories: [1] the users of transportation services (i.e., passengers, shippers, and receivers); [2] the providers of transportation services and equipment (i.e., carriers and equipment/vehicle manufacturers, including labor unions); and [3] state, regional, and local governments (Harper 1982).

Once a transportation bill has been drafted, the Secretary transmits the proposed legislation to the White House and Office of Management and Budget (OMB) for review (Hazard 1988). The White House reviews the bill for consistency with the President's agenda and the OMB evaluates whether it presents any budgetary concerns. If any problems arise, the U.S. DOT must address them before the bill is submitted to Congress by either the President or the Secretary of Transportation for consideration.

While the "*executive communication*" of legislative proposals to Congress has become a primary source of recent laws (Johnson 2003, p. 4), any member of the House of Representatives or the Senate is able to introduce legislation. As a result, during the reauthorization of major pieces of legislation there is likely to be more than one legislative proposal presented for consideration. Indeed, this was the case during the reauthorization of ISTEA in 1998 and TEA-21 in 2005 where the Administration and members of both the House and Senate prepared their own reauthorization bills.



Source: Adapted from Hazard (1988, p. 42).

Figure 8.2: Federal Transportation Policy Channels, Structures, and Flows

Once a bill has been submitted to either the House or Senate, it is referred to the appropriate committee(s) for evaluation. At present, there are 20 standing committees in the House and 16 in the Senate as well as a number of select committees. Each committee has jurisdiction over specific subject matters, which means that when a comprehensive bill is considered by each house it may need to be divided among multiple committees with one committee acting as the lead. With regards to the authorization of surface transportation legislation, the House Transportation and Infrastructure Committee (currently chaired by Congressman Don Young, R-AK) and the Senate Environment and Public Works Committee (currently chaired by Senator James Inhofe, R-OK) are the most important committees in each house (CQ 2004). Other important committees are the House and Senate Appropriations Committees that set federal spending limits and the House Ways and Means and Senate Finance Committees that have jurisdiction over federal taxes. Table 8.2 provides a list of the core Congressional committees within the House and Senate that have jurisdiction over transportation.

The division of subjects among Congressional committees presents a significant hurdle for legislation designed to address sustainable development/transportation. For example, under the current committee structure, transportation legislation that adopts a systems view and tries to integrate highway, railroad, mass transit, airway, waterway, and pipeline policy into a single bill would be divided along subject lines and evaluated in a reductionist manner. This outcome is problematic since a piecemeal evaluation is unlikely to identify the social benefits that are visible from an assessment of the legislation as a whole - i.e., the sum of the whole might be greater than the sum of the parts. Furthermore, public and private sector interest groups that align themselves with the subject matter of Congressional committees are likely to resist policies that reduce the funding or emphasis given to their interests. Thus, the architects of transportation legislation face significant challenges. Any attempt to integrate or significantly change transportation policy is likely to face staunch resistance from established, (usually) territorial standing committees and interest groups.

Table 8.2: Important House and Senate Committees/Subcommittees with Jurisdiction over Transportation

House Committees/Subcommittees[785]	Senate Committees/Subcommittees[786]
Appropriations Committee — Subcommittee on Transportation, Treasury, and Housing and Urban Development — Subcommittee on Homeland Security **Transportation and Infrastructure Committee** — Subcommittee on Aviation — Subcommittee on Coast Guard and Maritime Transportation — Subcommittee on Highways, Transit, and Pipelines — Subcommittee on Railroads **Budget Committee** **Homeland Security Committee** **Ways and Means Committee**	**Appropriations Committee** — Subcommittee on Transportation, Treasury, the Judiciary, Housing and Urban Development, and Related Agencies — Subcommittee on Homeland Security **Environment and Public Works Committee** — Subcommittee on Transportation and Infrastructure **Commerce, Science, and Transportation Committee** — Subcommittee on Aviation — Subcommittee on Surface Transportation and Merchant Marine **Banking, Housing, and Urban Affairs Committee** — Subcommittee on Housing and Transportation **Budget Committee** **Finance Committee**

8.2.1 Consolidation of Congressional Committees

Given the above discussion, an important question is how can a national transportation policy designed to support sustainable development remain intact through the Congressional review process? The obvious, but rather unrealistic, answer would be to consolidate the transportation functions of the standing committees in the House and Senate into a single transportation committee in each body. Such action would limit the influence of modal-oriented committees and interest groups and encourage the evaluation of legislation from a system-wide perspective. However, restructuring the committee system will certainly receive strong resistance for several reasons (Dye 2001). First, standing committees are often referred to as 'little legislatures' or the 'gate keepers' of Congress that jealously guard their policy jurisdictions and resist any actions that encroach upon their territory. Second, committee chairs are likely to support other committee chairs whose authority is being threatened in fear that their authority might be next. Third, the seniority system presents a significant barrier since Congressional members who have waited years for the opportunity to serve in a leadership position are unlikely to support actions that may undermine their future political influence as a committee chair.

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[785] Sources: United States House of Representatives, *Committee Offices*, http://www.house.gov/house/CommitteeWWW.shtml (accessed 04/09/06); and the American Public Transportation Association (APTA), *Congressional Committees*, http://www.apta.com/government_affairs/congress/congressional_committees.cfm (accessed 04/09/06).

[786] Source: United States Senate, *Committees*, http://www.senate.gov/pagelayout/committees/d_three_sections_with_teasers/committees_home.htm (accessed 04/09/06).

Given that changing the structure of Congressional committees is highly unlikely, other mechanisms need to be identified to guide sustainable transportation policy through the Congressional review process as it stands. It is possible to identify two approaches that might have some success under the right circumstances and political conditions. These are discussed in the following two sections.

8.2.2 The Moynihan Model

The first approach is based on the process that led to the passage of ISTEA in 1991. The architect of ISTEA was Senator Daniel Moynihan (D-NY), who played an instrumental role in reshaping the national transportation agenda away from the interstate era's focus on highways. Senator Moynihan was convinced that a new approach to transportation policy was necessary and became a strong supporter of intermodalism (Dilger 2003). This focus led Senator Moynihan to work closely with the Surface Transportation Policy Project (STPP) - a coalition of environmentalists, transportation planners, bicyclists, and other transportation consultants - with whom he identified ways to change the distribution of highway and transportation funds among the modes. Given Senator Moynihan's influential role in the process that led to ISTEA, the author has labeled this approach to transportation policy development as the 'Moynihan model.'

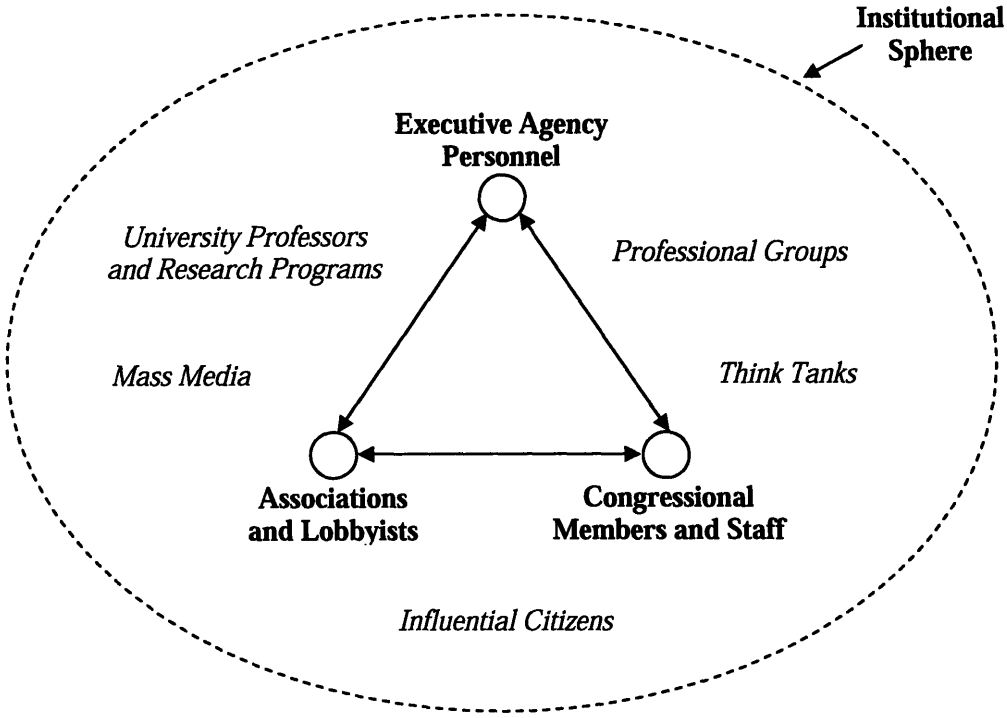
In addition to Senator Moynihan serving as a 'policy entrepreneur,' it is widely understood that the passage of ISTEA was made possible due to the confluence of the following factors (Dilger 2003):

- the completion of the interstate highway system that opened a window of opportunity for those seeking a more balanced approach to national transportation policy;
- the growing awareness that prevailing transportation policies had not enhanced the condition of bridges and highways, reduced sprawl, or significantly improved air quality highlighting the need for change in strategy; and
- the call by American industry for the development of an integrated, comprehensive, coordinated, and multimodal transportation system that could support their just-in-time supply chains.

The Moynihan model has three important characteristics. First is the formation of a strong alliance between a Congressional committee/subcommittee and special interest groups. In the case of ISTEA, this alliance consisted of manufacturers, the U.S. Conference of Mayors, the American Transit Association, and STPP members. Second, this alliance must promote an appealing agenda for change that encourages other congressional committees, executive agencies, and interest groups to engage in a different approach to national transportation policy. Third, the alliance must endorse important elements of the concept of sustainable development/transportation.

The Moynihan model provides a good example of how the dynamics of 'iron triangles' - more recently known as 'policy networks' - in Washington D.C. (Figure 8.3) can be utilized when creating legislative proposals. By capitalizing on emerging factors such as the need for improved air quality and a more balanced national transportation agenda,

Senator Moynihan was able to build an agenda for change that was able to undermine the highway lobby's monopoly over national transportation policy. However, while ISTEA did present a major shift in transportation policy, the highway lobby was still able to hold onto its 'promotional politics' of the past and increase funding for highways and transit, which remained in separate programs (Dilger 2003).[787]



Sources: Based upon Hazard (1988, p. 43) and Bonser et al. (2000).

Figure 8.3: The 'Iron Triangle' Considered in a Broader Context

An important conclusion from Chapter 7 is that a useful way to capture the interest of Congressional members would be to focus on core pieces of the sustainable transportation puzzle (such as energy security and national competitiveness) rather than trying to focus on all aspects of the concept at once. With this is mind, it is possible to consider factors that might stimulate a transportation policy innovation along the lines of the Moynihan model. Three factors that are likely to generate significant pressure over the coming decades for a change in policy are: [1] increasing levels of congestion; [2] the growing federal deficit; and [3] global climate change. Although it is difficult to predict how a policy network might form around these factors, it is likely that the success of a sustainable transportation policy will rest upon how well the problem is defined and whether the proposed solution is politically palatable (Rochefort and Cobb 1994). In addition, the Moynihan model requires the skills of a talented policy entrepreneur - who must also be an influential Congressional committee/subcommittee chair - who can shape the national debate and press for a real change in transportation policy.

[787] See Dilger (2003) for a discussion of how ISTEA came to pass, including a review of the debates and hard-won compromises that occurred within the policy networks in Washington D.C.

However, one must recognize that Congress's fragmented approach to the consideration of national transportation policy is likely to enable established policy networks to continue to resist any major changes. This means that if a sustainable transportation policy is to become a reality, the 'problem definition' used to initiate change must be able to overcome existing political barriers or influential policy networks.[788] While the Moynihan model has the potential to initiate movement towards a sustainable transportation policy, its dependence upon policy networks and the skill of policy entrepreneurs to capitalize on pressing issues makes it a less reliable mechanism for change.

8.2.3 The DOT Reinvention Model

A second, more structured approach is labeled by the author as the 'DOT reinvention model.' Under this model, the U.S. DOT is the change agent that - with the necessary authorization of Congress and the support of the President - reinvents both itself and national transportation policy to better support the principles of sustainable transportation.[789] The basic idea for this scenario is based upon Hazard's (1988) insightful analysis of how the U.S. DOT should be restructured and revitalized to be an effective executive agency in the twenty-first century. The rationale for reinventing the U.S. DOT is to address the diffused decision-making authority within the Department that undermines its sense of purpose and hampers the creation of a unified national transportation policy.

While there are numerous ways to restructure the U.S. DOT, Hazard (1988) makes a convincing argument that any attempt to radically change the modal administrations of the U.S. DOT would be very difficult politically. An example of such a change would be the consolidation of the Federal Highway, Transit, Railroad, Maritime, and Pipeline Administrations into a single Surface Transportation Administration (STA). While the idea of an STA is appealing from a sustainable transportation perspective - since it would support a multimodal, systems approach to surface transportation policy - those proposing the new organizational arrangement would have to overcome significant resistance from the 'iron triangles' that surround and protect the interests of the modes. If these iron triangles - which consist of Congressional standing committees, influential public and private sector groups, and the modal administrations - were to oppose such a consolidation plan it would be virtually impossible to implement.

Thus, a more practical approach would be to keep the modal administrations intact. The modal administrations have a high level of expertise that is well respected and relied upon by Congressional committees and other executive departments. Therefore, any restructuring of these administrations risks jeopardizing this valuable source of knowledge.

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[788] For a valuable discussion of the dynamics of agenda building and problem development, see Cobb and Elder (1983) and Rochefort and Cobb (1994).

[789] For a discussion of the principles of sustainable transportation, see Section 6.2.2.

Given the above issues, Hazard (1988) argues that a better approach would be to strengthen the authority of the Office of the Secretary of Transportation (OST) by [1] giving the Secretary the freedom to 'initiate' policy development for Congressional consideration and approval, and [2] establishing more powerful Assistant Secretaries whose authority aligns more closely with the federal government's transportation functions (discussed in Section 8.1).[790] Hazard (1988) also recommends that the Department's modal administrations be streamlined into six system-oriented divisions covering aviation, highways, pipelines, railroads, transit, and waterborne modes. The rationale behind Hazard's (1988, p. 130) recommendations is that the U.S. DOT "*has never had a comprehensive set of modal administrations working under an enlightened ...* [OST] *structure*" and a "*comprehensive and responsive modal administration structure should be given a fair chance before abandoning the idea of a modal operating division altogether.*"

The strength of Hazard's recommendations is that they provide a way to enhance the capability and responsiveness of the U.S. DOT to changing economic, social, and environmental factors by making moderate changes to the Department's organization and decision-making authority. While the modal administrators would lose some autonomy to the OST, they would remain intact, allowing the U.S. DOT to retain constituency groups that make useful allies when defending transportation needs against other national needs. In effect, Hazard's (1988) recommendations seek to centralize authority within the U.S. DOT - as originally proposed prior to the Department's formation in 1966 - to ensure that transportation decisions are less likely to be based upon interest group politics.

In practice, Hazard's recommendations would still require the modal administrators to develop the policies and programs to implement the President's/Secretary's agenda. However, these would now require the approval of the Assistant Secretaries before being formally included in U.S. DOT transportation bills. By giving the Assistant Secretaries the authority to sign-off on modal administration initiatives, their cross-cutting functional roles would become integrated with the activities of the vertically-oriented modal administrations. Thus, the oversight authority given to the Assistant Secretaries should enable the OST to push initiatives that aim to create a truly multimodal transportation system.

A critical element of the 'DOT reinvention model' is the need for the President and the Secretary of Transportation to be advocates for, or sympathetic to, sustainable development/transportation. Since the modal administrations will be held accountable for implementing the President's/Secretary's agenda by the Assistant Secretaries, it is

[790] The transportation functions of the federal government include: formulating economic and social regulation; creating policies to support the development/operation of interstate and international ways; encouraging the development of multimodal transportation services; providing federal funds to assist with the development of transportation modes; funding research and development; intervening in transportation services under extenuating circumstances; and operating and managing the Department.

important that the Department's agenda promotes the principles of sustainable development/transportation for substantive action to occur in this area.[791, 792]

In summary, for the DOT reinvention model to succeed, the following actions need to occur: [1] the U.S. DOT and its stakeholders (i.e., state and regional/local governments, American industry, transportation carriers, etc.) need to acknowledge that the structure of the Department must be changed to enable it to address some of the most pressing transportation problems facing the nation; [2] the President needs to promote/support sustainable development/transportation; [3] the U.S. DOT's enabling legislation needs to be altered to provide the Secretary of Transportation with more freedom to promote transportation policies in the interest of the nation; [4] the decision-making authority granted to the Assistant Secretaries needs to be increased; and [5] the U.S. DOT's modal administrations need to be streamlined.

As with the Moynihan model, the success of the DOT reinvention model rests upon the confluence of the right circumstances and political conditions. However, whereas the Moynihan model relies upon the strength of policy networks, the DOT reinvention model advocates a structural change to the transportation decision-making environment. If the U.S. DOT's reinvention is successful, there should be a shift in the Department's political power to the OST. This would weaken the policy networks associated with the modal administrations and focus Congressional attention on the more powerful (and functionally oriented) Assistant Secretaries. If the OST is able to foster strong working relationships with the leadership of the modal administrations, the U.S. DOT would be able to present a united front on policy initiatives. The real benefit of such a transition lies in the Department's ability to support policy initiatives during the Congressional review process. Instead of independent modal administrations seeking to promote their own modes (possibly) at the expense of others, the OST would become the central voice that supports the U.S. DOT's initiatives from a multimodal and holistic perspective.

While the above discussion presents an idealistic perspective, one must acknowledge that any attempt to transform the institutional behavior of the U.S. DOT will take time and face setbacks as existing policy networks resist change. However, as history has often shown, if the right circumstances align radical change can occur very quickly.

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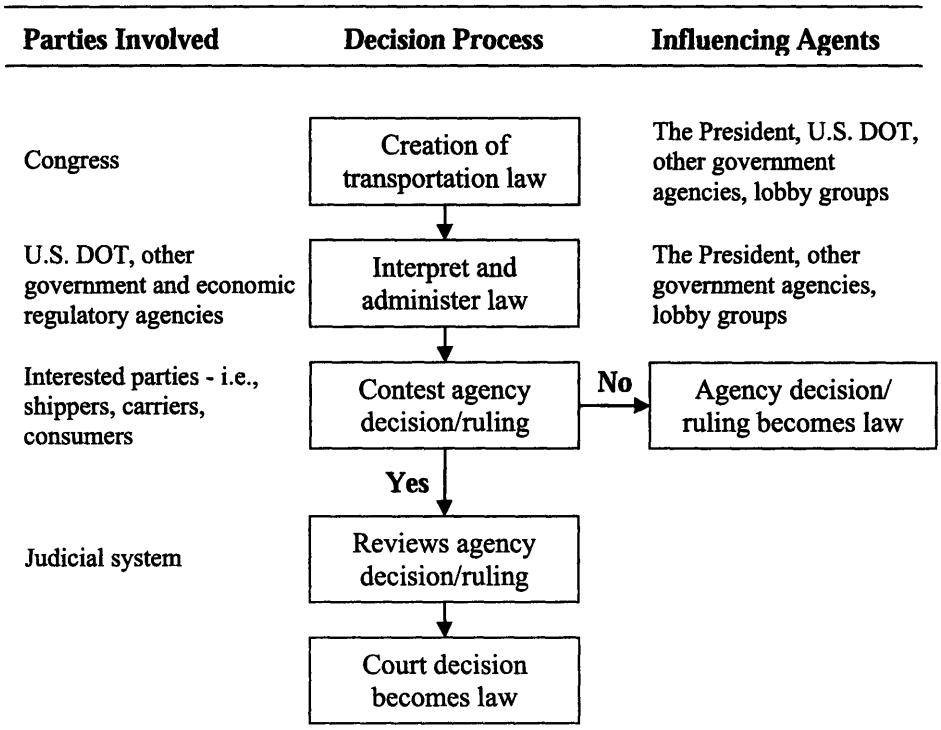
[791] One approach that the Secretary could adopt would be to establish transportation performance outcomes that encourage movement towards sustainable development. An interesting idea might be to set 'maximum levels of congestion' and develop initiatives to address problems in heavily congested regions. Since transportation and land use are interrelated, in addition to pursuing traditional transportation solutions the U.S. DOT could consider ways to integrate its policies with other executive agencies - such as the Department of Housing and Urban Development (HUD) - to ensure that the federal government's policies are not operating at cross purposes. It is likely that if the President supports the notion of sustainable development, the notion of integrating or coordinating the policies of executive agencies would become an important executive objective.

[792] Many modal administrations are already responding to public and private sector groups that are demanding better social, environmental, and economic performance from the transportation system. This observation indicates that there might be a bottom-up push for more sustainable transportation policies that would make it easier for the OST to pursue sustainable transportation as an overarching objective.

It is useful to place the above discussion in the context of how a transportation policy is formulated and implemented. Figure 8.4 provides a simple flow diagram of the actions that occur once a transportation law has been passed by Congress. While the focus of the above discussion revolves around the 'influencing agents' that shape legislation - i.e., the top right hand corner of Figure 8.4 - there are other points in the process of implementing a transportation policy where efforts can be made to deploy important elements of the concept of sustainable development/transportation. For example, the manner in which the U.S. DOT interprets a law is one area where significant movement can be made towards sustainable development/transportation. Of course, the U.S. DOT must consider sustainable development/transportation to be a worthy objective - one that it could defend in court - for this approach to work.

While mechanisms that are based upon interpretation and the judicial process have merit, the author has chosen to focus on ways to shape the formulation of transportation legislation since this is one of the most influential leverage points.



Source: Adapted from Lieb (1981, p. 12).

Figure 8.4: The Process of Formulating and Implementing Transportation Policies

8.2.4 Conclusion

The purpose of this section was to explore the structure of the federal government and the complex decision-making environment within which national transportation policy is developed. Under the prevailing circumstances, those who wish to pursue policies that support sustainable development/transportation will most likely face significant barriers that limit the success of their initiatives. These are the division of transportation functions across Congressional committees, powerful policy networks that promote modal interests without necessarily being concerned about the wider system impacts, and a relatively weak U.S. DOT that is seen as a 'holding company' of modal administrations.

Three approaches are presented as potential ways to overcome the above barriers. The first approach - to consolidate the transportation functions of Congressional standing committees into a single transportation committee in each house - is presented as the least practical due to the significant political hurdles that would need to be overcome. The second approach - the 'Moynihan model' - is seen to have potential, but its reliance on the formation and strength of a sustainable transportation policy network makes its ability to change policy uncertain. The third approach - the 'DOT reinvention model' - presents a structural change to the decision-making environment by establishing the U.S. DOT as a strong advocating body for sustainable transportation policies. The transformation of the U.S. DOT into a more powerful and integrated executive agency would enable the Department to support sustainable development/transportation policies through the Congressional review process.

An important aspect of all three approaches is the political will to promote/support an *integrated* and *holistic* approach to national transportation policy - central elements of sustainable transportation. Interestingly, each of the three approaches relies upon a different group of political actors to succeed. For example, the consolidation of Congressional standing committees primarily requires the support of Congressional members. The Moynihan model is based upon the support of public/private sector groups and influential Congressional members or standing committees. Finally, the DOT reinvention model requires strong executive branch leadership as well as support from Congress. Under the right political conditions and prevailing circumstances - i.e., under a 'perfect storm' scenario - one or more of the three approaches could be successful. However, it is difficult to predict whether such a storm will occur and, if so, when.

Although there are significant barriers to changing the status quo, the benefits of creating a more sustainable transportation system are likely to far outweigh the time and energy required to transform the national transportation policy architecture. As the saying goes, 'nothing worth doing is easy and nothing easy is worth doing.'

The following section examines the U.S. approach to sustainable development/transportation to gauge the likelihood of the federal government officially endorsing this concept.

8.3 The U.S. and Sustainable Development/Transportation

8.3.1 The Federal Position on Sustainable Development

Since the international emergence of sustainable development in the late 1980s and 1990s, many nations around the world have endorsed the concept as a national objective. However, while sustainable development has received attention in the U.S., there is currently no integrated national strategy to pursue this objective. At best, the U.S. position on sustainable development can be described as "*somewhat ambiguous*" (Fletcher 1997, p. 4).

The U.S. position is complicated by the nation's patchwork of social regulation that addresses specific social and environmental problems. During the 1960s and 1970s the U.S. was a leader in establishing regulation designed to protect the natural environment and civil rights.[793] However, this regulation tends to be designed to address a specific problem such as air quality or civil rights and only in a few incidents do the laws attempt to integrate or co-optimize social and economic regulation.[794] Thus, any serious attempt to pursue sustainable development would require careful consideration of how existing laws and policies could be integrated. A significant challenge in such an endeavor would be to convince environmental and human rights groups that movement towards sustainable development would not weaken existing laws. It is well documented that the 'institutionalization' of the environmental movement since the 1970s has made transformational advances in environmental legislation difficult to achieve (Coglianese 2001) - see Section 3.4.1. Therefore, a comprehensive restructuring of social and economic regulation to support sustainable development is unlikely to occur unless both the President and Congress take decisive steps towards this objective.

Since the 1992 Rio Conference on Environment and Development, most federal agencies have established programs or developed objectives that support the principles of sustainable development relevant to their statutory missions. However, without a national policy to integrate and coordinate agency activities, these efforts will remain fragmented, most likely reducing their overall effectiveness.

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[793] Examples of federal regulation that can be considered sustainable development-related regulation include the following: 1964 Civil Rights Act; 1966 National Historic Preservation Act; 1969 National Environmental Policy Act (NEPA); 1970 Occupational and Safety Health Act (OSH Act); 1970/77/90 Clean Air Act (CAA); 1972/77 Clean Water Act (CWA); 1973 Endangered Species Act (ESA); 1975 Energy Policy and Conservation Act; 1976 Resource Conservation and Recovery Act (RCRA); 1978 National Energy Act; 1979 Emergency Energy Conservation Act; 1980/86 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - also known as Superfund; and 1990 Americans with Disabilities Act (ADA). In addition to these acts, there have been numerous Presidential Executive Orders (EOs) that focus on issues central to sustainable development. The most notable EO, written by President Clinton, raised the notion of 'environmental justice.'

[794] A notable example of an attempt to integrate environmental and development concerns is the connection established between the 1990 Clean Air Act Amendments and the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA also established connections to important social issues by providing funds to meet certain ADA obligations.

The closest the federal government has come to creating a national policy on sustainable development has been the creation of the President's Council on Sustainable Development (PCSD) in 1993. In response to the Rio conference, President Clinton (1993a, p. 1) established PCSD to "*recommend ... a national sustainable development action strategy that will foster economic vitality.*" The PCSD consisted of 25 members appointed by the President who were leaders from industry, government, nonprofit organizations, and Native American groups.

During its six-year existence (1993-1999), the PCSD prepared three reports that are often referred to as a basis for a national strategy on sustainable development (Dernbach 2002a; Dernbach and Bernstein 2003; Spyke 2005). In the first report - *Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future* - the PCSD outlined a national vision of sustainable development (below) and established ten interrelated goals (Box 8.1) with corresponding indicators that support and measure progress towards this vision. The report also recommended 154 specific actions in 38 policy areas. While many of these action items focused on the role of the federal government, they also called upon virtually all public and private sector groups to take action.

> "*Our vision is of a life-sustaining Earth. We are committed to the achievement of a dignified, peaceful, and equitable existence. A sustainable United States will have a growing economy that provides equitable opportunities for satisfying livelihoods and a safe, healthy, high quality of life for current and future generations. Our nation will protect its environment, its natural resource base, and the functions and viability of natural systems on which all life depends*" (PSCD 1996b, p. iv).

Box 8.1: PCSD's (1996b, p. 12-13) National Goals Toward Sustainable Development

GOAL 1: HEALTH AND THE ENVIRONMENT
Ensure that every person enjoys the benefits of clean air, clean water, and a healthy environment at home, at work, and at play.

GOAL 2: ECONOMIC PROSPERITY
Sustain a healthy U.S. economy that grows sufficiently to create meaningful jobs, reduce poverty, and provide the opportunity for a high quality of life for all in an increasingly competitive world.

GOAL 3: EQUITY
Ensure that all Americans are afforded justice and have the opportunity to achieve economic, environmental, and social well-being.

GOAL 4: CONSERVATION OF NATURE
Use, conserve, protect, and restore natural resources - land, air, water, and biodiversity - in ways that help ensure long-term social, economic, and environmental benefits for ourselves and future generations.

GOAL 5: STEWARDSHIP
Create a widely held ethic of stewardship that strongly encourages individuals, institutions, and corporations to take full responsibility for the economic, environmental, and social consequences of their actions.

Box 8.1: PCSD's (1996b, p. 12-13) National Goals Toward Sustainable Development

GOAL 6: SUSTAINABLE COMMUNITIES
Encourage people to work together to create healthy communities where natural and historic resources are preserved, jobs are available, sprawl is contained, neighborhoods are secure, education is lifelong, transportation and health care are accessible, and all citizens have opportunities to improve the quality of their lives.

GOAL 7: CIVIC ENGAGEMENT
Create full opportunity for citizens, businesses, and communities to participate in and influence the natural resource, environmental, and economic decisions that affect them.

GOAL 8: POPULATION
Move toward stabilization of U.S. population.

GOAL 9: INTERNATIONAL RESPONSIBILITY
Take a leadership role in the development and implementation of global sustainable development policies, standards of conduct, and trade and foreign policies that further the achievement of sustainability.

GOAL 10: EDUCATION
Ensure that all Americans have equal access to education and lifelong learning opportunities that will prepare them for meaningful work, a high quality of life, and an understanding of the concepts involved in sustainable development.

The members of the PCSD supported their vision statement with a series of statements that captured their shared beliefs. For example, the Council stated that "[t]*o achieve our vision of sustainable development, some things must grow - jobs, productivity, wages, capital and savings, profits, information, knowledge, and education - and others - pollution, waste, and poverty - must not*" (PCSD 1996b, p. v). In general, the position of the PCSD (1996b) aligned with the principles and definitions outlined in the 1987 Brundtland Report (see Section 3.4.3). Thus, the Council adopted a technologically optimistic perspective that relied upon the nation's innovative capacity to grow the economy while reducing negative environmental impacts and inequality.[795]

The PCSD's (1997) second report - *Building on Consensus: A Progress Report on Sustainable America* - identified ways to implement the recommendations put forward in its previous report. In addition, the Council specifically called upon President Clinton to "*fully integrate sustainable development*" into his second term agenda.[796]

However, while the Clinton Administration did continue to support sustainable development, the concept was not given a prominent role in Clinton's second term. With the Republicans holding a majority in both the House and Senate, any initiative to pursue

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[795] This perspective is most clearly captured by two sections of the Council's 'We Believe Statement.' "*There are certain beliefs that we as Council members share that underlie all of our agreements. We believe: ... [5] Economic growth based upon technological innovation, improved efficiency, and expanding global markets is essential for progress towards greater prosperity, equity, and environmental quality. ... [13] Steady advances in science and technology are essential to help improve economic efficiency, protect and restore natural systems, and modify consumption patterns*" (PCSD 1996, pp. v-vi).

[796] Source: PCSD, *Building on Consensus: A Progress Report on Sustainable America*, http://clinton2.nara.gov/PCSD/Publications/Progress_Report.html (accessed on 04/09/06).

sustainable development would have been challenging, especially if legislation was required to adjust and broaden the authority of executive agencies. Given the political environment, President Clinton adopted a less progressive, but more politically feasible approach and revised the charter of the PCSD in 1997 to focus on four substantive policy areas.[797] These were: [1] the reduction of greenhouse gas emissions (a new topic area that had not previously been addressed by the Council); [2] the creation of an innovative environmental management system; [3] the promotion of sustainable communities; and [4] the establishment of U.S. leadership in sustainable development at the international level.

In 1999, the PCSD delivered its final report - *Towards a Sustainable America: Advancing Prosperity, Opportunity, and a Healthy Environment for the 21st Century* (PCSD 1999) - which outlined the Council's recommendations on the four substantive policy areas mentioned above.

In addition to its three main reports, the PCSD established a number of task forces (comprised of PCSD members and non-members) that prepared reports on Eco-Efficiency; Energy and Transportation; Population and Consumption; Public Linkage, Dialogue, and Education; Sustainable Agriculture; Sustainable Communities; and Natural Resources.[798] The early work of the PCSD also led to the creation of a U.S. Interagency Working Group on Sustainable Development Indicators (known as the SDI Group) (1996-1999). In 1998, the SDI group published an experimental set of national indicators of sustainable development that was later revised in preparation for the 2002 Johannesburg Conference (SDI Group 1998; 2001). These two reports represent the building blocks for a national framework of indicators of sustainable development.[799]

In summary, the federal position on sustainable development is characterized by the nation's patchwork of social regulation and by various independent initiatives led by executive agencies. While these regulations and activities are clearly a step in the right direction, their overall impact is reduced by the lack of integration or co-optimization between initiatives. The foundation for a national policy/strategy on sustainable development that could address this problem has been laid by the work of the PCSD and the SDI Group. However, the executive branch and/or Congress has yet to make sustainable development a national priority. The following two sections look at the factors that have prevented the establishment of a national policy on sustainable development and present several ways that the organizational structure of the federal government could be altered to give the concept an institutional home.

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[797] Source: PCSD, Authorizing Documents, *Revised Charter*, April 25, 1997, http://clinton2.nara.gov/PCSD/Charter/#rc (accessed on 04/09/06).

[798] Source: PCSD, *Publications*, http://clinton2.nara.gov/PCSD/Publications/ (accessed on 04/09/06).

[799] For a review of national indicators of sustainable development, which includes the SDI Group's (2001) experimental set of indicators, see Chapter 5 and Appendix A.

8.3.1.1 Factors Preventing the Establishment of a National Policy on Sustainable Development

The PCSD was unable to initiate federal action on sustainable development since the Council did not have any statutory authority to enforce its recommendations. Instead, it was only able to "*advise the President on matters involving sustainable development*" (Clinton 1993a, p. 1). In addition, no Congressional members were appointed to the PCSD, which lowered the visibility of sustainable development in Congress (Dernbach 2002a). As a result, much of the Council's valuable work has not been implemented due to the unwillingness or inability of the President to act upon its recommendations and a lack of Congressional support for sustainable development.

In *Stumbling Towards Sustainability* (Dernbach 2002b) - a comprehensive assessment of U.S. efforts to achieve sustainable development since the Rio conference - Dernbach (2002a) provides an evaluation of the federal government's attempt to pursue sustainable development. His overall conclusion is rather pessimistic.

> "*While the PCSD's recommendations could provide the objectives of a national strategy, sustainable development is not actively supported by the nation's leaders, there is no strategic thinking or action on behalf of the federal government, there is no governmental coordinating or implementing mechanism for a strategy, and there is little public education. The national effort falls short of that needed to adequately respond to the challenges and opportunities of sustainable development*" (Dernbach 2002a, p. 733).

Dernbach (2002a) highlights several reasons why the U.S. has failed to establish a national strategy. First, the continuing debate over the appropriate level of social and economic regulation has hampered federal initiatives. The institutionalization of the environmental movement provides a good example of the significant political barriers that face any effort to integrate and recalibrate federal legislation, even if the purpose of the integration is to further environmental, social, and economic objectives. In addition, the defederalization movement of the Reagan era has possibly reduced the federal government's ability to reestablish a strong regulatory position on important issues.

Second, there is an unwillingness to address the broader issues raised by sustainable development such as over-consumption. The problem here is that taking action to reduce material consumption or energy use can be portrayed as placing limits on individual rights and freedoms. However, as discussed in Section 2.1.4, by adopting a hands-off, laissez faire approach to development governments might actually be failing to protect important freedoms. The complexity or controversial nature of issues related to sustainable development means that it is easier for agencies or officials to ignore or defer them to others - i.e., they adopt a 'not in my back yard' (NIMBY) approach - rather than try to tackle the issues head on.[800] Such inaction limits the debate on sustainable development, reducing the likelihood that a federal policy will emerge.

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[800] Forrester argues that highly complex systems present a number of characteristics that make it extremely difficult for an individual or agency to address a problem such as sustainable development. These are: [1]

Finally, the breadth of issues captured by sustainable development means that the concept does not fit within the left-right political spectrum that characterizes environmental politics.[801] In addition, obtaining bipartisan political support for sustainable development is complicated by the fact that its principles resonate with potentially opposing liberal/conservative and Republican/Democratic views. As Dernbach (2002a, p. 734) comments, the concept "*combines personal responsibility with social concerns, a healthy respect for the power of the market and private decision-making with a desire to steer that market in a sustainable manner.*" Therefore, any attempt to move forward on sustainable development will require consensus on issues that can be viewed very differently by political parties and public/private stakeholders. However, since no one party 'owns' the concept, one could argue that this presents an opportunity to bring individuals from all sides of the debate together to make sustainable development a national objective.

In a much broader critique of the 'unsustainable industrial state,' Ashford (2004; 2007) presents a number of fundamental faults (or systemic problems) that limit a nation's ability to address sustainable development (see Section 4.1.2). These are:

1. the fragmentation [and inadequacy][802] of the knowledge base that leads to the creation of single purpose or narrowly-fashioned solutions to complex problems;[803]
2. the inequality of access to economic and political power;
3. the tendency towards 'gerontocracy' - i.e., the governance of industrial systems by outdated ideas;

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the incentive to transfer complex problems to others (i.e., NIMBY); [2] the difficult tradeoffs that exist between the present and future; [3] the significant resistance that confronts most policy changes; [4] the transfer of the burden to the intervener; and [5] the existence of a limited number of high-leverage policies to address a problem. Source: Professor Jay W. Forrester, MIT, lecture on *System Dynamics and Sustainability*, held at MIT on 18th January 2002.

[801] This observation by Dernbach (2002a) reinforces the conclusion from the author's meetings with key organizations and agencies in Washington D.C., which highlighted the problem of locating sustainable development within traditional political coalitions (see Section 7.3). In addition, the general 'D.C. consensus' was that, under the prevailing political environment, sustainable development has virtually no traction in Congress.

[802] While fragmentation of the knowledge base is a major barrier to addressing sustainable development, the uncertainty surrounding society's understanding of - and the effectiveness of solutions to - problems such as climate change or toxic pollution is another barrier to action. In situations where the negative impacts of human activity are unknown, the precautionary principle should be applied.

[803] Dernbach (2003, p. 250) reinforces this problem by arguing that "*integrated decision-making is the foundational principle of sustainable development. ... Thus, sustainable development requires that fragmentation in decision-making be eliminated - that is, that environmental and social concerns be integrated into economic and security decision-making.*" Dernbach (2003) identifies four areas where integrated decision-making could occur. These are [1] in the selection of the decision-making process - e.g., a procedural or substantive mechanism could be used to either consider or achieve desired objectives, respectively; [2] in the scope of the decision-making process - e.g., decisions could be integrated around a resource, issue, activity, or geographic place; [3] in the time horizon - e.g., the decision-making process could integrate both short- and long-term objectives; and [4] in the selection of an implementation method - e.g., legal and policy tools could be integrated to achieve a desired outcome and decision-makers could take action to overcome horizontal/vertical integration barriers to decision-making processes (ibid, pp. 259-282).

4. the failure of markets to charge the true social cost of industrial activity; and
5. the inherent difficulty in markets addressing issues that span over long time horizons.

In the case of the U.S., one could argue that the first two systemic problems have largely frustrated attempts to establish a national strategy on sustainable development. The fragmentation of the knowledge base - i.e., the division of federal activities and authority among Congressional committees and executive agencies - creates a situation in which no one entity has a complete overview of, and ability to influence, the entire system of federal policy. For example, executive agencies are often unable to address sustainable development in a comprehensive manner since their limited statutory authority constrains their actions and results in the creation of narrowly-focused policies. This situation can be referred to as 'not in my terms of reference' (NIMTOR) and can be both a barrier to taking action and an excuse for inaction.

Interestingly, while the authority of the PCSD was limited, it was able to address the fragmentation problem since it had the freedom to look at the role of the federal government in a comprehensive manner. Thus, many of its recommendations began to address the need for the *horizontal* and *vertical integration* of policies and initiatives across executive agencies and between the various levels of government, respectively. With the termination of the PCSD in 1999, the executive branch may have lost the only entity that had the capability to develop *and* promote a national sustainable development strategy. In its absence, it is unlikely that such a strategy will emerge due to the balkanized structure of existing executive level departments and agencies.

The second systemic problem highlights a barrier to creating a national policy on sustainable development that is perhaps best characterized by Dye's (2001) model of 'top-down policymaking.' Dye (2001) challenges the common belief that public policy in the U.S. responds to the demands of the people and flows from the bottom-up. Instead, he argues that policy formulation is dominated by a governing elite - i.e., those people who control the nation's largest organizations and institutions. Dye's (2001, p. 4) top-down policymaking model distinguishes four different processes that influence how the national elite shape their "*values, interests, and preferences into public policy.*" These are:

- *The policy formulation process* - commonly referred to as 'agenda setting' that is dominated by leaders of foundations, think tanks, commissions, and task forces.
- *The leadership selection process* - the ability of an individual to run for office depends upon how well his/her views align with views of the moneyed elite. Thus, the leadership selection process is driven by corporations, banks, media conglomerates, law and investment firms, insurance companies, and wealthy individuals who collectively support their interests.
- *The interest group process* - the process by which public and private sector interest groups form networks to promote policy that protects or furthers their interests.
- *The opinion making process* - the process by which the mass media transmits the opinions of the national elite to government decision-makers and the public.

Dye's (2001) model of top-down policymaking is a useful way to consider inequality of access to economic and political power. The outcome of Dye's (2001) model is that the impetus for a national strategy for sustainable development rests with the national elite, who, up until now, have not shown significant support for the concept.

In addition to the above challenges, the thorny politics and long-term focus that tend to accompany sustainable development issues might also encourage agencies and officials to adopt a 'not in my term of office/election year' (NIMTO/NIMEY) stance. Given the four-year Presidential cycle and shorter time frames for executive agency administrators, it is much more effective for the executive branch leadership to invest its political capital in issues that are likely to provide important reelection benefits. The situation is similar for Congressional members, although the six-year election cycle for Senators does provide some room to maneuver. However, while extended terms in office might benefit an administration and Congressional members who wish to pursue sustainable development initiatives, the general public's distrust of the federal government and the 'term-limits' movement are likely to make change in this area difficult (Crane and Pilon 1994; Tridico 1998-99). The difference between the timeframe of political cycles and important sustainable development concerns can be described as the problem of *disparate time horizons.*

In conclusion, there are a number of challenges that must be addressed if progress is to be made towards creating a national strategy on sustainable development.

8.3.1.2 Federal Approaches to Creating a National Strategy on Sustainable Development

Prior to any attempt to create a national strategy on sustainable development, the President and/or Congress must decide that such a strategy is in the best interest of the nation. Without such a decision progress will be difficult. The clear message from the Washington, D.C. meetings (see Section 7.3) was that the concept of sustainable development currently has no traction in the Bush Administration or Congress. This means that high-profile federal action on sustainable development is unlikely in the short-term. However, this does not mean that progress cannot be made (see Section 8.4.2).

Those who have considered how the federal government might establish a national strategy on sustainable development have presented an array of approaches that are discussed in this section. In general, the ideas range from making the existing federal system work more effectively to more radical approaches that focus on enhancing existing or creating new executive-level entities to lead efforts on sustainable development. The more aggressive proposals require a much stronger federal commitment to sustainable development. Given its attempt to create a national strategy, the discussion begins with the PCSD.

In general, the recommendations of the PCSD (1996b; 1999) focused on ways to move towards sustainable development by capitalizing upon the existing structure of federal

agencies - i.e., making the current federal system work. In particular, the Council highlighted numerous opportunities for interagency collaboration (i.e., *horizontal integration*) and called for enhanced cooperation among federal, state, and local governments (i.e., *vertical integration*) and public/private sector groups. A major goal of the PCSD (1996b) was for existing agencies to establish 'interagency partnerships' to identify how federal policies could be better integrated/coordinated. However, without a clear Presidential commitment to such action, agencies have little incentive to be proactive in this area. Thus, there needs to be a catalyst (such as a national policy) to stimulate action, and an entity (such as a reinstated PCSD or an enhanced President's Council on Environmental Quality [CEQ])[804] to coordinate and report on federal activities.

In a critique of the PCSD, Tridico (1998-99) argues that existing federal agencies should (where possible) provide the resources and personnel to implement the recommendations put forward in the Council's reports. In addition, she argues that "[w]*hile agencies are reorienting their response to environmental issues into the guidelines of the PCSD formula, the President should reinstate the council to continue its mission toward sustainability*" (ibid, p. 251). Furthermore, the membership of the PCSD should be expanded to include representatives from community groups and American youth. Interestingly, Tridico (1998-99) does not mention the importance of including high-ranking Congressional members on the committee, which would be a useful way to raise the visibility of sustainable development in Congress. Finally, Tridico (1998-99) argues that the PCSD should reinstate the SDI Group to enable it to continue and expand its work on national indicators of sustainable development.

While the SDI Group's (2001) scope was limited to the development of national indicators, it made a number of recommendations on ways to continue and enhance the group's work in this area. Its recommendations focused on establishing an institutional home for the SDI Group, either within or outside of the federal government. Its two main recommendations were to [1] give an existing executive agency the responsibility to develop national indicators with 'voluntary' collaboration from other agencies and [2] formally establish the SDI Group under the CEQ to enhance the visibility of the group's work and its ability to initiate interagency collaboration on indicator development (SDI Group 2001). Building upon the latter recommendation, if the CEQ were to be given the authority to provide oversight and independent commentary on the function of agencies

[804] The CEQ was established under Title II of the 1969 National Environmental Policy Act (NEPA) (42 U.S.C. § 4371). The core functions of the CEQ are to monitor the condition and trends in the quality of the environment and annually report the results to the President, appraise federal programs/activities for compliance with NEPA, and recommend environmental policies and initiatives to the President that promote and improve environmental quality (42 U.S.C. § 4344). The CEQ was originally required to prepare an annual Environmental Quality Report to Congress, but this mandate was rescinded in response to the Republican Party's 'Contract with America' and the Federal Reports Elimination and Sunset Act of 1995. The CEQ is located within the Executive Office of the President, from which it is able to coordinate federal environmental efforts and work closely with executive agencies and other White House offices. Source: Council on Environmental Quality (CEQ), http://www.whitehouse.gov/ceq/ (accessed 04/09/06). If the CEQ were to lead efforts on sustainable development, its functions and capabilities would need to be expanded beyond its current focus on environmental quality to include social and economic concerns.

in relation to sustainable development, locating the SDI Group within the CEQ would further enhance the group's visibility and provide the CEQ with direct access to data for reporting purposes.

Dernbach (2002a) - who is one of the strongest advocates for a national strategy on sustainable development - also supports an enhanced CEQ in his recommendations for how the federal government could create the institutional capacity to address sustainable development. He specifically highlights the following comprehensive set of actions (ibid):

- The federal government should establish a national strategy on sustainable development with specific goals and priorities. This strategy should be supported by a national set of indicators that can measure progress towards sustainable development.
- An executive-level entity should be created to coordinate and assist with the implementation of the national strategy. Dernbach (2002a) argues that an enhanced CEQ is one solution.[805] If pursued, the CEQ should be given the authority to develop and coordinate U.S. positions on sustainable development and lead interagency collaboration.
- A counterpart entity should be established in Congress and given the responsibility to coordinate, investigate, and report on the impacts of proposed/existing legislation on sustainable development.[806] The primary role of this entity would be to modify or repeal laws that encourage/support unsustainable activities.

The latter two of Dernbach's (2002a) recommendations focus on ways to address the fragmentation of federal activities and authority within the executive branch and Congress. However, fragmentation also exists in the reporting and oversight systems that support the federal government. Here, specific reference is made to the work of the Government Accountability Office (GAO). While the GAO provides an essential role in evaluating the effectiveness of federal programs, activities, and functions, the GAO's actions are primarily led by the needs of Congress. Given the current division of authority among Congressional committees, it is unlikely that the GAO will be tasked to undertake a comprehensive evaluation of federal efforts to move towards sustainable development. However, it is important to note that in the past the GAO has been asked to evaluate *elements* of sustainable development such as the extent of federal influence on urban sprawl and local growth patterns (GAO 1999; 2000). The limitation of these projects, however, is that they did not consider multiple aspects of sustainable development simultaneously.

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[805] Another solution put forward by Dernbach (2002a) is the idea of using the Government Performance and Results Act (GPRA) of 1993 as a mechanism to initiate and measure an agency's progress towards sustainable development. As with enhancing the CEQ, there must be a Presidential commitment to sustainable development for agencies to integrate the concept into their strategic plans.

[806] Dernbach's (2002a) idea of creating a Congressional entity to address sustainable development is different from the idea of consolidating congressional committees discussed in Section 8.2.1.

If no entity within the executive branch has the responsibility to lead federal efforts on sustainable development, there will be no comprehensive programs, policies, or activities related to sustainable development for the GAO to evaluate. Thus, without a national strategy on sustainable development to integrate federal actions, the GAO may continue to reinforce the fragmentation of knowledge through piecemeal evaluation of agency programs and policies.

One important caveat to the above statement is that the GAO's Comptroller General (CG) has the authority to: "*(1) invest in significant current or emerging issues that may affect the nation's future and (2) address issues of broad interest to the Congress, with an emphasis on longer-range, crosscutting, and transformational issues*" (GAO 2004a, p. 9). This authority clearly enables the CG to establish a project to evaluate federal efforts related to sustainable development. However, a major barrier to such action is the "*limited portion of its resources*" that the GAO can dedicate to agency projects (ibid, p. 9). The CG would also have to consider the ramifications of pursuing a topic that has virtually no support from the current President or Congress.

If the executive branch were to establish leadership on sustainable development by empowering the CEQ to [1] create sustainable development policy initiatives, [2] coordinate interagency collaboration, and [3] prepare an annual report to the President and Congress on federal efforts to achieve sustainable development, this would be an invitation for the GAO (via Congress) to engage in cross-cutting activities of a similar nature. The work of the CEQ in integrating federal policy and agency activities would enable Congress to task the GAO with evaluating the effectiveness of the CEQ's efforts in transitioning the nation towards sustainable development.

An alternative to enhancing the role of the CEQ that aligns more closely with the PCSD's (1996b) approach to sustainable development would be to encourage federal agencies to establish interagency regulatory groups around overlapping issues.[807] Box 8.2 highlights the core functions/responsibilities of government that relate specifically to sustainable development (see Section 4.1.4). What is most evident from this list of functions/responsibilities is their cross-cutting nature. Thus, any federal strategy designed to address sustainable development must incorporate mechanisms to integrate regulatory, industrial, employment, and trade policy. An interagency regulatory group is one such mechanism.

Box 8.2: Role of Government in Sustainable Development

National Functions/Responsibilities:

- Support and expand education and health opportunities.
- Provide physical infrastructure and legal and institutional frameworks.
- Act as a force to integrate, not just coordinate, policies.
- Invest in and promote path-breaking science and technology development - for both environmental

[807] One reason why overlap is so prevalent is that the federal government "*must divide itself into organizational units - and the problems the government has to solve do not fit neatly into these divisions*" (NPR 1993, p. 17).

Box 8.2: Role of Government in Sustainable Development

improvement and job design.
- Act as a trustee of new technologies.
- Sustain a healthy economy that creates rewarding and meaningful employment, reduces poverty, and provides the opportunity for a high quality of life for all.
- Protect the environment and ensure that every person benefits from clean air, clean water, and a healthy home, work, and leisure environment.
- Act as a trustee of worker and citizen interests to ensure a fair outcome.
- Facilitate/arbitrate over competing interests to ensure a fair process.
- Extend equity considerations to future generations.

International Functions/Responsibilities:
- Reform institutions at the global level to ensure developing nations have equitable access to global markets, technology, and information.
- Establish trade and foreign policies that further the achievement of sustainable development.
- Ratify international treaties designed to protect the environment and the well-being of humans.
- Ensure peace and security.

Sources: Ashford (2007); Dernbach (1998); Fukuda-Parr (2002); Leisinger (1998); PCSD (1996b; 1999).

The precedent for an interagency regulatory group dates back to the Carter Administration when the heads of the major environmental and public health agencies (i.e., the EPA, CPSC, FDA, and OSHA)[808] formed the Interagency Regulatory Liaison Group (IRLG) in 1977 to coordinate their regulatory activities (Schierow 1998).[809, 810] The fact that the IRLG was formed by the agencies themselves and connected their activities at the political appointee level was significant. Without high-level support, agency staff would have found it difficult to take action and direct resources to address the group's recommendations.

Although the work of the IRLG produced some promising results - such as the interagency 'Early Warning System' established to notify agencies participating in the group of "*newly identified health hazards or of planned or impending regulatory actions*" (Wrenn 1978, p. 1) - it was disbanded in 1981 by the Reagan Administration in an effort to reduce the level of cooperation among federal agencies (Ashford and Caldart forthcoming 2007b).

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[808] The initial members of the IRLG - the Environmental Protection Agency (EPA), Consumer Product Safety Commission (CPSA), Food and Drug Administration (FDA), and Occupational Health and Safety Administration (OSHA) - were later joined by the Food Safety and Quality Service of the U.S. Department of Agriculture (USDA) (Schierow 1998).

[809] Source: Environmental Protection Agency (EPA), *Douglas M. Costle: Oral History Interview, Regulatory Analysis*, http://www.epa.gov/history/publications/costle/15.htm (accessed 04/09/06).

[810] Prior to the formation of the IRLG, the Nixon Administration proposed the idea of a 'super cabinet' that would direct domestic policy from offices in the White House. President Nixon sought to overcome the barriers posed by sector-oriented departments by consolidating them into four new agencies that could better address cross-cutting issues (see Section 7.3). The basic philosophy was to weaken the strength of the clientele-related departments and integrate the decision-making authority of the executive branch. Given the radical nature of this proposal, it is not seen as feasible under the current political environment. However, it is important to acknowledge that significant changes to the executive branch to address sustainable development are not impossible.

While the formation of the IRLG can be described as 'organic' - i.e., its creation was not mandated - similar interagency entities have been formed at the request of U.S. Presidents. For example, in 1978 President Carter established the U.S. Regulatory Council (RC) in an effort to coordinate and improve regulations (NPR 1993). While the RC was disbanded at the start of the Reagan Administration, the idea of creating an interagency group to coordinate regulatory activity surfaced again in 1993. The proposal, put forward by the National Performance Review (NPR 1993, p. 20), recommended that the President establish the interagency Regulatory Coordinating Group (RCG) to "*provide a forum for agencies to discuss issues of common concern, to assist agencies in finding more innovative approaches to regulation and better methods of developing regulation, and to improve coordination of regulatory policies.*" President Clinton (1993b, p. 5) responded to this request by creating the interagency Regulatory Working Group (RWG) in Executive Order 12,866 to "*assist agencies in identifying and analyzing important regulatory issues.*" Both the RC and RWG provide examples of how it is possible to establish an interagency group to coordinate agency regulation and standard setting. Therefore, if the President were to create an 'enhanced CEQ,' the Council could use the experience of the RC and RWG to 'formally' initiate (via a Presidential Executive Order) interagency cooperation to integrate or co-optimize regulation related to sustainable development.

Regardless of which approach one adopts, it is essential for the federal government to act on sustainable development since its agencies have significant resources and expertise that can be brought to bear on important societal problems (Spyke 2005). While focusing on ways to make the existing federal system work more effectively presents the easiest solution, it is doubtful whether this approach will lead to significant progress. Therefore, if the President and Congress decide to pursue sustainable development, an ideal approach would be to try and implement Dernbach's (2002a) comprehensive set of actions. In addition, one might also consider reestablishing the SDI Group within an enhanced CEQ and either encouraging or mandating the establishment of interagency regulatory groups in important areas.

Without Presidential or Congressional support, progress towards sustainable development will be difficult. Hence, the challenge facing its advocates is how to *create a compelling long-term vision of sustainable development that generates sufficient interest in the concept to overcome the significant barriers to its realization.* A failure to create such a vision means that change is only likely to occur following a persistent national/international crisis that captures the political agenda and forces change. While such a crisis may not lie too far into the future (Meadows et al. 2004), once the symptoms of a system 'overshoot' begin to present themselves it is too late to take preventative action. Thus, the federal government (as trustee) must adopt a *proactive*, *preemptive*, and *long-term* view on development in order to identify ways to confront unsustainable trends and lead efforts towards a socially, environmentally, and economically healthy future.

8.3.2 The Federal Position on Sustainable Transportation

Since the federal government has not endorsed the concept of sustainable development, it is not surprising that there is no formal policy on sustainable transportation. While a subset of regulation and federal initiatives (discussed in the following sections) have focused on important aspects of the concept of sustainable transportation, these cannot be considered as an integrated national strategy.

8.3.2.1 Federal Legislation and Programs that Support Sustainable Transportation

In response to the emergence of the environmental movement during the 1960s and 1970s (see Sections 3.2 and 3.3) and sustainable development during the 1980s and 1990s (see Section 3.4), legislation passed by Congress began to incorporate broader social regulations that influenced federal actions across all sectors of the economy. Since the formation of the U.S. DOT in 1966, the following *transportation-related* legislation has played a significant role in shaping the Department's policies and programs:

- 1969 National Environmental Policy Act (NEPA);
- 1970 Occupational and Safety Health Act (OSH Act);
- 1970/77/90 Clean Air Act (CAA);
- 1972/77 Clean Water Act (CWA);
- 1973 Endangered Species Act (ESA);
- 1975 Energy Policy and Conservation Act;
- 1978 National Energy Act;
- 1979 Emergency Energy Conservation Act;
- 1980/86 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - also known as Superfund; and
- 1990 Americans with Disabilities Act (ADA).

Until 1991 and the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA), transportation legislation had evolved primarily along modal lines with limited integration of modal policies. ISTEA changed this approach. The legislation marked the beginning of the post-interstate era and a desire to move towards the creation of a multimodal,[811] interconnected, equity-based transportation system and the preservation of this system. Box 8.3 provides several excerpts from ISTEA's declaration of policy that highlight how the legislation placed a new emphasis on many issues relating to the legislation listed above. For example, the policy contained specific objectives to improve air quality, environmental protection, energy efficiency, and the transportation services available to disadvantaged persons. Since its creation, ISTEA has largely remained intact philosophically through two reauthorizations in 1998 (TEA-21) and 2005 (SAFETEA-LU).

[811] The use of the word 'intermodal' in the title of ISTEA was unfortunate since in reality most transportation systems connect to more than one mode. A better word would have been 'multimodal;' however, this would have created a less memorable acronym.

Box 8.3: Excerpts from ISTEA's Declaration of Policy (P.L. 102-240, Section 2)

It is the policy of the United States to develop a National Intermodal Transportation System that is economically efficient and environmentally sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy efficient manner.

The National Intermodal Transportation System shall consist of all forms of transportation in a unified, interconnected manner, including the transportation systems of the future, to reduce energy consumption and air pollution while promoting economic development and supporting the Nation's preeminent position in international commerce.

The National Intermodal Transportation System shall include a National Highway System which consists of the National System of Interstate and Defense Highways and those principal arterial roads which are essential for interstate and regional commerce and travel, national defense, intermodal transfer facilities, and international commerce and border crossings.

The National Intermodal Transportation System shall include significant improvements in public transportation necessary to achieve national goals for improved air quality, energy conservation, international competitiveness, and mobility for elderly persons, persons with disabilities, and economically disadvantaged persons in urban and rural areas of the country.

...

The National Intermodal Transportation System shall give special emphasis to the contributions of the transportation sectors to increased productivity growth. Social benefits must be considered with particular attention to the external benefits of reduced air pollution, reduced traffic congestion and other aspects of the quality of life in the United States.

ISTEA introduced a number of important policy innovations that support the objectives of sustainable transportation (Benfield and Replogle 2002; Frankel 2003; Schoener 2003; ACIR 1995; U.S. DOT 2000d). First, ISTEA devolved decision-making authority to metropolitan planning organizations (MPOs) by enhancing their role in transportation planning and programming. MPOs were given the responsibility for developing long-range transportation plans (LRTPs) and short-term transportation improvement programs (TIPs) that [1] must consider a broad range of non-traditional transportation planning factors and [2] are financially realistic. The planning factors were important since they covered the majority of sustainable transportation objectives (see Section 7.1). In addition, the requirement for financial realism gave the transportation planning process a sense of credibility that was previously lacking. At the state-wide level, state Departments of Transportation (DOTs) were required to work closely with MPOs and were held to an almost identical set of planning factors.

Second, ISTEA supported its objective to create an intermodal/multimodal transportation system by increasing the ability of MPOs and state DOTs to transfer federal funds between transportation programs. The basic idea was that 'flexible funding' would enable the development of a more balanced transportation system and reduce the predominant focus on highways. In particular, ISTEA established the Surface Transportation Program (STP) that provided unprecedented flexibility in the use of federal funds for transportation initiatives and required 10% of STP funds to be set aside for both safety

and transportation enhancements.[812] While the principle of flexible funding was welcomed by many sustainable transportation advocates, in practice only a small portion (about 7% or $3.3 billion) of the available flexible funds were used on non-highway related projects between 1992 and 1999 (STPP 2000).[813] McCann (1999) argues that the best way to address this problem would be to divide surface transportation funds equally between highway and transit. However, such a solution seems somewhat arbitrary and might lead to significant system inefficiencies. The challenge is to manage the highway legacy and maintain important highway networks while identifying ways to make the entire transportation system more sustainable.

Finally, a significant policy innovation in ISTEA was the integration of surface transportation legislation with the 1990 Clean Air Act Amendments (CAAA) (Lyons 2000; Weiner 1997). In particular, the CAAA 'transportation conformity' provision was instrumental in connecting transportation planning with air quality goals (42 U.S.C. § 7506(c)). The conformity provision states that in air quality non-attainment or maintenance areas, *all* transportation plans and programs supported by federal aid are required to 'conform' to the state implementation plan (SIP) (FHWA 2001; FHWA and FTA 1995). The SIP is a statewide planning document that shows how a state will comply with each of the national ambient air quality standards (NAAQS). Since transportation is one of several sectors that generate air pollution, the SIP provides a mechanism through which decision-makers can identify the most cost-effective, or politically feasible, way to meet the NAAQS by setting emission reduction targets for stationary, area, and mobile sources.

The challenge facing MPOs in non-attainment or maintenance areas is to develop their transportation plans and programs without [1] violating their emissions budget, [2] increasing the frequency or severity of air quality violations, or [3] delaying any progress towards meeting the NAAQS (42 U.S.C. § 7506(c)(1)(B)). A failure in any of these areas means that federal funding and approval for transportation projects can be withheld. To help MPOs address air quality problems, ISTEA established the Congestion Mitigation and Air Quality (CMAQ) Program to fund transportation projects and programs that contribute to air quality improvements and reduce congestion.[814] Thus, when considered

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[812] ISTEA defined transportation enhancements as the "*provision of facilities for pedestrians and bicycles, acquisition of scenic easements and scenic or historic sites, scenic or historic highway programs, landscaping and other scenic beautification, historic preservation, rehabilitation and operation of historic transportation buildings, structures, or facilities (including historic railroad facilities and canals), preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian or bicycle trails), control and removal of outdoor advertising, archaeological planning and research, and mitigation of water pollution due to highway runoff*" (23 U.S.C. 101(a)).

[813] Between 1992 and 1999, state DOTs received almost $50 billion (just over a quarter of federal surface transportation funds) that could have been spent on any surface transportation project; 87% of this funding was spent on highway and bridge projects (STPP 2000). One possible reason for this was that the additional funds provided by ISTEA and TEA-21 gave state DOTs an opportunity to implement highway projects that had been in development for years, even decades.

[814] The CMAQ program is not the only source of federal funds that can be used to address air quality and congestion problems (FHWA 1999). For example, funds available under the Surface Transportation Program (STP) and the Federal Transit Administration's (FTA's) capital assistance programs can also be

together, CAAA, ISTEA, and CMAQ created an innovative planning framework that *integrated* air quality targets with transportation decision-making, and provided a dedicated source of funding to help decision-makers protect human health and reduce congestion.[815]

Since the formation of ISTEA, environmental advocates have fought hard during the act's reauthorizations to retain, improve, and add new programs that support components of sustainable transportation (Benfield and Replogle 2002; Dilger 2003). As a result, the current surface transportation legislation (SAFETEA-LU) includes a number of programs that have the potential to improve the environmental, social, and economic performance of certain elements of the transportation system (Box 8.4). In particular, the Transportation, Community, and System Preservation (TCSP) program was specifically designed to better integrate transportation and urban development and move the current system towards sustainable development/transportation.[816] The idea was to capture successful and innovative planning practices from the TCSP program and incorporate them into other federal transportation programs. However, significant earmarking of the TCSP program's limited funding has reduced its efficacy and ability to initiate change.

Box 8.4: SAFETEA-LU Programs that Support Elements of Sustainable Transportation (with FY 05-09 authorizations)[817]

- *Surface Transportation Program (STP)*: provides flexible funding that can be used on any federal-aid highway; 10% of funds are set aside for transportation enhancements - $32.6 billion.
- *Congestion Mitigation and Air Quality Improvement (CMAQ) Program*: provides funding for projects and programs in air quality non-attainment and maintenance areas that reduce transportation-related emissions and congestion - $8.6 billion.
- *Capital Investment Grants (New Starts)*: provides funding for major fixed guideway capital investment projects (New Starts) and capital investment grants of $75 million or less for smaller transit investments (Small Starts) - $8.0 billion.
- *Highway Safety Improvement Program*: provides funding for a new federal-aid program (beginning in FY 2006) to fund projects and programs that reduce traffic fatalities and serious injuries on all public roads - $5.1 billion.

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used to further these goals. However, while funding is necessary, "*the greatest air quality benefit will accrue ... from a partnership of Federal, State and local efforts*" (ibid, p. 1).

[815] An important study of the CMAQ program by the Transportation Research Board (TRB 2002) concluded that while it is not possible to determine the cost-effectiveness of the program, it does provide an important stream of funding that "*encourages regions to experiment with nontraditional projects*" that "*would probably not have occurred without CMAQ*" (ibid, p. 8). Furthermore, the potential for regions to experiment with new ways to improve air quality is seen to encourage interagency cooperation and the formation of broad constituencies around new ideas.

[816] Source: Personal communication with Edward Weiner (Senior Policy Analyst, Office of the Secretary of Transportation, U.S. DOT), January 30, 2006.

[817] Sources: FHWA, *SAFETEA-LU Fact Sheets*, http://www.fhwa.dot.gov/safetealu/factsheets.htm (accessed on 04/09/06); FHWA, *Funding Tables*, http://www.fhwa.dot.gov/safetealu/fundtables.htm (accessed on 04/09/06); and FTA, *SAFETEA-LU Implementation*, http://www.fta.dot.gov/17003_ENG_HTML.htm (accessed on 04/09/06). Note: While the transportation programs in Box 8.4 are not a comprehensive list, they do represent many of the core environmental and social programs in SAFETEA-LU.

Box 8.4: SAFETEA-LU Programs that Support Elements of Sustainable Transportation (with FY 05-09 authorizations)[817]

- *Job Access and Reverse Commute*: provides funding for local programs that offer transportation services to low-income individuals who live in city centers and work in suburban locations - $727 million.
- *Formula Program for Elderly Persons and Persons with Disabilities*: provides funding to increase mobility for the elderly and persons with disabilities - $584 million.
- *Intelligent Transportation Systems (ITS) Research*: provides funding to support a comprehensive ITS research, development, and operational test program with priority given to enhancing mobility and productivity, improving safety, and integrating vehicle and infrastructure technologies - $550 million.
- *New Freedom Program*: provides funding to support the development of transportation services and public transportation alternatives beyond that required by the Americans with Disabilities Act of 1990 (ADA) to assist individuals with disabilities - $339 million.
- *Transportation, Community, and System Preservation (TCSP) Program*: provides funding for research and projects that investigate the relationship between transportation, community, and system preservation plans and practices and identifies private sector-based initiatives to improve those relationships - $270 million.
- *Clean Fuels Grant Program*: provides capital grants for clean fuel buses (up to 25 percent "Clean Diesel") and related facilities - $188 million.
- *Non-motorized Transportation Pilot Program*: provides funding for demonstration projects to evaluate the extent to which bicycling and walking can provide a solution to transportation problems - $100 million.
- *Value Pricing Pilot Program*: provides funding to evaluate the effectiveness of different value pricing approaches at reducing congestion - $59 million.
- *Safe Routes to School Program*: provides funding to enable and encourage children, including those with disabilities, to walk and bicycle to school in a safe and healthy environment - $54 million.

In addition to the programs described in Box 8.4, SAFETEA-LU includes three major federal-aid highway programs that focus on maintaining and improving the transportation system. These are the National Highway System ($30.5 billion, FY 05-09), the Interstate Maintenance Program ($25.2 billion, FY 05-09), and the Bridge Program ($21.6 billion, FY 05-09). While these programs are essential for keeping the current system operational, the predominant focus on highways means that it is difficult for states and metropolitan areas to direct attention towards developing a multimodal system. Further, the high cost of maintaining the national highway system is a significant financial burden that is likely to limit the scale of future sustainable transportation initiatives.

Beyond the programs within SAFETEA-LU, there are other federal transportation initiatives that can be associated with sustainable transportation. For example, with regards to aviation, two programs designed to assist airports in meeting their obligations under the CAAA are the (recently completed) Inherently Low Emission Airport Vehicle (ILEAV) pilot program[818] and Voluntary Airport Low Emissions (VALE) program[819]

[818] The ILEAV pilot program was established by the 2000 Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21). The pilot program authorized the FAA to make grants of up to $2 million to each of no more than 10 commercial service airports situated in air quality non-attainment

(FAA 2004). In many ways the ILEAV and VALE programs are similar to CMAQ since they provide funds to reduce emissions of criteria pollutants that are causing a region to fall into non-attainment with the NAAQS.

With regards to energy efficiency and reducing oil imports, the Corporate Average Fuel Economy (CAFE) standards - established by the Energy Policy Conservation Act of 1975 - effectively doubled the fuel economy of passenger cars to 27.5 mpg and reduced the fuel consumption of light trucks (the current light truck standard is set to increase from 21.6 to 22.2 mpg in 2007).[820] While a fuel tax might have been a more cost-effective approach and would have increased (rather than reduced) the per-mile cost of driving - making modes such as transit more attractive (CBO 2003; Dinan and Austin 2004)[821] - there was, and still is, strong opposition by the President and Congress to increasing fuel taxes (Lave and Lave 1999).

Another program designed to increase the fuel economy of vehicles was the Partnership for a New Generation of Vehicles (PNGV) established by President Clinton in 1993 (Black 1996; Sissine 1996). The PNGV aimed to create an affordable, 'super-efficient' car that could achieve 80 mpg, meet safety and emission standards, and not compromise performance and comfort. The program brought together the 'Big Three' automobile manufacturers (i.e., DaimlerChrysler, Ford, and General Motors), seven federal agencies, national laboratories, universities, suppliers, and the United States Council for Automotive Research (USCAR).[822] The program also sought to enhance the competitiveness of the U.S. automobile industry (Sissine 1996). Each manufacturer was

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areas. These grants enabled participating airports to evaluate the performance of low emission technology and alternative fuels. See the FAA, *Inherently Low Emission Airport Vehicle (ILEAV) Pilot Program, Final Report,* http://www.faa.gov/airports_airtraffic/airports/environmental/vale/media/ileav_report_final_2005.pdf (accessed on 04/09/06).

[819] The VALE program was developed by the Federal Aviation Administration (FAA) in response to a mandate given by the Vision 100-Century of Aviation Reauthorization Act of 2003. This act called for a voluntary program to reduce airport ground emissions at commercial service airports located in air quality non-attainment *and* maintenance areas. The VALE program effectively extends the incentives of the ILEAV pilot program to other airports (FAA 2004). See the FAA, *Voluntary Airport Low Emissions (VALE) Program,* http://www.faa.gov/airports_airtraffic/airports/environmental/vale/ (accessed on 04/09/06).

[820] For a detailed and up-to-date discussion of the CAFE standards, see the National Highway Traffic Safety Administration's (NHTSA's) *CAFE Overview,* http://www.nhtsa.gov/cars/rules/CAFE/overview.htm (accessed on 04/09/06).

[821] The federal gasoline tax is currently set at 18.4 cents per gallon. However, the average gasoline tax - including federal, state, and local taxes - is 41 cents per gallon. The Congressional Budget Office (CBO 2003) has estimated that gasoline taxes would have to be increased by 46 cents per gallon to achieve a 10 percent reduction in gasoline consumption. It was estimated that such a tax increase would impose a welfare cost of $2.9 billion per year. In contrast, CAFE standards would have to be increased to 31.3 mpg for passenger cars and 24.5 mpg for light trucks to achieve the same reduction in fuel consumption (ibid). In addition, the annual cost imposed upon manufacturers and consumers of new vehicles would range from between $3.0 and $3.6 billion (or $184 and $228 per new vehicle), depending on whether a fuel economy credit trading scheme was established (which would lower costs).

[822] Source: U.S. Department of Energy and the Environmental Protection Agency, Partnership for a New Generation of Vehicles, http://www.fueleconomy.gov/feg/pngv.shtml (accessed on 04/09/06).

originally required to reveal a concept vehicle in 2000[823] and have a production prototype ready by 2004. However, in 2002, the Department of Energy announced the FreedomCAR initiative (where CAR stands for cooperative automobile research), which replaced the PNGV. The FreedomCAR initiative effectively cancelled the PNGV mandate to have production prototypes of diesel hybrids ready for 2004.

The bold objective of the FreedomCAR program is to develop "*emission- and petroleum-free cars and light trucks.*"[824] To achieve this objective, the initiative is focusing on the development of fuel cells and advanced hybrid propulsion systems. While both the PNGV and FreedomCAR initiatives support many of the environmental objectives of sustainable transportation, critics of these programs argue that they represent an attempt by the automobile industry and government officials to undermine calls to strengthen CAFE standards (Sperling 2002; 2003). The PNGV initiative was also criticized as 'corporate welfare' since automobile manufacturers were already undertaking research in this area and had more than adequate resources to fund such work (Nader 2000).

While an analysis of the best approach to improving fuel economy is clearly necessary, the objective of this discussion is to highlight initiatives and programs that can be associated with sustainable transportation.

In conclusion, this section identifies a number of federal initiatives that support progress towards specific aspects of sustainable transportation. However, the effectiveness of these initiatives is likely to be reduced by the fact that there is no federal mechanism to coordinate or integrate these activities.[825] The fact that surface and air transportation legislation are considered separately and the majority of programs within transportation legislation are directed at specific modes provides little hope that the current system will be developed in an integrated, multimodal way. A better approach would be to craft a comprehensive transportation act that explicitly attempts to remove legislative barriers and focuses on creating an integrated, multimodal system. In addition, the CAAA and ISTEA/TEA-21/SAFETEA-LU policy framework provides a good example of how environmental and transportation legislation can be integrated to address specific issues such as air quality. Thus, one could envision a transportation act that begins to move away from the traditional 'procedural' focus on planning guidance towards a more 'performance-based' approach that attempts to realize specific environmental, social, and economic objectives.[826] Under this model, the CAAA would be one of many acts that

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[823] Source: U.S. Department of Energy, PNGV Concept Vehicles Presented to the Public in 2000, http://www1.eere.energy.gov/vehiclesandfuels/facts/favorites/fcvt_fotw128.html (accessed on 04/09/06).

[824] Source: U.S. Department of Energy, FreedomCAR and Vehicles Technologies Program, http://www.eere.energy.gov/vehiclesandfuels/ (accessed on 04/09/06).

[825] While this section focuses primarily on transportation programs, an evaluation of federal transportation research initiatives undertaken by the National Science and Technology Council (NSTC) reached a similar conclusion. The NSTC (1999, p. 1) argues that "*although there are current Federal transportation research activities that address - sometimes indirectly - selected issues associated with sustainability, a holistic, strategic, and coordinated approach is clearly needed.*"

[826] While it might be relatively straightforward to establish environmental and social standards that relate to transportation, it is likely to be difficult to create meaningful economic standards. The challenge is that it is not obvious whether transportation investment leads to economic growth or vice versa. For a detailed discussion of the transportation system and the economy see Section 6.2.3.

establish standards to which the transportation sector and other sectors would be held accountable. The failure of a sector to meet environmental, social, or economic standards would jeopardize its federal funding.

8.3.2.2 The PCSD's Approach to Sustainable Transportation

The one federal initiative that looked specifically at creating a national strategy on sustainable development - i.e., the President's Council on Sustainable Development (PCSD) - did not consider transportation in a comprehensive manner. As Benfield and Replogle (2002, p. 650) comment, "*the work of the PCSD related to transportation planning and management was somewhat scattered and arbitrary, varying in emphasis and structure from one report to another.*" Notwithstanding this criticism, the PCSD did manage to capture many of the fundamental elements of sustainable transportation. While transportation was not a major focus of the PCSD, it was an important consideration within the themes of 'sustainable communities' and 'climate change.'

In its first report, the PCSD (1996b) included transportation in its section on 'strengthening communities.' The Council identified four steps that can be taken to move the transportation system towards sustainability and presented four indicators to measure progress towards this objective (Box 8.5). In addition, with regards to community growth and management, the Council recommended that the federal government "*encourage shifts in transportation spending toward transit, highway maintenance and repair, and expansion of transit options rather than new highway or beltway construction*" (PCSD 1996b, p. 99). Further, the principle of an accessible transportation system was included in the sixth goal of the PCSD, which focused on sustainable communities (see Box 8.1).

Box 8.5: PCSD's (1996b, p. 54) Recommendations and Indicators Relating to Transportation and Sustainable Development

[The PCSD outlined four] ... steps that can be taken by government at all levels, communities, businesses, and residents to address the challenge of a sustainable transportation system.

- Improve community design to contain sprawl better, expand transit options, and make efficient use of land within a community to locate homes for people of all incomes, places of work, schools, businesses, shops, and transit in close proximity and in harmony with civic spaces.
- Shift tax policies and reform subsidies to improve economic and environmental performance and equity in the transportation sector significantly.
- Make greater use of market incentives in addition to changes in tax and subsidy policies to achieve environmental objectives.
- Accelerate technology developments and encourage public-private collaboration to move industrial sectors closer to economic, environmental, and equity goals.

Progress in the transportation sector could be measured using the following indicators:

- **Congestion**: Decrease in congestion in metropolitan areas.
- **National Security**: Increase in economic and national security through reduced dependency on oil imports.
- **Transportation Efficiency**: Decrease in the rates of freight and personal transportation emissions of greenhouse gases and other pollutants, including carbon monoxide, lead, nitrogen oxides, small

Box 8.5: PCSD's (1996b, p. 54) Recommendations and Indicators Relating to Transportation and Sustainable Development

particulate matter, sulfur dioxide, and volatile organic compounds.

- **Transportation Patterns**: Progress toward stabilizing the number of vehicle miles traveled per person while increasing the share of trips made using alternative transportation modes.

At the same time as the PCSD released its first report, its task force on transportation and energy published its findings. The task force structured its work around three strategic goals that focused on sustainable economic growth,[827] sustainable energy,[828] and sustainable transportation (PCSD 1996a). The strategic goal for sustainable transportation was as follows:

- "*Improve the economic and environmental performance of the U.S. transportation system while increasing all Americans' access to meaningful jobs, services, and recreation*" (PCSD 1996a).

To measure progress towards this goal, the task force developed five objectives (or 'indicators of progress'). These were to [1] reduce oil imports; [2] decrease traffic congestion; [3] reduce greenhouse gas emissions per passenger-mile by 20 percent by 2010 and 40 percent by 2025; [4] stabilize vehicle miles traveled (VMT) by enhancing alternatives to single occupancy vehicles (SOV); and [5] improve accessibility by increasing the share of trips made by alternatives to personal motor vehicles to 30 percent by 2025.

The focus of the third and fourth recommendations of the task force received close attention in the PCSD's (1999) final report. Following the 1992 Rio Conference, the topic of global climate change became an agenda item for the Clinton Administration. In 1993, President Clinton and Vice President Gore released their 'Climate Change Action Plan' (Clinton and Gore 1993) - which included a specific set of actions directed at transportation[829] - and in 1994 President Clinton established the 'Car Talks' committee (officially known as the *Policy Dialogue Advisory Committee to Assist in the Development of Measures to Significantly Reduce Greenhouse Gas Emissions from Personal Motor Vehicles*). While many initiatives in the Climate Change Action Plan proved to be unsuccessful (Brunner and Klein 1999; Hahn et al. 2003) and the Car Talks committee was unable to reach a consensus (Bergman 1996; Black 1996; NSTC 1999), President Clinton continued to show support for the issue by revising the PCSD's charter

[827] The strategic goal for sustainable economic growth was as follows: "*Pursue economic, environmental, and social policies that encourage global competitiveness and a long-term economic growth rate of at least 2.5 percent per year. Environmental improvements must be realized while providing opportunities and income gains that are distributed broadly throughout society and contribute to reducing poverty and inequity*" (PCSD 1996a).

[828] The strategic goal for sustainable energy was as follows: "*Improve the economic and environmental performance of U.S. energy supply and use, while ensuring that all Americans have access to affordable energy services and increasing the competitiveness of American business*" (PCSD 1996a).

[829] Three recommendations put forward by the Climate Change Action Plan focused on transportation. These were to [1] provide workers with the option to cash-in the value of their employer-paid parking spaces to pay for commuting alternatives to the automobile; [2] reduce VMT; and [3] create a tire labeling program to help consumers identify tires that have low rolling resistance (Clinton and Gore 1993).

in 1997 and requesting the Council to advise him on the "*domestic implementation of policy options to reduce greenhouse gas emissions.*"[830]

As a result of this new mandate, the PCSD devoted the first substantive chapter of its final report, *Towards a Sustainable America*, to addressing climate change. Within this chapter, the Council put forward three recommendations to reduce the transportation sector's impact on climate change. These were to:

1. "*Reduce greenhouse gas emissions from vehicles.*
2. *Accelerate development and use of cleaner fuels and engines.*
3. *Reduce vehicle-miles traveled*" (PCSD 1999, p. 21).

To support the above recommendations, the Council developed ten action items that focused on a wide array of transportation-related initiatives (Box 8.6). Many of the items in Box 8.6 are central to achieving a more sustainable transportation system. In addition, these action items incorporated the three transportation initiatives put forward in the 1993 Clinton-Gore Climate Change Action Plan.[831]

Box 8.6: PCSD's (1999, p. 22) Ten Transportation Action Items to Address Climate Change

Action 1: Government and businesses should accelerate efforts to procure clean fuel/engine fleet vehicles and fuel them in ways that result in real reductions of greenhouse gas emissions.

Action 2: Establish consumer tax incentives for purchase of efficient, advanced technology vehicles.

Action 3: Establish new programs and strengthen existing policies that foster alternative transportation choices and provide an incentive to drive fewer miles including:

(a) Policies that encourage the use of mass transit such as tax benefits for employer-subsidized transit pass and parking cash-out programs.
(b) Credits or incentives for compact development.
(c) Policies that promote car-sharing programs such as those already established in Europe and the United States, which offer the potential to reduce greenhouse gas emissions by lowering the total number of vehicle trips and vehicle-miles traveled within major cities.
(d) Public education and outreach efforts to identify and promote the benefits of efficient vehicles and other transportation choices to stimulate demand for these technologies.
(e) Research on the impact of telecommuting, information technologies, and Internet commerce on reducing greenhouse gas emissions.

Action 4: Improve infrastructure for intermodal transportation (i.e., bike racks, bus shelters, train stations).

Action 5: States and localities should establish appropriate road pricing policies that reduce congestion, mitigate greenhouse gases, and mitigate any impact on low-income commuters.

Action 6: In cases where greenhouse gas reductions can be quantified and verified against credible benchmarks, give communities the opportunity to receive credit when they use community design to lower traffic by adopting zoning codes and other changes that encourage more efficient land use patterns to reduce pollution from motor vehicles.

Action 7: Increase and redirect existing support for research, development, and deployment and production of advanced vehicle components towards technologies that enable greater efficiency including hybrid electric systems, lightweight materials, clean engines, energy storage systems, and fuels.

[830] Supra note 797.
[831] Supra note 829.

Box 8.6: PCSD's (1999, p. 22) Ten Transportation Action Items to Address Climate Change

Action 8: Support research to determine the potential of intelligent transportation systems (a group of technologies that could improve the flow of traffic through urban areas) to reduce greenhouse gas emissions.

Action 9: Prioritize and accelerate efforts to develop infrastructure for alternative-fueled vehicles that reduce greenhouse gas emissions.

Action 10: Perform additional research on how to reflect the number of vehicle-miles traveled as a variable cost of insurance so that drivers better understand the price associated with the number of miles they drive.

In addition to climate change, the PCSD's (1999) final report continued the Council's focus on the concept of sustainable communities (however, this time, less emphasis was given to transportation). Interestingly, the inclusive planning and flexible investment strategies of the Transportation Equity Act for the 21st Century (TEA-21) - first introduced in ISTEA - were endorsed by the Council as innovative mechanisms to "*preserve and enhance the sustainability of communities*" (ibid, p. 62).

The PCSD's (1996b; 1999) consideration of transportation within the themes of *sustainable communities* and *climate change* have had a lasting impact on the federal government's approach to transportation.

Following the publication of *Towards a Sustainable America*, the Clinton Administration announced the Livable Communities Initiative (LCI) in 1999.[832] A primary goal of the LCI was to "[e]*ase traffic congestion by improving road planning, strengthening existing transportation systems, and expanding use of alternative transportation.*"[833] To achieve this goal, the Administration increased funding for public transit and passenger rail and directed additional funds at three programs within TEA-21 - i.e., the Congestion Mitigation and Air Quality (CMAQ) Program, the Transportation Enhancements Program, and Transportation and Community and System Preservation (TCSP) Pilot Program.[834] The fact that the LCI supported existing programs is an indication that the principles of sustainable communities were already being promoted by transportation legislation. Indeed, in 1994 the Federal Transit Administration (FTA) announced its own 'Livable Communities Initiative' under authorization from ISTEA to strengthen the linkage between transportation services and the communities served (FTA 1994; U.S.

[832] Since towards the end of the 1990s the concept of sustainable development had little political appeal, the Administration's focus on communities was perhaps the only way to draw attention to an important element of the larger concept. While the Livable Communities Initiative focused on initiatives such as improving the local environmental, smart growth, community-led planning, and enhancing meaningful employment, it did not address important issues such as climate change or resource consumption.
[833] Source: The Clinton-Gore Livability Initiative, *Building Livable Communities for the 21st Century*, http://clinton4.nara.gov/CEQ/livability.html (accessed on 04/09/06).
[834] Source: The Clinton-Gore Livability Initiative, *Community Transportation Choices*, http://clinton4.nara.gov/CEQ/transportation.html (accessed on 04/09/06).

DOT 1996).[835] This indicates that while the work of the PCSD and the LCI has influenced transportation activities, the reverse is also true.

The livability agenda had a significant influence on the U.S. DOT's approach to the development of transportation infrastructure. For example, in its 2000-2005 Strategic Plan, the Department put forward seven infrastructure and investment strategies that reflect a clear concern for the health of communities (Box 8.7).

Box 8.7: U.S. DOT (2000c, p. 48) Infrastructure and Investment Strategies

a) Form alliances for public and private investment in transportation facilities and services to make communities more livable by helping them link growth strategies, land use plans, safety, environmental quality and economic development;

b) Help all levels of government and communities find ways to use transportation more effectively through planning techniques and operations that are sustainable, community friendly, improve environmental protection, environmental justice and scenic qualities;

c) Advance environmentally preferable transportation solutions, such as pedestrian travel, bicycling, mass transit and virtual travel, as alternatives to personal vehicle use;

d) Support, leverage and broker public and private investments in transportation by integrating economic development, environmental viability and social equity;

e) Promote public involvement in planning and ensure compliance with Title VI of the Civil Rights Act to reduce adverse impacts of transportation infrastructure and operations on minority and low-income communities and ensure the equitable distribution of transportation facilities and services;

f) Work with other agencies to improve and streamline the environmental review process while improving environmental protection; and

g) Improve DOT-owned or controlled facilities for the benefit of host communities by preventing pollution, recycling, using recycled products, and cleaning up contaminated facilities.

In the same year that the LCI was announced, the U.S. DOT launched the Center for Climate Change and Environmental Forecasting.[836] The Center was created as the U.S. DOT's lead entity for technical expertise on transportation and climate change (U.S. DOT 2000b; 2004). Indeed, the U.S. DOT (2000a) views the Center as one of two broad-based approaches to sustainable development; the other approach relates to smart growth/livable community initiatives (mentioned above). While the Center is clearly beneficial for sustainable transportation, the lack of leadership on climate change both from the Bush Administration and Congress has limited federal efforts to address the issue. Thus, the majority of initiatives that focus on reducing the impacts of transportation on climate change occur at the state and local level (Deakin 2002).

To summarize, while the PCSD's (1996b; 1999) first and final reports make some valuable recommendations on how to create a more sustainable transportation system, they do not articulate a clear sustainable transportation policy. Instead, the Council addresses transportation issues through the lenses of sustainable communities and climate

[835] See the Federal Transit Administration (FTA), *Livable Communities Initiative*, http://ntl.bts.gov/DOCS/livbro.html (accessed on 04/09/06).

[836] Source: The U.S. DOT, *Center for Climate Change and Environmental Forecasting*, http://climate.volpe.dot.gov/index.html (accessed on 04/09/06).

change. While one could be critical of this approach, transportation is a means to an end - i.e., it is primarily a derived demand - and it may be more effective to address transportation issues by focusing on ultimate ends such as clean air or happiness. An interesting question is whether transportation is seen as the 'dog' or the 'tail.' For example, the CAAA conformity provision can be seen as the air quality tail wagging the transportation dog (Dunn 1996). Conversely, one could also view the problem from the perspective of the transportation tail wagging the sustainable development dog. In the latter case, one could ask the question of whether the transportation sector is responsible for leading efforts towards sustainable development. The view of the author is that *all* sectors have a collective responsibility to make progress towards sustainable development, which is why it is vital that a national strategy be created to integrate and coordinate their efforts.

8.3.2.3 The Federal Government's 'Auto, Plus' Approach to Surface Transportation

Although there is no formal transportation policy to coordinate the activities described in the previous two sections, a useful framework that appears to capture the current federal approach to transportation is Dunn's (1996) 'Auto, Plus' paradigm. This paradigm is based upon the basic idea that the automobile is an integral part of the American lifestyle that delivers significant benefits to a wide range of people. Thus, the Auto, Plus viewpoint is committed to preserving the benefits of automobility. However, it also recognizes that the automobile creates a number of negative externalities that need to "*be addressed in ways that are cost effective, complement the strengths and achievements of the auto system, and enhance individuals' mobility choices*" (Dunn 1996, p. 170).

The 'Plus' refers to the promotion of initiatives that reduce the social burden of the automobile while maintaining its 'basic achievements.' These initiatives include "*innovations in regulatory policy, in energy-efficient auto technology, in community design, and in alternative modes of transport*" (Dunn 1996, p. 170). Today, congestion charging or value pricing should be added to Dunn's list. While these two instruments raise important equity considerations, they provide a mechanism through which congestion and environmental issues can be addressed. Hence, the 'Plus' component of the paradigm incorporates what many consider to be the central elements of sustainable transportation.

Another important aspect of the Auto, Plus paradigm is that it is grounded in political realism. Dunn (1996) argues that transportation policies that increase the cost of owning/using an automobile or reduce its convenience run against mobility preferences and market forces.

> "*The Auto, Plus outlook recognizes the necessity of broad and durable public support for problem-solving actions. This means avoiding policies that are in direct confrontation with mass preferences on individual mobility choices, that are unnecessarily complex, and that are costly and difficult to administer in our decentralized federal system. It is 'conservative' in the best sense of the term.*

That is, it seeks to conserve the benefits of automobility while addressing its problems and permitting as much room for alternative choices as is genuinely desired by individuals and communities" (Dunn 1996, p. 171).

If Dunn's (1996) notion of Auto, Plus is compared to the federal government's approach to surface transportation policies and programs discussed in Section 8.3.2.1, the similarities between the two quickly become apparent. Perhaps the best indicator of the federal government's approach to surface transportation is its funding allocations. SAFETEA-LU authorizes $286 billion (FY 04-09) for surface transportation, of which $234 billion (82%) is directed towards highway and safety programs, and $52 billion (18%) is directed at transit programs.[837] However, the Passenger Rail Investment and Improvement Act of 2005 (PRIIA) recently authorized $11.4 billion of federal funds over a six-year period (FY 06-11) to help Amtrak upgrade and maintain the passenger rail system. While PRIIA increases non-highway funding, the total amount is still significantly less than the funding directed at highways. The fact that federal funding for passenger rail is considered separately from SAFETEA-LU (the *surface* transportation act) provides further evidence of the desire to keep highway funds from being diverted to other modes.

The current federal role in transportation is largely a product of the interstate era (see Section 8.1). The significant investment in the interstate highway system combined with the creation of the Highway Trust Fund (HTF) created a *highway legacy* that the federal government must now manage. A particularly cumbersome problem is the HTF. It was initially established to keep revenues from federal highway user tax receipts separate from the General Fund so they could be invested directly back into the interstate system. The basic philosophy underpinning the HTF is the notion of 'user fee = user benefit' - i.e., federal highway taxes should benefit those who pay the tax (Ankner 2003). The use of user-based taxes or fees to fund transportation dates back to the first toll roads and bridges in the U.S. Thus, "[f]*unding for transportation in the United States is anchored in the concept of 'User Fees'*" (ibid, p. 1). The major problem with the current 'user fee = user benefit' approach, however, is that the user fees do not cover the true social costs of transportation. In fact, current user fees are less than those required to maintain the condition and performance of existing transportation systems (U.S. DOT 2002).

The reason that approximately 80 and 20 percent of SAFETEA-LU's funding is directed towards highways and transit, respectively, is that the HTF diverts the same percentages of federal highway tax receipts into the Highway Account and Mass Transit Account. While ISTEA, TEA-21, and SAFETEA-LU have gradually increased the amount of 'flexible funds' that can be transferred from highway to transit programs, there is clearly a structural bias towards highways in the way that funds are initially allocated. However, any attempt to change the structure of the HTF to support the development of a truly multimodal transportation system is likely to face significant barriers. First, diverting funds generated from highway taxes away from highways to transit runs against the 'user

[837] Source: U.S. House of Representatives, Committee on Transportation and Infrastructure, SAFETEA-LU, *Executive Summary*, http://www.house.gov/transportation/highway/issues/safetealu.pdf (accessed on 04/09/06).

fee' principle. Second, any change to the HTF is likely to face significant resistance from groups that benefit from the current structure of the Fund - particularly those groups supported by the Highway Account. Finally, the general public's reliance on automobiles makes any attempt to divert funds away from maintaining and developing the highway system difficult to sustain.

Given the above observations, Dunn's (1996) Auto, Plus paradigm seems to accurately represent the current federal approach to transportation. However, an important question is how much emphasis is being placed on each of the 'Auto' and 'Plus' components of the paradigm. Now that the interstate system is complete there is a need to rethink the way in which the federal government allocates its transportation funds. In the post-interstate era, the federal government has shifted its emphasis to maintaining and enhancing the capacity of the transportation system through a wide range of highway, mass transit, and other transportation programs (GAO 2004b).[838] There has also been a growing interest in private toll roads. One might characterize this shift in emphasis as placing more importance on the 'Plus' component of the Auto, Plus paradigm. The ISTEA-CAAA framework, the significant investment and interest in clean fuels and energy efficient vehicle technology, and the creation of transportation programs to enhance communities all indicate movement towards sustainable development/transportation. The challenge, therefore, is how to build upon the Auto, Plus paradigm and transform it into a sustainable transportation paradigm. This challenge is taken up in the following section.

8.4 The Federal Government's Future Role in Developing a Sustainable Transportation System

This final section identifies four major integration problems that limit the ability of the federal government to formulate sustainable development/transportation policy and presents a number of ways in which they can be overcome. Specific attention is given to policies and mechanisms that could enable the federal government to promote a more sustainable transportation system.

8.4.1 Visualizing the Barriers to Integrated Decision-Making

While there is a tremendous array of challenges that need to be addressed (see Section 8.3.1.1), there are four specific problems inherent in the federal system that tend to limit progress towards sustainable development/transportation. These are:

1. The lack of *horizontal integration* needed to overcome the balkanization/fragmentation of issues across and within government agencies;

[838] In many ways, the growing attention given to transit reflects a failure of the federal government to maintain these systems during the interstate era (see Section 8.1).

2. The lack of *vertical integration* needed to overcome the bureaucratic barriers that exist between the multiple levels of government - i.e., federal, state, and regional/local;[839]
3. The problem of integrating or aligning federal policies and programs with the diverse transportation needs of different states, regions, and local areas across the U.S.;[840] and
4. The problem of *disparate time horizons* - i.e., the long-term nature of many issues related to sustainable development makes it difficult to address problems given the short-term focus of political cycles.

Any attempt to fashion a logical and coherent set of sustainable transportation policies and programs has to, at a minimum, address these four issues. While the first three clearly revolve around integration, the fourth issue can also be considered as an integration problem. It is based upon the need to integrate disparate time horizons into the decision-making process.

While it is difficult to visualize the last two problems, the first two can be represented using simple diagrams. The problem of horizontal integration is represented by Figure 8.5.

The role of the federal government in the nation's development can be characterized by activity areas (i.e., those areas where government provides basic goods and services), which are represented in Figure 8.5 by a series of concentric circles. These activity areas are usually supported by cabinet-level departments or agencies. If necessary, each activity area could be broken down further. For example, transportation could be divided into transit, highway, airways, waterways, etc. There is no hierarchy to the activity areas shown in Figure 8.5. Thus, those located near the center of the circle are not necessarily more or less important than those located near the edge. In addition, only a representative group of activity areas has been shown in Figure 8.5; other areas that could be added to the diagram include agriculture and health and human services.

The wedges in the diagram represent the challenges (or important issues) that confront efforts to move towards sustainable development. These challenges match those shown in Figure 4.1 (Section 4.1.2). In addition, a 'competitiveness' wedge has been added to account for the economic challenge of delivering effective and efficient goods and services. The rationale is that competitiveness is a critical factor of economic growth and one that is closely related to technological innovation - an issue of direct interest to virtually all government activity areas.

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[839] This problem can also be expanded to include the vertical barriers that can exist *within* agencies.

[840] In Section 7.3, the observation is made that the unique structures of MPOs across the U.S. make it difficult for the FHWA/FTA to certify MPO planning processes in a unified manner. While there are significant problems with the federal MPO certification process, its primary strength is its flexible design, which enables local circumstances and needs to be taken into account. This action reflects a desire to ensure that federal mandates are not unnecessarily burdensome.

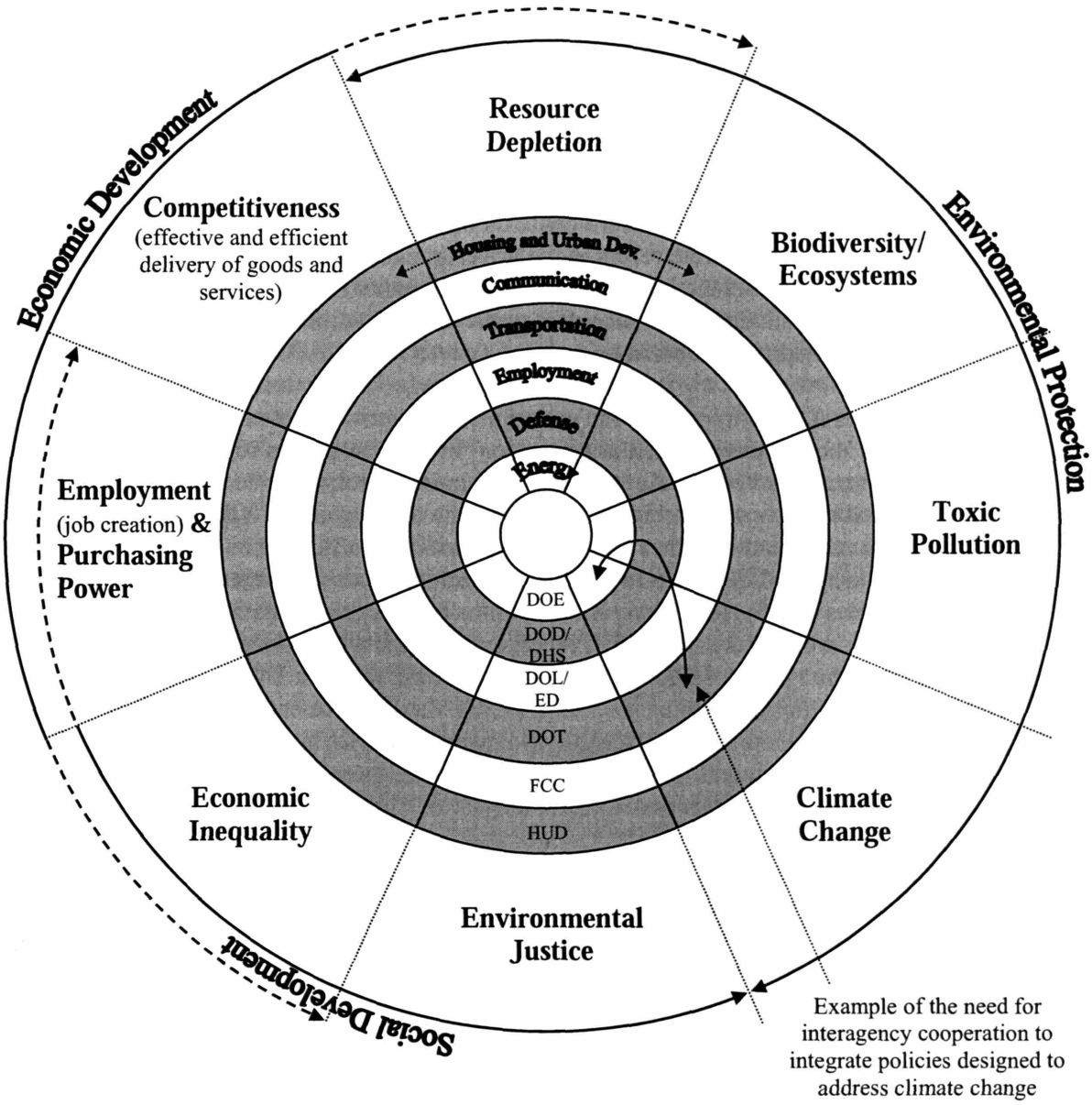

Figure 8.5: Government Activity Areas and Sustainable Development Concerns - The Challenge of Horizontal Integration

The three arrows that follow the circumference of the outer circle in Figure 8.5 identify the important issues (or wedges) that relate to environmental protection, social development, and economic development. The solid lines represent a direct connection between the theme of the arrow and an issue (e.g., economic development is directly related to employment and competitiveness[841]), and the dashed lines indicate an indirect

[841] Note: The decision to highlight competitiveness as an important issue rather than economic growth is intentional. The basic argument is that focusing on the competitive delivery of goods and services is more likely to lead to long-term economic benefits, than a focus on short-term economic growth. See Sections

link. The dashed lines also mean that another theme is more closely related to a particular issue. For example, economic development is fueled by resources, but the availability of resources is not a traditional measure of economic development. Thus, resource depletion is directly related to environmental protection and indirectly related to economic development.

Employment appears in two different contexts in Figure 8.5. The employment activity shown in the concentric circle refers to the government's role of ensuring an adequate supply of workers to fuel the industrial state. On the other hand, the employment concern relating to sustainable development refers to the creation of better jobs and mechanisms that enhance individual purchasing power.

Figure 8.5 does not incorporate those governmental agencies that address *multiple-activity* areas such as environmental protection. In many ways, an organization such as the Environmental Protection Agency (EPA) is more closely aligned with the environmental wedges shown in Figure 8.5 than an activity area.[842] This observation highlights an important question raised in Section 8.3.2.2: Should the U.S. DOT develop policies and programs designed to encourage sustainable development, or should other federal agencies such as the EPA - whose authority over environmental issues spans across activity areas - take the lead? The critical issue is which government agency is really driving the system. In the case of transportation, the U.S. DOT is the lead agency; however, other federal agencies such as the EPA, the Department of Energy (DOE), and the Department of Housing and Urban Development (HUD) also play influential roles. Thus, part of the horizontal integration problem is that there is no natural marriage between government entities that address activity or multiple-activity areas.

Given the current structure of the federal system, there are two approaches to the creation of policies for sustainable development. In the first approach, separate policies are developed by each activity area such as transportation or energy to address specific problems. In the second approach, the federal government establishes a single policy to address a specific problem area - such as climate change - that influences the actions of all relevant federal agencies. Both approaches highlight different barriers to horizontal integration. The problem with the first approach is that policies designed for a specific activity area can have significant impacts on other activity areas (as indicated by the double headed arrow in Figure 8.5). Thus, if activity areas were to independently design strategies to address global climate change, the final array of policies might (in some cases) work against one another.

The problem with the second approach is that the challenges (i.e., the wedges in the diagram) are not considered together when policies are designed to address a specific issue. For example, compressive policies that focus on reducing greenhouse gas emissions across all activity areas might lead to negative impacts in other areas such as

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2.3.1, 4.2.3, and 4.2.4 for a discussion of how technological innovation can enhance competitiveness and lead to economic growth.

[842] Figure 8.5 represents the author's best attempt to capture the multidimensional nature of sustainable development. While it has limitations, it does provide a way to visualize the horizontal integration problem.

increased levels of toxic pollution. This situation might occur if it were decided that expanding the use of ethanol in fuels would be a good solution to reducing greenhouse gas emissions. The problem with ethanol is that is produces aldehydes (carcinogenic substances) during combustion. In addition, a dramatic increase in the production of ethanol would lead to an increase in the use of pesticides to grow crops. Thus, unless the entire system-wide impacts of a policy are considered *and* addressed, the single-purpose design of policies is unlikely to move a nation towards sustainable development.[843]

In general, the problem of horizontal integration can be characterized by the lack of connectivity between [1] the activity areas (i.e., the concentric rings), [2] the issues within each activity area (i.e., the segments within a concentric ring), and [3] the social/environmental/economic challenges that cut across the activity areas (i.e., the wedges).

By expanding Figure 8.5 vertically, it is possible to visualize the problem of vertical integration. Figure 8.6 indicates that each level of government - i.e., federal, state, and regional/local - has its own system to deliver goods and services and address problems that might or might not align with the systems at the other levels. Thus, even the best conceived federal policies can fail due to the different practices and procedures in place at the state, regional, and local level.

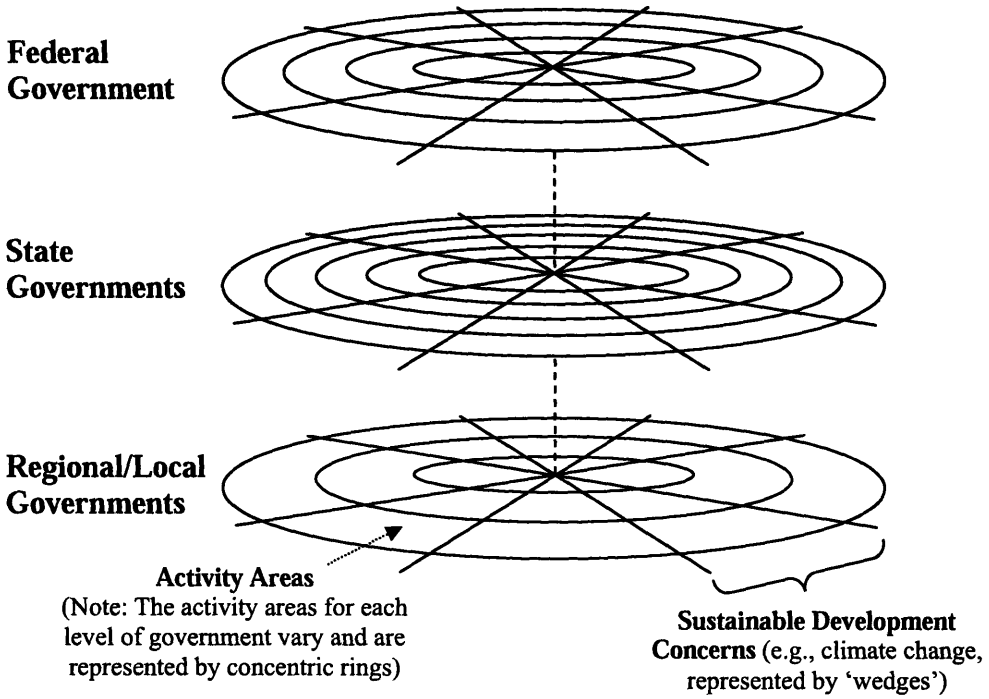

Figure 8.6: Government Activity Areas, Sustainable Development Concerns, and Different Levels of Government - The Institutional Challenge of Vertical Integration

[843] The trade-off matrix is a useful tool that the federal government could use to consider the impacts of proposed legislation on stakeholder groups and important social, environmental, and economic indicators (see Section 4.2.1.4).

As mentioned previously, it is difficult to visualize the last two integration problems in a meaningful way. The third problem of aligning federal transportation policies and programs with the needs of different geographic areas is complicated by the varying condition, performance, and extent of existing infrastructure and the forces that shape transportation demand (such as changing demographics and economic performance). The perennial debate between the federal and state governments on the appropriate role of the federal government in transportation provides some insight into the potential challenges in this area.

Finally, the fourth problem of disparate time horizons can best be described as the need to ensure that transportation decisions are informed by a long-term vision. Thus, decision-making becomes integrated in a longitudinal sense and is less influenced by political cycles. The next section presents several ways in which the four integration problems discussed above might be addressed.

8.4.2 Sustainable Transportation and the Federal Role

This section identifies opportunities for the federal government to overcome the barriers to integrated decision-making with regards to transportation. It also recommends a set of comprehensive actions that the federal government could take to promote a more sustainable transportation system.

In Section 8.3.1.2, a number of recommendations are put forward on how to create the institutional capacity within the federal government to develop and implement a national strategy for sustainable development. One recommendation that specifically addresses the problem of horizontal integration is the need for an executive-level entity to lead or initiate interagency collaboration on regulatory activities. Rather than creating an entirely new entity, it was proposed that the functions of the Council on Environmental Quality (CEQ) be enhanced to enable it to consider the full range of sustainable development issues. An enhanced CEQ would be particularly effectively since its position in the Executive Office of the President would give it the necessary authority to lead efforts to integrate federal regulatory initiatives.

However, the creation of an enhanced CEQ requires a strong Presidential commitment to sustainable development and Congressional support for any proposed change, which seems unlikely given the current political climate. Since the objective of this chapter is to put forward practical ideas, *it is assumed that a national strategy for sustainable development will remain illusive in the short-term.* This assumption significantly changes the environment within which a sustainable transportation policy/strategy could be created and effectively places this responsibility on the U.S. DOT. Therefore, the remainder of this section discusses opportunities for an enlightened U.S. DOT to lead efforts towards sustainable development/transportation. It is believed by the author that the U.S. DOT could adopt this position since a broad interpretation of the Department's originating statute permits the development of sustainable transportation policies and programs (see Section 8.2).

Without an enhanced CEQ (or similar body), the U.S. DOT would be responsible for identifying those agencies with which it must collaborate to overcome problems associated with horizontal integration. The U.S. DOT could use a more comprehensive version of Figure 8.5 - or a suitable alternative - to identify those federal agencies that it needs to work with to address the full range of issues related to sustainable transportation. In effect, the U.S. DOT would need to establish an interagency regulatory liaison group (IRLG) - attended by agency administrators - to focus on regulatory activities that impact transportation. This group would be able to identify which agency should take the lead on specific issues relating to transportation such as air quality, resource usage, competitiveness, etc. In all likelihood, each lead agency would have the statutory authority and ability to adequately address its chosen or (collectively) assigned issue(s).

The ability of the U.S. DOT to initiate real progress towards sustainable transportation depends on its willingness to think beyond traditional ways of addressing and linking transportation problems. The objective of Figure 8.5 is to help agencies identify areas where interagency collaboration could lead to progress on more than one critical challenge/issue at once. Thus, a situation might arise in which the U.S. DOT calls upon other agencies to take the lead on a critical transportation issue. For example, the EPA or DOE might champion efforts to reduce greenhouse gas emissions from vehicles, either by promoting a carbon trading mechanism or leading/financing efforts to develop hypervehicles and advanced fuels. Of course, the U.S. DOT could also play a role via more stringent CAFE standards or valuing pricing mechanisms, which could reduce CO_2 emissions by promoting more fuel efficient vehicles or reducing congestion, respectively. In addition, HUD (in collaboration with the U.S. DOT) could support these efforts by encouraging development patterns that reduce the need to drive and promote sustainable communities. If the political will existed, the creation of sufficiently stringent CO_2 or CAFE standards could also promote competitiveness by encouraging disrupting innovations in automobile technologies. The creation of such standards provides a good example of how regulatory initiatives focused on a specific challenge can significantly impact other areas. The critical issue is whether these impacts are unintended side effects or desired system improvements.

If the above discussion is considered within the context of the 'Auto, Plus' paradigm (see Section 8.3.2.3), those initiatives that achieve CO_2 emission reductions without increasing the cost of driving or constraining automobility are likely to be the most attractive from a political standpoint. However, while initiatives such as value pricing have yet to receive widespread public support, if congestion continues to rise, drivers might welcome such schemes. This point highlights the dynamic nature of the transportation system and the fact that the federal government's role in transportation will continue to evolve (see Section 8.1), changing the regulatory and policy instruments at its disposal.

In Sections 8.2.1, 8.2.2, and 8.2.3, three models are presented that might enable a national sustainable transportation policy to be established in the U.S. These are: [1] the *Consolidation of Congressional Committees*; [2] the *Moynihan Model*; and [3] the *DOT*

Reinvention Model. The first model was determined by the author to be unrealistic since restructuring Congressional committees will face significant resistance. The second model requires no institutional changes to the federal government and relies upon the power of policy networks and entrepreneurs to shape transportation regulation. While the success of such a model depends upon the willingness, capacity, and opportunity of a policy network to influence transportation legislation, it can work under any institutional structure and is, therefore, the most flexible model. The third model relies upon the willingness of the President and Congress to restructure the U.S. DOT to make it into a more effective agency. It also requires the President to agree that moving towards sustainable development is an important national objective and for Congress to be sympathetic to this idea. Thus, if there is no Presidential or Congressional support for a national strategy on sustainable development, the Moynihan Model is the only instrument capable of promoting sustainable transportation legislation.

However, if the requirement that the President and Congress need to support sustainable development/transportation is relaxed in the U.S. DOT Reinvention Model, the revised model can be promoted as a way to enhance the capability and effectiveness of the Department in leading/supporting federal transportation initiatives. The model's changes to the U.S. DOT's organizational structure would also help overcome horizontal integration problems that exist *within* the Department. If the Office of the Secretary of Transportation (OST) is given more authority, this action will reinforce the ability of the Secretary and Assistant Secretaries to integrate the Department's own regulatory initiatives. It will also enable the OST to speak in a united and authoritative manner when coordinating its regulatory activities with those of other agencies.

In the situation that the OST's ability to craft a sustainable transportation policy is limited by the President's agenda, the office could use its resources to support the activities of others (via the Moynihan Model) to create such a policy.

With regards to the problem of vertical integration, there is no easy mechanism to coordinate federal, state, and regional/local transportation initiatives. It seems that the best approach would be for the U.S. DOT to continue to build working relationships with governmental/quasi-governmental entities affected by federal regulation to identify ways to overcome potential problems/agenda conflicts. One interesting idea would be to transform the FHWA and FTA field offices into U.S. DOT field offices to better integrate the activities of the Department with those of state DOTs and MPOs. Such offices would also promote a multimodal approach to transportation rather than focusing predominantly on highways or transit.

The creation of DOT field offices would also help address the problem of better integrating federal policies and programs with the wide-ranging transportation needs of states, regions, and local areas across the U.S. The field offices would provide a conduit through which compliance with federal mandates could be assessed in the context of local circumstances. The offices could also ensure that federal mandates do not undermine positive state DOT and MPO initiatives. Another way to increase the effectiveness of federal transportation programs at the regional and local level would be

to continue and enhance the ability to move funds between programs. However, flexible funds are only valuable if they can be used in the desired way. Therefore, an interesting idea would be to give the DOT field offices the authority to sanction the use of a predetermined amount of authorized funds on important projects that fall outside the scope of federal programs.

Finally, with regards to the problem of disparate time horizons, at the federal level the government (as trustee) has a responsibility to ensure that the (distributional) impacts of its decisions are considered in a short-, long-term (e.g., 20 years), and intergenerational context. To help integrate these time horizons a trade-off approach, without automatically discounting future benefits, could be used to consider the expected impacts of various transportation policies over different time intervals (see Section 4.2.1.4). At the regional level the easiest way to address this issue would be to maintain the federal requirement that MPOs develop long-range transportation plans (LRTP). Many MPOs are already using the LRTP as a way to consider sustainable development in their visioning process. Further, if these plans were developed using a participatory backcasting approach (see Section 4.2.6), MPOs and their stakeholders could explore the use of promising sustainable technologies that could open new trajectories towards sustainable transportation.

It is important to recognize that the purpose of the above discussion is to consider how the U.S. DOT could promote sustainable development/transportation given specific assumptions about the political environment. Therefore, if this environment were to change, the actions that the federal government could/should take are likely to be different. Thus, the strategy one adopts when developing a national sustainable development/transportation policy will revolve around a careful analysis of the prevailing political environment.

Table 8.3 presents a comprehensive set of actions that the federal government could/should use to promote a sustainable transportation system. If these are considered along with the recommendations put forward by the PCSD in Section 8.3.2.2, they provide a rich source of ideas from which the federal government could create a strategy on sustainable transportation (if the political will for such a strategy exists).

An important argument of this research is that any federal initiative to pursue sustainable transportation should adopt a holistic systems approach. Further, if the federal government (specifically the U.S. DOT) is to play an active role in transitioning the nation's transportation system towards sustainability, it needs to adopt a *proactive*, *preemptive*, and *performance-based* approach to transportation policy. The use of performance measures/standards to develop the transportation system supports both the current quasi-laissez faire approach to the provision of transportation services and the federal government's technological approach to sustainable development. In addition, in creating performance criteria (or sustainable transportation indicators - see Section 6.4) the federal government can begin to establish a clear statement on the desired objectives of the transportation system.

Table 8.3: Sustainable Transportation and the Role of the Federal Government

	Sustainability Approach	The Federal Role
System Conceptualization [a]	*Holistic systems approach* - The transportation system is considered as a series of interconnected socio-technical systems that function like biological and ecological systems. A healthy system displays modal diversity for people and freight that increases with population size. The system is analyzed both in terms of its sub-systems and their interconnections, as well as how the system/sub-systems interact with the natural environment. The whole cannot be analyzed as a simple sum of its parts.	Broaden the scope of issues to be included in the analysis of transportation legislation and projects. In collaboration with other sectors, identify the environmental and resource usage constraints within which the transportation sector must operate. The CAAA/SAFETEA-LU framework is a good example of a mechanism that effectively sets environmental limits to transportation activity. Establish a multimodal entity within the U.S. DOT with technical and policy expertise to focus specifically on ways to connect the transportation modes. Identify opportunities to integrate surface and air transportation legislation.
Transportation Planning [a, b]	Maximize system efficiency through the provision of a highly interconnected and multimodal transportation system that encourages the use of the most efficient modes of transportation. Promote accessibility rather than mobility. Land use planning (including environmental considerations) is an integral part of transportation planning; '*transportation-land-environment planning*' replaces '*transportation planning*' as a descriptor.	Retain the federal transportation planning factors in SAFETEA-LU. Increase the burden of proof for compliance with these planning factors. Extend the planning factors to air transportation planning, with appropriate amendments. Make *transportation-land-environment planning* an important element of long-range transportation plans.
Stakeholder Involvement [b]	High level of stakeholder involvement. Stakeholders have a more influential role in the planning/decision-making process and are more cognizant of the distributional impacts of transportation policies/programs/projects. Stakeholders play a central role in participatory backcasting/scenario planning exercises.	Retain and reinforce SAFETEA-LU's requirement to include the public in transportation planning and decision-making processes. Ensure that similar requirements exist for planning related to aviation operations and airport development. Establish a pilot project to evaluate the technique of participatory backcasting.
Modal Choice	A more balanced approach to the provision of transportation is applied. Where feasible, innovative solutions should be tested to begin to bridge the gap between public and private transportation.[c]	Ensure states and regions/local areas have the flexibility to develop the most efficient mode(s) to meet their transportation needs. Consider ways to minimize the impacts that federal programs have on creating unnecessary or inappropriate transportation projects.

	Sustainability Approach	The Federal Role
Funding	Transportation funding is directed towards enhancing and integrating modal diversity and, in general, is not constrained to a particular mode. In a situation where the transportation system is largely built, funding focuses on operating, maintaining, and transforming the existing system towards a more sustainable form. Significant and sustained financial support is provided for sustainable transportation research.	Maintain and increase funding flexibility. Change the name of the Highway Trust Fund (HTF) to the Transportation Trust Fund (TTF). Evaluate whether the 80:20 split of federal funds between highways and transit represents the best division of funding from a 'transportation system,' rather than a political, perspective. In addition, consider new mechanisms that can finance a multimodal transportation system without elevating the priority given to a specific mode of transportation. Provide significant support for research aimed at improving the environmental, social, and economic performance of the transportation system.
U.S. DOT Strategic Objectives	— Safety; — Accessibility; — Multimodality; — Economic development; — Environmental protection/enhancement; and — Security. Rather than simply *managing* the strategic areas, the U.S. DOT should search for ways to achieve *transformational improvements* in each area (see *Competitiveness/Innovation*).	Adopt a *proactive*, *preemptive*, and *performance-based* approach to the delivery of transportation services. Ensure the U.S. DOT's strategic objectives support the principles of sustainable transportation (see Table 6.3, Section 6.2.2). Set ambitious national transportation performance objectives and identify ways to transform the transportation system to meet these objectives.
Equity	The principles of ethical transportation policy (see Box 6.2, Section 6.2.4.4) are applied in the choice of options and pathways for achieving those options. Federal law and guidance related to equity is adhered to.	Identify ways to ensure that transportation decisions make the transportation-disadvantaged members of society relatively better off. Integrate the principles of ethical transportation policy (see Box 6.2, Section 6.2.4.4) into federal transportation regulation and programs.
Employment [d]	Continue current approach while searching for radical improvements in the human-technology interface (i.e., the integration of human resources and engineering artifacts).	Ensure that public and private transportation service providers adhere to national worker health and safety standards.

	Sustainability Approach	The Federal Role
Economics and Policy Development/ Analysis	Ecological economics. Policy development is based upon *dynamic efficiency* - i.e., the need to consider how change occurs over time. Primary analysis tool: Trade-off/positional analysis (supported by the Rawlsian/utilitarian decision-making philosophy).	Encourage the use of analysis tools that enable transportation analysts and decision-makers to evaluate and trade-off the impacts of their policies and programs with regards to important social, environmental, and economic concerns. Highlight the importance of considering these policies and programs in a dynamic, rather than static, manner.
Competitiveness/ Innovation [d]	Competitiveness is achieved through changing the nature of meeting market needs by encouraging radical or disrupting innovation. Innovation occurs through an integrated process of technological, institutional, social/behavioral, and organizational changes. Government policy is integrated and co-optimized (i.e., is designed to achieve multiple objectives) and a range of incentives (including more stringent environmental regulation - i.e., the 'strong' Porter hypothesis) is used to encourage disrupting innovation.	Identify ways to transition away from the current procedural approach to transportation planning towards a more substantive approach that requires simultaneous progress (where possible) on social, environmental, and economic fronts. Use Figure 8.5 - or a suitable alternative - to identify ways to integrate or co-optimize federal regulatory initiatives directed at, or related to, transportation. In coordination with other federal agencies, create ambitious transportation performance standards - such as more stringent emissions standards - in areas where disrupting innovation might occur.
Externalities	A comprehensive set of environmental, social, and economic externalities is identified and significant effort is made to prevent or internalize the social costs of any negative transportation externalities either through mandated standards or economic instruments. Great care is taken to properly balance efficiency and equity.	Identify ways to minimize negative transportation-related externalities (see Table 6.2, Section 6.2.2). Identify ways to ensure that the market reflects the true social cost of a transportation mode. Educate drivers about any federal subsidies paid to maintain low vehicle ownership and usage costs.
Pollution and Waste	Pollution and waste are *prevented* through system changes wherever possible. Pollution and waste streams are kept within ecological limits.	See *System Conceptualization* and *Competitiveness/Innovation.*

	Sustainability Approach	The Federal Role
Energy and Resources	Transition resource and energy dependence away from non-renewable resources towards renewable resources. Promote dematerialization/ecological modernization.	In addition to pursuing strategies to promote disrupting innovation, provide significant research funding to universities and national laboratories (via a competitive process) to develop technologies for hyper-efficient modes of transportation and explore the future potential of intelligent transportation systems (ITS).
Trade	The international transportation system is developed to support trade while protecting important social and environmental objectives. The impacts of trade are considered using ecological economics. The idea that trade can be analyzed in a 'value-neutral' way using neo-classical economics is rejected. Instead, trade is analyzed from more than one ideological perspective.[e, f] Thus, the development of the international transportation system depends upon market demand as well as other important environmental and social considerations.	Support the development of an efficient and multimodal national and international transportation system, considering the impacts of this system in relation to important social and environmental factors, not just in relation to economic growth.
The Four Environmental Drivers of the Concern for Sustainable Development[844]	Governments provide a more balanced approach to addressing the four major environmental concerns.	Use Figure 8.5 as a way to consider the four environmental drivers of the concern for sustainable development when making transportation policy decisions.

Key: [a] Replogle (1991; 1995); [b] Litman (2003); [c] Hoogma et al. (2002), [d] Ashford et al. (2002); [e] Janelle and Beuthe (1997); and [f] Söderbaum (2005).

While Table 8.3 presents a wide array of actions that the federal government could/should take to promote a sustainable transportation system, perhaps the most effective tool to help overcome integration problems is the hybrid trade-off/positional analysis framework. This tool is designed to explicitly address the problem of fragmentation in decision-making by requiring decision-makers to consider the social, environmental, and economic impacts of proposed policies/programs over different time horizons. In the situation where it is not possible to co-optimize all elements of sustainable transportation, the tool allows decision-makers to trade-off outcomes from a propose policy/program in a transparent manner. The trade-off matrix also invites

[844] The four environmental drivers of the concern for sustainable development are [1] the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being; [2] the rapid use of finite resources and energy supplies; [3] the direct impacts of toxic pollution on human health and the health of other species; and [4] the disruption of the global climate.

decision-makers to consider alternative strategies to address a problem, which would help an interagency regulatory liaison group identify new ways to address a problem.

Finally, while many of the ideas discussed throughout this chapter and put forward in Table 8.3 might appear radical, when they are compared to the core stated principles of the U.S. DOT's (2000d) transportation policy architecture it appears that many simply reinforce existing objectives.[845] The five core principles that inform the current transportation policy architecture are as follows:

- "*A **Holistic Approach**: Transportation decision making should recognize and foster appropriate tradeoffs among individual transportation choices, industry forces and societal goals.*
- ***Collaboration and Consensus Building**: Transportation decision making should use an open and inclusive process, providing an opportunity for all parties and stakeholders to engage the issues and influence the outcomes.*
- ***Flexible and Adaptable**: The transportation decision-making process should be able to respond quickly and effectively to changing conditions and unpredictable, unforeseen events.*
- ***Informed and Transparent Decision Making**: Transportation decisions should be made openly and based on the best information and analysis available.*
- ***Innovation**: Transportation decisions should promote a continuing climate of innovation that reflects vision and speeds the movement of new ideas and products into service*" (U.S. DOT 2000d, p. 10).

Thus, it is believed by the author that the basic statutory authority and guiding principles for the U.S. DOT to formulate a national sustainable transportation strategy are already in place. What is missing is a Presidential and/or Congressional desire to pursue sustainable development/transportation as a national objective.

8.4.3 Conclusion

This final section highlights the fact that the major barrier to transitioning towards sustainable transportation is not a lack of intelligent ideas, but a lack of integrated decision-making within the federal system. Further, the approach that one adopts when developing a sustainable transportation strategy revolves around political factors and the performance of the transportation system. Hence, while a comprehensive set of actions is put forward by the author, the actual steps that the federal government could/should take will be dictated by prevailing circumstances. Perhaps the most influential factor shaping the decision-making environment is whether the President and/or Congress support the concept of sustainable development/transportation. In this section the assumption is made that such support is not likely to be forthcoming in the short-term. Therefore, in the absence of strong Presidential and/or Congressional support, a number of options are

[845] However, the author recognizes that the emphasis the U.S. DOT places on principles supporting the transportation policy architecture is likely to depend upon the Department's willingness to take action in these areas.

recommended for how the U.S. DOT (in collaboration with other agencies) could make progress towards sustainable development/transportation.

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9 Conclusions

9.1 General Conclusions and Contributions

9.1.1 What Distinguishes Unsustainable Transportation from Sustainable Transportation?

While the U.S. transportation system provides significant economic and social benefits, the system is also a major contributor to unsustainable development. With regards to the environment, the transportation system has played - and continues to play - an influential role in each of the four environmental drivers of the concern for sustainable development. First, the transportation system is responsible for a wide range of impacts that affect ecosystems and biological diversity and indirectly affect human health and well-being. Second, the transportation system relies upon non-renewable resources and energy supplies to build/maintain infrastructure and manufacture and power transportation vehicles/equipment. Third, toxic chemicals released during the manufacture and disposal of transportation vehicles/equipment and through the incomplete combustion of fossil fuels can directly affect human health and the health of other species. Finally, the ozone-depleting substances and greenhouse gases released from motor vehicles and transportation equipment play a major role in the disruption of the global climate.

With regards to society, the impacts of transportation are mixed. On the one hand, transportation provides unprecedented freedom of mobility; on the other it can disrupt communities, reduce accessibility, and isolate and limit the freedom of those unable to afford automobility. From an economic perspective, the transportation system is considered to be the backbone of the economy, but as congestion increases, the ability of transportation to support economic growth will be jeopardized. Of course, the type of economic growth supported is of critical importance to sustainable development. For example, if this growth is based upon the unconstrained use of natural resources, it poses a significant threat to ecosystem integrity and raises important intergenerational equity considerations.

In general, the U.S. approach to development is grounded firmly in capitalism and the basic economic assumption is that a rising tide lifts all boats. Within this paradigm, transportation investment is seen as necessary to support or encourage economic growth. However, as history has revealed, it is important to have safeguards in place to limit or eliminate adverse impacts to human health, the environment, and society from poorly executed transportation developments and negative system externalities. The problem is that these safeguards appear to be insufficient to prevent growth in unsustainable transportation trends. Since the core transportation systems in the U.S. are largely already in place, these trends relate primarily to increasing vehicle miles traveled (for passenger and freight vehicles) and the accompanying negative social, environmental, and economic impacts. However, the commitment to 'build our way out of congestion' still remains in some quarters.

Thus, the problem of unsustainable transportation is that the services delivered by - or benefits received from - the transportation system are being paid for at increasing social, environmental, and economic costs that are unsustainable over the long-term. This dissertation sets out to identify and develop tools that the federal government could and should use to understand and address these problems.

Sustainable transportation is not an *end state*, but rather a *process* of continual improvement that removes perverse incentives and halts or reverses clearly unsustainable development. Specific emphasis is given to the design of *integrated* and *coherent* policies and programs that seek to improve social, environmental, and economic transportation-related factors and impacts.

9.1.2 Why Has the U.S. Failed to Achieve a Sustainable Transportation System?

The problems associated with unsustainable transportation are not new, which raises the question of why there has been a failure to adequately address them. The answer can be found in failures or inadequacies that have occurred in economics and markets, in legislation and the political process, in public/private sector management, and in technology. Each one of these aspects shapes the economic, regulatory, and political environment within which the transportation sector operates. The interconnectedness of these factors makes it difficult to locate a single root cause of a problem. For example, is the relatively stagnant fuel economy of the U.S. vehicle fleet due to inadequate fuel prices, weak CAFE standards, or a failure of manufacturers to act with corporate social responsibility? A corollary question is whether the federal government has failed to take energy security seriously. President Bush's recent acknowledgment that "*America is addicted to oil*" suggests that the prior reluctance (or failure) to address the oil question may now be changing.[846]

Perhaps the most important *technical* factor shaping the transportation decision-making environment - which currently limits progress towards sustainable transportation - is America's love affair with automobility. Fueled by highway construction during the interstate era and low gasoline/diesel prices, the automobile has become the primary mode of transportation for the vast majority of people. Therefore, any effort to reduce the negative impacts from transportation by improving vehicle technology or reducing congestion is likely to face significant public resistance *if* it means higher costs for vehicle ownership and/or use. The problem is made worse when one realizes that current 'user fees' (e.g., federal taxes on fuel, tires, etc.) are not adequate to cover highway and bridge rehabilitation/maintenance costs, let alone the true social costs of automobiles and other vehicles. Thus, the interstate era not only radically changed transportation demands, but created a financial burden that current and future societies must carry. Furthermore, the rise of the automobile has made alternative modes of transportation (such as transit) less economically viable due to low-density suburban sprawl. Rising sprawl has, in turn,

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[846] Source: President Bush, *State of the Union Address*, January 31, 2006, http://www.whitehouse.gov/news/releases/2006/01/20060131-10.html (accessed on 04/09/06).

increased the dependency on the automobile, creating a positive feedback loop and further entrenching automobility.

The U.S. reliance on automobility effectively defines the decision-making environment within which sustainable transportation policies must emerge. While some progress has been made towards improving negative impacts from highways and vehicles, significant change has been limited by public and industry opposition to regulation that is perceived as 'anti-highway' and/or 'anti-auto.' Thus, if one were to call for a substantial redirection of transportation funds to alternative modes, such action would be unlikely to gain widespread support. The 'user fee = user benefit' approach that underlies transportation investment decisions is another reason why such a redirection of funds would be difficult. However, as mentioned above, the 'user benefit' is currently much greater than the 'user fee.' Simply addressing this problem could be an important step towards a more sustainable transportation system.

Given the dominance of automobility and the fact that sustainable transportation is currently associated with anti-highway/-auto policies, it is not surprising that the federal government has taken limited action on this issue. If the concept of sustainable transportation is to stimulate real change there needs to be a clear, long-term, and compelling vision to inform and guide transportation (and transportation-related) policies and programs. It is important to understand that there may be no single vision of what a sustainable transportation system should look like. What would be a sustainable system in Europe is unlikely to translate to the U.S. The state of the respective transportation and political systems in each nation are quite different. However, in either case, a transition towards a more sustainable system should be guided by performance objectives and incentives that are clear, unambiguous, and supported by a transportation market that provides more optimal solutions.

Other important factors that have limited progress towards a national sustainable transportation policy are as follows:

1. The lack of Presidential and/or Congressional support for making sustainable development/transportation a national objective;
2. The lack of *horizontal integration* needed to overcome the balkanization/fragmentation of issues across and within government agencies and Congress;
3. The lack of *vertical integration* needed to overcome the bureaucratic barriers that exist between the multiple levels of government - i.e., federal, state, and regional/local;
4. The problem of *disparate time horizons* - i.e., the long-term nature of many issues related to sustainable development makes it difficult to address problems given the short-term focus of political cycles;
5. The complexity of the legislative process which is influenced by interest groups that tend to promote individual modes at the expense of a more integrated approach;

6. The problem of integrating or aligning federal policies and programs with the diverse transportation needs of different states, regions, and local areas across the U.S.; and
7. The inadequacy of tools and/or planning guidance to inform and create a clear vision for the development of sustainable transportation policies and programs.

While all of the above factors are addressed in this thesis, the final issue lies at the center of the research. The significant impacts of the transportation system on society, the economy, and the environment indicate that the system cannot be considered in isolation. Yet, the decision-support tools that are used by transportation professionals tend to ignore, or are incapable of including, some important issues related to sustainable development/transportation (such as equity or ecological integrity). This means that only certain value-laden perspectives on a problem are considered and that decision-makers may not appreciate (or might choose to ignore) the full implications of their actions. Further, the fact that transportation is a highly interconnected system makes it difficult to address a topic such as sustainable development if the available tools only consider a constrained number of issues at once. Thus, an important question is what types of tools/approaches need to be considered to adequately address sustainable transportation.

9.1.3 What Tools/Approaches Might the Federal Government Use to Aid Decision-making and Promote Sustainable Transportation?

State and metropolitan transportation planning and decision-making processes are informed by federal regulations and requirements that specify the general approach that must be taken for federal funds to be received. These requirements include the development of state and regional goals that guide the creation of a Long-Range Transportation Plan (LRTP) and short-range Transportation Improvement Program (TIP); the inclusion of stakeholders in a continuing, cooperative, and comprehensive planning process; and the consideration of a wide range of planning factors (that do align with the objectives of sustainable transportation). In addition to transportation regulations and requirements, there are a number of federal laws that impact transportation. For example, transportation policies and programs must comply with environmental and civil rights law.

While the general approach to the transportation planning and decision-making process is defined, state DOTs and metropolitan planning organizations (MPOs) are able to select any analytic tool or approach to evaluate their policies and programs. The traditional set of economic tools that transportation planners and decision-makers use include benefit-cost analysis (BCA), economic impact analysis, life cycle costs analysis (LCCA), and cost-effectiveness analysis (CEA). Other techniques used include travel demand and air quality models, risk assessments, environmental impact assessments (EIAs),[847] and multi-criteria approaches (MCA).

[847] Note: An EIA may be required under NEPA if a proposed transportation project is likely to have a significant impact on the human and natural environment.

While State DOTs and MPOs have discretion over which tools and approaches they use, their need to prove that their actions present the most economically sensible solution to a problem elevates the importance of tools such as BCA and CEA. Indeed, the federal government advocates the use of BCA to evaluate transportation investments. However, an interesting finding from this research is that many MPOs do not rely on BCA when making difficult transportation investment decisions. This indicates that there is a need for a decision-support tool that can incorporate the broad transportation planning factors as well as consider the objectives of regional/local land-use, housing, community development, and employment strategies. The nature of these issues means that such a tool must be able to accommodate the political process that requires decision-making to be democratic and accountable.

Thus, this research [1] identifies important elements that are missing from current transportation tools and approaches (such as a rigorous or explicit treatment of equity and a failure to account for technological, organizational, institutional, and social innovation); [2] highlights useful organizing frameworks that are not commonly used, but are believed by the author to be essential; and [3] develops new frameworks where gaps exist. The specific tools or approaches explored or developed in this thesis are:

- The Rawlsian/utilitarian decision-making philosophy;
- The hybrid trade-off/positional analysis framework;
- Ecological economics vs. environmental economics;
- Stakeholder participation (e.g., participatory backcasting); and
- Explicit planning for stimulating technological innovation.

The Rawlsian/utilitarian decision-making philosophy was extended by the author to ensure that the fundamental principles of fairness (or equity) and environmental protection fall at the center of transportation planning and decision-making (see Section 9.2.3).

The hybrid trade-off/positional analysis framework was developed by the author to provide decision-makers with an alternative to techniques such as BCA (see Section 9.2.6). This new framework does not require decision-makers to monetize and aggregate disparate factors. It also invites stakeholders into the decision process, considers distributional impacts, supports the comparative analysis of alternatives over time, and permits the consideration of technological change.

The transdisciplinary field of ecological economics is identified as an approach that is central to sustainable development. Whereas environmental economics sees the major system failure as the inability to price or assign property rights, ecological economics sees the problem as the inability of the economy to operate within biophysical limits. Ecological economics presents an essential approach to decision-making for sustainable transportation that should be used at the regional, state, and federal level.

The idea of stakeholder/public participation is central to transportation planning and decision-making. While the majority of MPOs use some form of visioning process to develop their LRTP, this research advocates the use of *participatory backcasting*. This

approach aligns closely with sustainable development and the importance of collectively identifying a desirable future and creating policies to work towards that future.

Finally, the importance of considering ways to stimulate rapid technological change is a general theme throughout this dissertation (see Section 9.2.5). An emphasis is placed upon the need to integrate government interventions with the objective of encouraging a system transformation towards sustainability. In particular, the idea of establishing more stringent environmental regulation (i.e., the 'strong' Porter hypothesis) to encourage disrupting innovation is put forward as a useful way to stimulate system innovations and improve national competitiveness.

9.1.4 How Might the Federal Government Develop a More Sustainable Transportation System?

As introduced in Section 9.1.1, sustainable transportation is seen as a *process* of continual improvement that removes perverse incentives and halts or reverses clearly unsustainable development. To help guide the transformation process, the federal government must focus on essential areas to initiate fundamental change. These include:

- Changes in prices, markets, and industry structure to shape private/public sector activity and transportation supply/demand;
- System changes related to the organizational/institutional structure of government;
- Changes in law and the political process (e.g., legislation, regulation, negotiation, and stakeholder participation); and
- Technological/scientific changes (e.g., options for research and development, innovation, and diffusion of existing technology).

Within these broad areas, specific actions need to be crafted to encourage the development of a more sustainable transportation system.

An underlying premise of this research is that movement towards sustainable development/transportation is only likely to occur through the right balance of *challenge* and *support*. The *challenge* aspect stems from the articulation of new pathways of development that in some cases require the adoption of a revised value system and (perhaps) a radically different approach to decision-making. The *support* aspect is encapsulated by the multidimensional decision-support framework shown in Table 9.1. This table presents a comprehensive set of actions or approaches - a blueprint - that the federal government could/should use to promote a sustainable transportation system.

Table 9.1: Sustainable Transportation and the Role of the Federal Government

	Sustainability Approach	The Federal Role
System Conceptualization [a]	*Holistic systems approach* - The transportation system is considered as a series of interconnected socio-technical systems that function like biological and ecological systems. A healthy system displays modal diversity for people and freight that increases with population size. The system is analyzed both in terms of its sub-systems and their interconnections, as well as how the system/sub-systems interact with the natural environment. The whole cannot be analyzed as a simple sum of its parts.	Broaden the scope of issues to be included in the analysis of transportation legislation and projects. In collaboration with other sectors, identify the environmental and resource usage constraints within which the transportation sector must operate. The CAAA/SAFETEA-LU framework is a good example of a mechanism that effectively sets environmental limits to transportation activity. Establish a multimodal entity within the U.S. DOT with technical and policy expertise to focus specifically on ways to connect the transportation modes. Identify opportunities to integrate surface and air transportation legislation.
Transportation Planning [a, b]	Maximize system efficiency through the provision of a highly interconnected and multimodal transportation system that encourages the use of the most efficient modes of transportation. Promote accessibility rather than mobility. Land use planning (including environmental considerations) is an integral part of transportation planning; '*transportation-land-environment planning*' replaces '*transportation planning*' as a descriptor.	Retain the federal transportation planning factors in SAFETEA-LU. Increase the burden of proof for compliance with these planning factors. Extend the planning factors to air transportation planning, with appropriate amendments. Make *transportation-land-environment planning* an important element of long-range transportation plans.
Stakeholder Involvement [b]	High level of stakeholder involvement. Stakeholders have a more influential role in the planning/decision-making process and are more cognizant of the distributional impacts of transportation policies/programs/projects. Stakeholders play a central role in participatory backcasting/scenario planning exercises.	Retain and reinforce SAFETEA-LU's requirement to include the public in transportation planning and decision-making processes. Ensure that similar requirements exist for planning related to aviation operations and airport development. Establish a pilot project to evaluate the technique of participatory backcasting.
Modal Choice	A more balanced approach to the provision of transportation is applied. Where feasible, innovative solutions should be tested to begin to bridge the gap between public and private transportation.[c]	Ensure states and regions/local areas have the flexibility to develop the most efficient mode(s) to meet their transportation needs. Consider ways to minimize the impacts that federal programs have on creating unnecessary or inappropriate transportation projects.

	Sustainability Approach	The Federal Role
Funding	Transportation funding is directed towards enhancing and integrating modal diversity and, in general, is not constrained to a particular mode. In a situation where the transportation system is largely built, funding focuses on operating, maintaining, and transforming the existing system towards a more sustainable form. Significant and sustained financial support is provided for sustainable transportation research.	Maintain and increase funding flexibility. Change the name of the Highway Trust Fund (HTF) to the Transportation Trust Fund (TTF). Evaluate whether the 80:20 split of federal funds between highways and transit represents the best division of funding from a 'transportation system,' rather than a political, perspective. In addition, consider new mechanisms that can finance a multimodal transportation system without elevating the priority given to a specific mode of transportation. Provide significant support for research aimed at improving the environmental, social, and economic performance of the transportation system.
U.S. DOT Strategic Objectives	— Safety; — Accessibility; — Multimodality; — Economic development; — Environmental protection/enhancement; and — Security. Rather than simply *managing* the strategic areas, the U.S. DOT should search for ways to achieve *transformational improvements* in each area (see *Competitiveness/Innovation*).	Adopt a *proactive*, *preemptive*, and *performance-based* approach to the delivery of transportation services. Ensure the U.S. DOT's strategic objectives support the principles of sustainable transportation (see Table 6.3, Section 6.2.2). Set ambitious national transportation performance objectives and identify ways to transform the transportation system to meet these objectives.
Equity	The principles of ethical transportation policy (see Box 6.2, Section 6.2.4.4) are applied in the choice of options and pathways for achieving those options. Federal law and guidance related to equity is adhered to.	Identify ways to ensure that transportation decisions make the transportation-disadvantaged members of society relatively better off. Integrate the principles of ethical transportation policy (see Box 6.2, Section 6.2.4.4) into federal transportation regulation and programs.
Employment [d]	Continue current approach while searching for radical improvements in the human-technology interface (i.e., the integration of human resources and engineering artifacts).	Ensure that public and private transportation service providers adhere to national worker health and safety standards.

	Sustainability Approach	The Federal Role
Economics and Policy Development/ Analysis	Ecological economics. Policy development is based upon *dynamic efficiency* - i.e., the need to consider how change occurs over time. Primary analysis tool: Trade-off/positional analysis (supported by the Rawlsian/utilitarian decision-making philosophy).	Encourage the use of analysis tools that enable transportation analysts and decision-makers to evaluate and trade-off the impacts of their policies and programs with regards to important social, environmental, and economic concerns. Highlight the importance of considering these policies and programs in a dynamic, rather than static, manner.
Competitiveness/ Innovation [d]	Competitiveness is achieved through changing the nature of meeting market needs by encouraging radical or disrupting innovation. Innovation occurs through an integrated process of technological, institutional, social/behavioral, and organizational changes. Government policy is integrated and co-optimized (i.e., is designed to achieve multiple objectives) and a range of incentives (including more stringent environmental regulation - i.e., the 'strong' Porter hypothesis) is used to encourage disrupting innovation.	Identify ways to transition away from the current procedural approach to transportation planning towards a more substantive approach that requires simultaneous progress (where possible) on social, environmental, and economic fronts. Use Figure 9.1 - or a suitable alternative - to identify ways to integrate or co-optimize federal regulatory initiatives directed at, or related to, transportation. In coordination with other federal agencies, create ambitious transportation performance standards - such as more stringent emissions standards - in areas where disrupting innovation might occur.
Externalities	A comprehensive set of environmental, social, and economic externalities is identified and significant effort is made to prevent or internalize the social costs of any negative transportation externalities either through mandated standards or economic instruments. Great care is taken to properly balance efficiency and equity.	Identify ways to minimize negative transportation-related externalities (see Table 6.2, Section 6.2.2). Identify ways to ensure that the market reflects the true social cost of a transportation mode. Educate drivers about any federal subsidies paid to maintain low vehicle ownership and usage costs.
Pollution and Waste	Pollution and waste are *prevented* through system changes wherever possible. Pollution and waste streams are kept within ecological limits.	See *System Conceptualization* and *Competitiveness/Innovation.*

	Sustainability Approach	The Federal Role
Energy and Resources	Transition resource and energy dependence away from non-renewable resources towards renewable resources. Promote dematerialization/ecological modernization.	In addition to pursuing strategies to promote disrupting innovation, provide significant research funding to universities and national laboratories (via a competitive process) to develop technologies for hyper-efficient modes of transportation and explore the future potential of intelligent transportation systems (ITS).
Trade	The international transportation system is developed to support trade while protecting important social and environmental objectives. The impacts of trade are considered using ecological economics. The idea that trade can be analyzed in a 'value-neutral' way using neo-classical economics is rejected. Instead, trade is analyzed from more than one ideological perspective.[e, f] Thus, the development of the international transportation system depends upon market demand as well as other important environmental and social considerations.	Support the development of an efficient and multimodal national and international transportation system, considering the impacts of this system in relation to important social and environmental factors, not just in relation to economic growth.
The Four Environmental Drivers of the Concern for Sustainable Development[848]	Governments provide a more balanced approach to addressing the four major environmental concerns.	Use Figure 9.1 as a way to consider the four environmental drivers of the concern for sustainable development when making transportation policy decisions.

Key: [a] Replogle (1991; 1995); [b] Litman (2003); [c] Hoogma et al. (2002), [d] Ashford et al. (2002); [e] Janelle and Beuthe (1997); and [f] Söderbaum (2005).

9.1.5 What Are the Barriers to Achieving Sustainable Transportation and How Can They Be Overcome?

The major barriers that have prevented the federal government from establishing a sustainable transportation policy are outlined in Section 9.1.2.

The lack of *Presidential and/or Congressional (i.e., political and financial) support for sustainable development/transportation* is perhaps the most significant barrier. One way to address this problem is to create a clear, long-term, and compelling vision that motivates the federal leadership to take action. Specifically, identifying ways to enhance

[848] The four environmental drivers of the concern for sustainable development are [1] the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being; [2] the rapid use of finite resources and energy supplies; [3] the direct impacts of toxic pollution on human health and the health of other species; and [4] the disruption of the global climate.

national competitiveness and environmental quality through technological, organizational, institutional, and social innovation is one useful area of future action and research.

The actions the federal government could take to circumvent the problem of *horizontal integration* depends upon whether its leadership is committed to sustainable development/transportation. In this research, horizontal integration is represented using Figure 9.1 that highlights the lack of connectivity between [1] activity areas (i.e., the concentric rings), [2] issues within each activity area (i.e., the segments within a concentric ring), and [3] social/environmental/economic challenges that cut across activity areas (i.e., the wedges). If there were Presidential and/or Congressional support, an ideal approach to addressing horizontal integration would be to establish an executive-level entity (such as an enhanced Council on Environmental Quality) to coordinate and assist with the implementation of a national sustainable development/transportation strategy. Such an entity could lead efforts to develop and coordinate interagency collaboration. In addition, a counterpart entity should be established in Congress and given the responsibility to coordinate, investigate, and report on the impacts of proposed/existing legislation on sustainable development/transportation. Without Presidential and/or Congressional support, one (probably less effective) option would be for an enlightened U.S. DOT to lead interagency collaboration on regulation that affects progress towards sustainable transportation.

With regards to the problem of *vertical integration*, there is no easy mechanism to coordinate federal, state, and regional/local transportation initiatives. It seems that the best approach would be for the U.S. DOT to continue to build working relationships with governmental/quasi-governmental entities affected by federal regulation to identify ways to overcome potential problems/agenda conflicts. One interesting idea would be to transform the FHWA and FTA field offices into U.S. DOT field offices to better integrate the activities of the Department with those of state DOTs and MPOs. Such offices would also promote a multimodal approach to transportation rather than focusing predominantly on highways or transit.

The creation of U.S. DOT field offices would also help address the problem of *better integrating federal policies and programs with the wide-ranging transportation needs of states, regions, and local areas across the U.S.* The field offices would provide a conduit through which compliance with federal mandates could be assessed in the context of local circumstances. The offices could also ensure that federal mandates do not undermine positive state DOT and MPO initiatives. Another way to increase the effectiveness of federal transportation programs at the regional and local levels would be to continue and enhance the ability to move funds between programs. However, flexible funds are only valuable if they can be used in the desired way. Therefore, an interesting idea would be to give the U.S. DOT field offices the authority to sanction the use of a predetermined amount of authorized funds on important projects that fall outside the scope of federal programs.

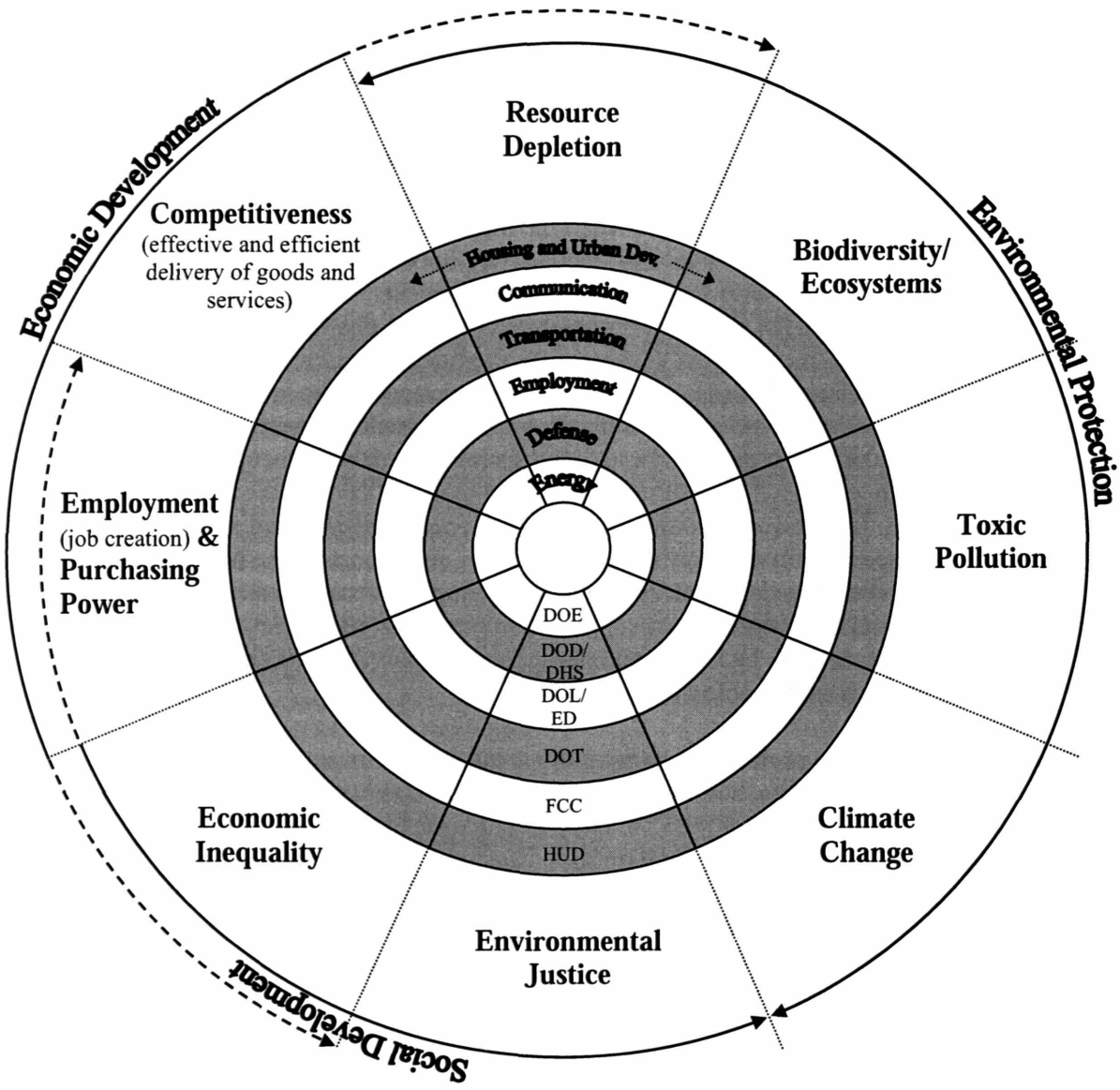

Figure 9.1: Government Activity Areas and Sustainable Development Concerns - The Challenge of Horizontal Integration

With regards to the problem of *disparate time horizons*, the federal government (as trustee) has a responsibility to ensure that the distributional impacts of its decisions are considered in short-term, long-term (e.g., 20 years), and intergenerational contexts. To help integrate these time horizons a trade-off approach, which does not automatically discount future benefits, could be used to consider the expected impacts of various transportation policies over different time intervals. At the regional level the easiest way to address this issue would be to maintain the federal requirement that MPOs develop long-range transportation plans (LRTP). Many MPOs are already using the LRTP as a way to consider sustainable development in their visioning processes. Further, if these plans were developed using a participatory backcasting approach, MPOs and their

stakeholders could explore the use of promising sustainable technologies that could open new trajectories towards sustainable transportation.

Yet another barrier to creating a sustainable transportation policy is the *complexity of the legislative process.* Two approaches that could support the creation of a sustainable transportation policy under the right circumstances are the 'Moynihan model' and the 'DOT reinvention model' (developed in Chapter 8). Both of these models consider ways to promote sustainable transportation legislation through the Congressional review process.

Finally, the *inadequacy of tools and/or planning guidance* to inform the development of sustainable transportation policies and programs is a significant (though largely unrecognized) barrier. This research has outlined existing and newly-developed decision-support tools that the author believes can be used to help overcome this challenge (see Section 9.1.3).

9.1.6 Conclusion

While it is clearly not possible to address all the challenges associated with moving the U.S. towards sustainable development/transportation, this research shows that it is possible to distill enough basic knowledge to identify actions/approaches that are *likely* to put the nation onto a more sustainable pathway. Rather than relying on a single discipline or field of study, this research attempts to consider the notion of sustainable development/transportation in a transdisciplinary manner by using what the author considers to be the most relevant and important organizing frameworks. These different lenses not only reveal the immense complexity of the concept of sustainable development/transportation, but also highlight critical factors that might have been overlooked had only one framework been considered. For example, while focusing on ways to enhance economic development is essential, care must be taken to ensure that the approach does not undermine human well-being or happiness. Likewise, efforts to develop transportation systems should ensure that the most disadvantaged members of society are made relatively better off under policies/programs/projects if real progress towards a more equitable society is a valued objective.

While there are a number of areas where more research is required, the author believes that the major objectives have been accomplished. Sustainable development and sustainable transportation have been conceptualized; a sustainable transportation decision-support framework that incorporates important lenses on sustainable development has been created and compared with regional transportation planning and decision-making practices; a comprehensive set of sustainable development/transportation indicators has been identified; and the future actions that the federal government should/could take to promote sustainable transportation have been outlined.

9.2 Executive Summary of Unique Contributions and Future Work

This research demonstrates that sustainable development is a multidimensional concept that should be approached in a transdisciplinary manner. The primary objective was to synthesize and integrate disparate and currently unconnected lines of thought that have not yet been applied in a systematic way to promote sustainable development and sustainable transportation. Thus, the primary contribution is the creation of a decision-support framework that identifies the principles, tools, and organizing frameworks that decision-makers could/should use to create policies and programs that transition society towards sustainability (Table 9.1). The multidimensional elements of the proposed framework have either been articulated or developed by the author throughout the dissertation (see Table 1.1 in Chapter 1).

The research presents the theoretical concepts important for sustainability in general and considers their application to the transportation planning and decision-making environment in the U.S. In general, the theories and ideas developed in the first strand of the research - specifically Chapters 2, 4, and 5 - can be applied to any sector (such as the energy and agricultural sectors). Chapter 6 is an intermediate chapter that considers the general theories and ideas in a transportation context. This chapter also articulates the sustainable transportation decision-support framework that is considered and used in Chapters 7 and 8, respectively.

The following sections identify unique contributions and, where appropriate, areas of future research.

9.2.1 History and Background

The first major undertaking of this research was to develop an understanding of the concept of sustainable development. While many texts have been written on the history of sustainable development, the approach in Chapter 3 is believed by the author to be unique. It tracks the rise of the concern for sustainable development by following the evolution of core ideas and arguments from the 1960s until today. These arguments were shaped by key events, international conferences/conventions, influential publications, and U.S. legislation, which are documented throughout the chapter (see Boxes 3.1, 3.2, and 3.9 in Chapter 3). In addition, it is argued by the author that the drivers of the concern for sustainable development can now be identified as four different environmental concerns:

1. The disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being;
2. The rapid use of finite resources and energy supplies;
3. The direct impacts of toxic pollution on human health and the health of other species; and
4. The disruption of the global climate.

These four environmental concerns should be considered in an integrated and comprehensive manner, rather than focusing on one or two concerns at the expense of the others.

Running in parallel with the history of sustainable development is a discussion of the emergence of the concept of sustainable transportation (see Sections 6.2.1 and 6.2.2). This discussion shows how the concept evolved from the larger debate on sustainable development and was particularly influenced by the Stockholm (1972) and Rio (1992) conferences. An important conclusion from this discussion is the fact that - at the international level - transportation is treated as a subset of other topics such as human settlements or energy rather than being considered as a topic in its own right. This finding is important since it highlights a potential shortcoming of current definitions of sustainable transportation. While these definitions are necessarily 'transportation-centered,' they fail to highlight the importance of integrating transportation decision-making with decisions in other key sectors (such as energy). A way to overcome this definitional problem is presented in Section 9.2.4.

9.2.2 Meeting Human Needs

There is convincing evidence to suggest that understanding the fundamental needs of humans is essential if we are to develop strategies to transition society towards more sustainable forms of development. Put simply, human needs motivate human behavior both individually and collectively and developing a better understanding of this relationship can only improve decision-making.

The main conclusion from Section 2.1.2 is that Kasser's (2002) four groups of essential human needs - [1] *safety, security, and sustenance*; [2] *competence, efficacy, and self-esteem*; [3] *autonomy and authenticity*; and [4] *connectedness* - and Max-Neef's (1989) notion that the satisfiers of needs are defined by economic, social, and political systems provide a useful framework from which discussions about human needs can progress.

In Section 6.2.4.3, Kasser's (2002) framework is considered in the context of transportation. While the analysis provides only a *preliminary* look at how transportation might satisfy the four sets of human needs, it identifies several interesting conclusions. First, the initial idea of developing transportation systems to support the satisfaction of human needs is highly complicated, especially for the first two sets of needs - i.e., safety, security, and sustenance and competence, efficacy, and self-esteem. This is primarily because the *supporting* role of the transportation system is secondary to other factors that play a more direct role in satisfying a specific need. For example, well-paid and meaningful employment is likely to be more influential than transportation in satisfying our sustenance, competence, efficacy, and self-esteem needs. Second, applying Sen's (1992) notion of 'equality of capabilities' to the development of transportation systems is likely to support the satisfaction of human needs for autonomy and authenticity by removing mobility and/or accessibility barriers facing disadvantaged members of society. Finally, transportation and land use strategies that increase accessibility and support

social interaction are likely to facilitate the satisfaction of our need for connectedness as well as enhance social capital.

The evaluation of the role of transportation in satisfying human needs revealed a lack of research in this area. While the field of psychology continues to undertake extensive research into human needs, there has been relatively little application of this research in transportation planning and decision-making. The notion of designing transportation systems to meet essential human needs is an interesting idea that is particularly relevant to sustainable transportation. A valuable area for future work would be to extend the initial ideas developed in this research by collaborating with experts in the psychology of human needs. The objective of this interdisciplinary research would be to identify whether it is possible to create a set of principles that could inform transportation planning and decision-making.

An important conclusion from Section 2.1.5 is that government, society (i.e., communities and individuals), and industry have a responsibility to promote values that center on innate human needs, the satisfaction of which should lead to good physiological and psychological health. However, given the inherent problem of 'producer-created demand' and the concern that consumers are finding it increasingly difficult to use their spending power effectively, the government (as trustee) has a responsibility to ensure that basic human needs are met in an equitable and just manner. For example, if too much emphasis is given to the market it is likely that the most disadvantaged members of society will suffer (e.g., who would provide education and primary health care for the poor?). Hence, government has an important role to play in ensuring that markets function for the benefit of society and intervening where they fall short. This argument raises the question of what is fair within society and what role should government play. To answer this question the research looked closely at the social contract between the governed and the government and developed a philosophy that places equity at the center of decision-making (see the following section).

9.2.3 Equity and the Rawlsian/Utilitarian Decision-making Philosophy

Equity concerns lie at the heart of sustainable development. Therefore, a critical aspect of this research was to develop a decision-making philosophy to ensure that intra- and intergenerational equity form an integral part of decision-making for sustainable development. Building upon the work of John Rawls (1971), a Rawlsian/utilitarian decision-making philosophy was refined to identify the fundamental principles that support fair and environmentally sound decisions in technology-related activities (see Section 2.2.2).

Rawls's (1971) Theory of Justice provides a framework in which political and moral decisions are made using impartiality and new social arrangements make the most disadvantaged members of society relatively better off. The Rawlsian approach should be seen as a movement (a dynamic process) and not as a final state. However, it is nonetheless possible to operationalize Rawls's theory of justice by 'bounding' the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian. [Note:

A utilitarian move can be defined as one in which overall well-being/welfare is maximized; however, no explicit consideration is given to the distributional impacts of new social arrangements, which could lead to inequality.] This bounding is achieved by identifying both the utilitarian (i.e., market) and Rawlsian outcomes to a problem and then seeking a solution (through stakeholder dialogue) that falls between these two outcomes. Thus, the author argues that solutions which lean towards Rawlsian outcomes are more likely to support sustainable development. Ideally, the final outcome should be perceived as fair, economically feasible, and in line with the interests of society as a whole.

The value of the Rawlsian/utilitarian decision-making philosophy is that it can be applied to *any* situation in which government is needed to change or implement new social arrangements (i.e., rules, regulations, laws, or policies) to improve the well-being of society (or ensure that basic human needs are met). Further, bounding the acceptable moves enables stakeholders to move away from a purely utilitarian approach to problem-solving that can be unfair to disadvantaged members of society.

It is important to recognize that this research has revised the definition of a 'Rawlsian outcome' in an effort to link Rawls's (1971) ideas to the natural world. The author defines a Rawlsian outcome as a decision that supports Rawls's (1971) two principles of justice and a third environmental principle (suggested by the author).

> **First Principle**: "*each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all*" (Rawls 1971, p. 302).
>
> **Second Principle**: "*social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged, consistent with the just savings principle, and (b) attached to offices and positions open to all under conditions of fair equality of opportunities*" (Rawls 1971, p. 302).[849]
>
> **(Suggested) Third Principle**: social arrangements are to be organized so that they (a) protect and continually improve the environment, especially for those individuals and species most heavily affected by environmental degradation/pollution, and (b) do not result in activities that exceed the ecological carrying capacity of the environment.[850]

The author believes that adding the third principle - the *environmental principle* - to Rawls's (1971) Theory of Justice demonstrates how his ideas can form a central pillar of our thinking about sustainable development. While Rawls's two principles of justice focus on the social world, the third principle is designed to force decision-makers and stakeholders to consider how their decisions might affect the natural world. It is believed that combining the social and natural realms in this manner supports the fundamental

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[849] While Rawls (1971) focuses on 'equality of opportunity,' it is also important to consider Sen's (1992) notion of 'equality of capabilities' when deciding whether a new social arrangement is equitable (see Section 2.2.3).

[850] It is believed by the author that the *environmental principle* is consistent with Rawls's (1971) 'just savings' principle since it can be argued that past, current, and future generations would select it.

elements of sustainable development. First and foremost, this approach places *social equity* at the center of decision-making. Second, it supports the notion of *economic growth*, so long as the benefits from this growth are distributed fairly among society. Finally, it makes the 'movement' towards a better *environment* a critical component of any new social arrangements. Hence, the framework provides a valuable tool through which 'movement' towards sustainable development becomes a real possibility.

In Section 6.2.4.4, a set of 'principles of ethical transportation policy' is presented that is adapted from Beatley's (1994) work on ethical land use. Beatley's (1994) original set of principles was developed by considering both Rawlsian and utilitarian positions and is therefore closely aligned with the approach taken in this research. While the principles of ethical transportation policy are not seen as an original contribution, they are mentioned here to highlight the continuity of ideas throughout the dissertation.

Since this research places a strong emphasis on achieving a *Rawlsian outcome* - i.e., an outcome where new policies or programs offer greater advantage to individuals or groups who are relatively worse off to begin with - it was important to identify the circumstances under which such an outcome could arise. Based upon the work of Ashford and Rest (2001), Table 9.2 was created to indicate the likelihood of arriving at a Rawlsian outcome given prevailing stakeholder and government postures (see Section 2.2.2).

Table 9.2: Likelihood of Achieving a Rawlsian Outcome with a Rawlsian/Non-Rawlsian Government *and* Strong/Weak Stakeholder Postures

	STAKEHOLDER POSTURE			
GOVERNMENT	**UTILITARIAN** (Maximizing individual/social benefit)		**COMMUNITARIAN** (Promoting the 'greater social good')	
	Stakeholder Influence	**Rawlsian Outcome**	**Stakeholder Influence**	**Rawlsian Outcome**
Rawlsian Government (Government acts as trustee for stakeholders)	*Strong*	Outcome uncertain	***Strong***	Extremely likely
	Weak	Possible	***Weak***	Highly likely
Non-Rawlsian Government (Government acts as facilitator for utilitarian/ majoritarian consensus)	*Strong*	Extremely unlikely	***Strong***	Likely
	Weak	Unlikely	*Weak*	Possible

While the ideas presented in Table 9.2 are hypothetical, they present some valuable insights that can help guide decision-making towards a just and fair society. In effect, the table shows two important outcomes: [1] *a Rawlsian-sympathetic government may not be sufficient to achieve a Rawlsian outcome if the stakeholders adopt a utilitarian posture and the government accedes to their wishes*; and [2] *a non-Rawlsian government can*

arrive at a Rawlsian outcome, but only if stakeholders adopt a communitarian posture[851] *and the government accedes to their wishes.*

Using Table 9.2 as a guide, a series of questions was included in the MPO questionnaire to try to identify the postures of both the MPOs (as 'quasi-governmental' organizations) and stakeholders (i.e., the public and MPO member entities) (see Section 7.2.3). The purpose of this exercise was to try to identify the likelihood of arriving at a Rawlsian outcome given the current transportation planning and decision-making environment at the regional level.

Despite the limitations of the questions, the results indicate that MPOs are seen as the facilitator of consensus among stakeholders and that the majority of stakeholders are perceived to either adopt a communitarian posture or endorse communitarian perspectives. These outcomes combine to make the chance of arriving at a Rawlsian outcome 'Possible' or 'Likely' (see the bottom right-hand cells in Table 9.2). Since the current MPO planning guidance requires MPOs to create a 'fair and impartial' setting for the planning and decision-making process, their ability to give preferential treatment to disadvantaged groups might be limited.

In addition to the questions on posture, the MPO questionnaire also attempted to identify whether certain groups are considered in, and receive benefits from, the transportation planning and decision-making process. The results indicate that a strong egalitarian approach is taken to the delivery of transportation services. This finding mirrors the MPO commitment to fairness and reinforces the moderate likelihood of arriving at a Rawlsian outcome.

The above results indicate that it might be difficult for MPOs to adopt a Rawlsian position in the decision-making process given the current MPO planning guidance and general egalitarian approach to the delivery of transportation services.[852] One possible way to address this problem would be to change the planning guidance to encourage MPOs (and their member entities) to adopt a Rawlsian approach when developing new policies/projects. For example, such guidance could state that disadvantaged groups that have been underserved by transportation services should receive *preferential* consideration in the transportation planning/decision-making process. The extent to which these groups receive preferential treatment would be determined by local circumstances and would likely be decided during the consensus-building process. What

[851] It should be understood that communitarian stakeholders will not develop a Rawlsian outcome based upon Rawls's (1971) *Theory of Justice*; rather, they are likely to approximate a Rawlsian outcome by pursuing the greater social good (or common purpose or goal). Thus, communitarians are 'likely' to arrive at a Rawlsian outcome from the perspective of shared moral values that stem from the traditions of a community. While it is not possible to know whether, and to what extent, communitarian stakeholders will develop Rawlsian outcomes - since the perception of a 'fair outcome' is likely to differ between communities - one would imagine that their strong emphasis on the 'community' is likely to prevent or minimize the marginalization of disadvantaged groups.

[852] However, it should be noted that a small number of respondents to the MPO questionnaire indicated that their organization makes decisions that might be described as Rawlsian. Thus, more research is required to identify the planning and decision-making processes that supported these decisions.

is not so clear is how MPOs would respond to the Rawlsian approach and whether they could advocate a Rawlsian position as part of a 'fair and impartial' planning process. The answer to this question is not straightforward and requires further research to fully consider the implications of requiring MPOs to adopt a Rawlsian approach.

Finally, the MPO questionnaire also revealed that transportation planners and decision-makers would be willing to support the first part of the suggested Third Principle of Justice - i.e., to protect and continually enhance the environment.

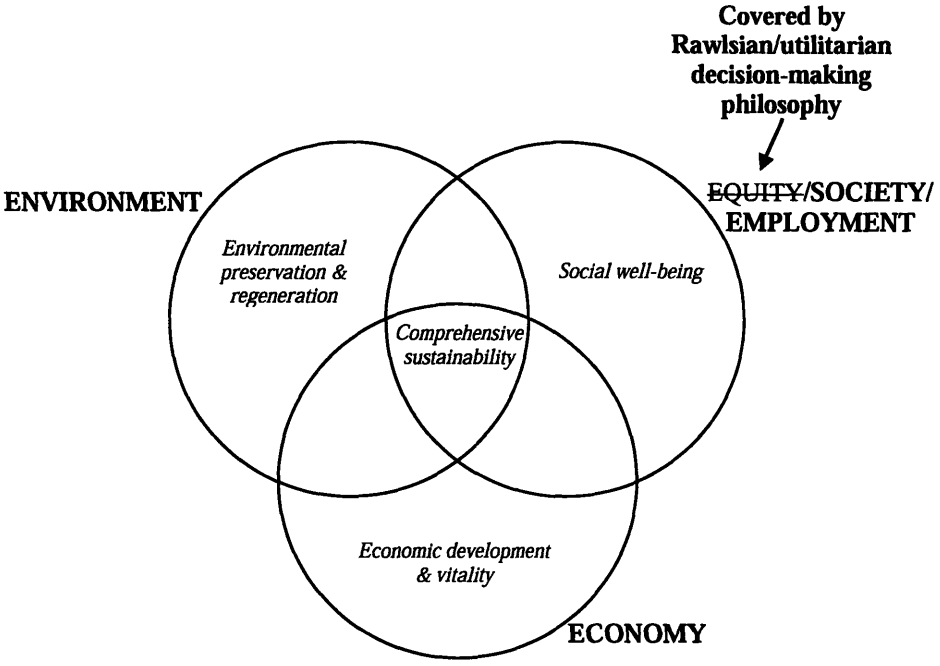
In conclusion, the Rawlsian/utilitarian decision-making philosophy is believed to present a valuable way to integrate equity and environmental considerations into decision-making for sustainable development/transportation. However, further research is required to consider the best way to introduce the idea to transportation planning and decision-making at the regional level.

9.2.4 Conceptualizing Sustainable Transportation

The argument that equity is central to decision-making for sustainable development had a strong influence on how sustainable transportation was conceptualized in this research. In addition, the need to link the two main approaches to considering sustainable transportation - i.e., the transportation-centered and holistic perspectives - led to a recommended change in an internationally recognized definition of sustainable transportation.

In general, sustainable transportation is either considered as a concept in its own right or it is treated as a component that affects the larger problem of sustainable development. These approaches are conceptually different. In the former case, definitions of sustainable transportation can be described as an expression of sustainable development within the transportation sector (see Section 6.2.2). These definitions revolve around the Three E's of environment, economy, and equity (or, more generally, society) and are often represented as shown in Figure 9.2. Hence, transportation becomes the center of attention and *crosscutting* issues such as climate change, environmental protection, livable communities, energy efficiency, and economic development become sub-themes within the concept of sustainable transportation. [Note: *Since equity is fundamental to sustainable development/transportation and should not be 'traded-off' against environmental or economic concerns, the author recommends that equity be considered within each dimension of Figure 9.2.*]

In the latter case, the predominant focus is on sustainable development. Here, transportation is treated as one of many factors that affect crosscutting issues. Thus, an important question is whether it is more beneficial to develop transportation policies and programs from a sustainable development (i.e., holistic) perspective than a sustainable transportation (i.e., transportation-centered) perspective. The author believes that both approaches are important and necessary but the transportation-centered perspective would benefit from being broadened to include its relationship with other sectors. This argument is reinforced by the need to address *horizontal integration* (see Section 9.1.5).



Sources: Adapted from CST (1997, p. 2) and Brodmann and Spillmann (2000, p. 8)

Figure 9.2: Visualization of the Three E's of Sustainable Transportation

The holistic (sustainable development) view is important since it defines the boundaries (the ecological limits) within which all sectors must collectively operate. In contrast, the transportation-centered view is important since it provides *sector-specific* objectives that guide the development of transportation policies and programs using the Three E's of sustainable transportation. However, a problem with existing definitions and principles of sustainable transportation is that they fail to explicitly recognize the need to integrate/coordinate transportation policies with those of other major sectors. Hence, the *link* between the holistic and transportation-centered perspectives of sustainable development is unclear.

One way to adjust the existing definitions of sustainable transportation is to recognize the need for the transportation sector to coordinate (or even better, integrate) its decision-making processes with those of other sectors. Thus, the author recommends the following change to an internationally accepted definition of sustainable transportation. In principle, this change can be applied to any definition of sustainable transportation that does not recognize the need to coordinate activities among sectors.

A sustainable transportation system is defined as one that:

- "*allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;*
- *is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;*

- [**in coordination with other sectors,**] *limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise*" (European Council 2001, pp. 15-16).

While the adjustment to the definition appears to be minor, it presents an explicit requirement for the transportation sector to work with other sectors to solve problems associated with sustainable development. Of course, the definitions of sustainable energy, agriculture, manufacturing, etc. must also include similar language for this approach to be effective. Linking the sector-centered and holistic perspectives of sustainable development in this manner *widens* the solution space for each sector. For example, the revised sustainable transportation definition makes inter-sector (and interagency) collaboration a primary agenda item in the search for progress towards sustainable development. For instance, if the transportation sector works closely with the energy sector, an entirely new set of solutions might become available that combines each sector's core competencies in new ways (see Section 8.4).

In conclusion, it is important and necessary to consider the development of transportation policies and programs from both a sustainable development (i.e., holistic) and sustainable transportation (i.e., transportation-centered) perspective. By considering both approaches the disadvantages of each approach are countered by the advantages of the other (Figure 9.3). The author believes that the recommended change to an internationally recognized definition of sustainable transportation should help integrate the two approaches.

The Three E's of Sustainable Transportation (*the transportation-centered view*)	**Viewing Transportation from the Perspective of Sustainable Development** (*the holistic view*)
Advantage:	*Advantage*:
— Provides sector-specific objectives and principles that guide the development of transportation policies and programs.	— Highlights the need to establish a national framework/policy to address sustainable development that can encourage sectors to coordinate/integrate their activities.
Disadvantage:	*Disadvantage*:
— Does not explicitly connect impacts from the transportation sector with those from other sectors. Thus, transportation tends to be considered in a vacuum.	— Does not provide detailed sector-specific objectives and principles to guide the development of transportation policies and programs.

Figure 9.3: Advantages and Disadvantages of Adopting a Transportation-Centered or Holistic View of Sustainable Development

9.2.5 Technological Change/Innovation

Technological change/innovation is considered in this research in a number of different contexts. Two areas of special interest are [1] describing the *process* of technological change and [2] considering how this process could be *stimulated* to achieve technological transformations towards sustainable development.

In Section 2.3.1, technological change/innovation is characterized in four functionally-useful ways - i.e., [1] product changes; [2] process changes; [3] shifts from products to product-services; and [4] more far-reaching system changes. All four types of technological change are necessary to achieve sustainable development. However, the impact of each type of change will depend upon whether it is *incremental*, *moderate*, or *radical* in nature and on the scale at which the change occurs. Further, technological innovations can be characterized as *sustaining* or *disrupting* (Christensen 1997). A *sustaining innovation* is a technological change along the same lines that technology has been developing historically. In contrast, a *disrupting innovation* can take two forms: one that combines two or more prior developments in a new way, creating an 'architectural' innovation; or one that stems from a new idea and is an 'intrinsic' innovation. While Christensen's (1997) theory behind the process of sustaining and disrupting innovation was originally developed in the context of *product* innovation, this research extends these ideas to describe the other three types of innovation.

The extension of Christensen's (1997) ideas beyond the *product* domain raises a number of important questions about how the different types of innovation might occur. In defining and distinguishing *sustaining* and *disrupting* product innovation, Christensen (1997) relies on the concept of 'value networks' made up of different customers. He notes that incumbent firms tend to develop predominantly sustaining product technologies for existing customers while new entrants pioneer disrupting product technologies for a new customer base that values different product attributes. However, *process* changes, though important to workers, are not very important to the customers of a product. Producers of products may develop more sustainable processes to make their products, but these actions are not normally driven by customer demand. Hence, Christensen's (1997) concept of 'value networks' and new customer bases may not be as useful in the process domain as they are in the product domain. Distinguishing sustaining and disrupting *technologies* may be useful, but these innovations are driven by producers and manufacturers who operate within a demanding regulatory environment rather than product consumers.

Thus, a central argument made in this research is that if technology is to advance at a rate necessary to move society towards sustainable development, then a Schumpeterian perspective of technological development is needed that anticipates the displacement of incumbent technologies, often by new entrants. This suggests that the *creative use of government intervention* (with a focus on both demand and supply-side policies) is a more promising strategic approach for achieving sustainable transformations in technological systems than a focus on policies that rely on an *incumbent firm's* more short-term economic self-interest.

In the context of *encouraging* technological transformations, supply-side policies (e.g., R&D support; tax treatment of investment; environmental, health, and safety regulation; etc.) are interventionist in nature and are focused on encouraging technological changes with certain performance characteristics in mind. In contrast, demand-side policies (e.g., purchasing tax incentives, public-service advertising, counter-advertising, education, etc.) are designed to change societal preferences and may be useful in implementing or gaining acceptance of sustainable development policies. While demand-side policies are less interventionist, they can have a significant effect on processes of change. The critical question is whether the rate of change towards sustainable development is likely to be sufficient under an evolutionary (laissez-faire) approach to innovation, or whether a more interventionist approach is required. An argument made in this research is that evolutionary approaches may proceed too slowly to stem critical problems such as global climate change. Thus, government intervention is seen as necessary to stimulate radical (i.e., significant) technological progress. An important objective of this intervention is to establish an innovation climate that supports the creation and diffusion of more environmentally sound technologies.

One way to stimulate technological upgrading and innovation is to establish more stringent environmental regulation - often referred to as the 'Porter hypothesis.' However, Porter's (1990) ideas refer primarily to incumbent firms that are less likely to develop disrupting technologies and lead the process of 'creative destruction.' Thus, Ashford's (1999) notion of a 'strong' Porter hypothesis is advocated by the author to create an environment where more stringent regulation is used to stimulate the entrance of entirely new products *and* processes into the market, thereby displacing dominant technologies (see Section 4.2.3.4). Hence, competitiveness is achieved through changing the regulatory environment to encourage radical and/or disrupting innovation.

However, changes in technology alone are unlikely to be sufficient to achieve sustainable development. Thus, technological change will need to be accompanied by institutional, social/behavioral, and organizational changes. Several examples of how such changes could be used to support technological innovation are presented in Sections 4.2.3.6 through 4.2.3.8.

While Porter's (1990) ideas focus on technological change, the author argues they can also be applied to changes (or innovations) in the transportation planning and decision-making process (see Section 7.2.7). Thus, the MPO questionnaire asked transportation planners and decision-makers whether the air quality standards established by the Clean Air Act (CAA) have led to any innovative (or non-traditional) planning activities. While the responses to this question were inconclusive, there was some evidence to suggest that several MPOs in air quality nonattainment areas have altered their transportation planning activities in response to the CAA. Thus, an interesting area for future research would be to undertake a more rigorous study to identify whether more stringent environmental regulation leads to the creation of innovative transportation planning and decision-making processes.

A follow-up question asked respondents to gauge the extent to which more stringent air quality standards would lead to improvements in the environment, the economy, and transportation technology. The results indicated that while many respondents have made a connection between more stringent environmental standards and technological change, they have not made a similar connection to economic growth. This outcome means that any attempt to increase the stringency of environmental regulations is likely to face significant resistance due to the perception that more stringent regulations will negatively impact the economy - even if these perceptions are likely to be incorrect.

The same question was asked during a series of meetings with transportation professionals and decision-makers in Washington, D.C. (see Section 7.3). The general response was that it would be very difficult (in the current political climate) for the federal government to apply more stringent environmental standards. A better way to influence the development of the transportation system was seen to be through the use of incentives or penalties rather than regulation. Thus, unless a compelling case can be made for using stringent regulation to stimulate disrupting innovation, the idea is unlikely to gain Congressional support. This conclusion means that a valuable area for future research would be to identify the benefits of, and make a case for, the 'strong' Porter hypothesis.

9.2.6 The Hybrid Trade-off/Positional Analysis Framework

The hybrid trade-off/positional analysis framework was developed by the author as an alternative decision-support tool to benefit-cost analysis (BCA).

Trade-off and positional analysis are two similar techniques that require decision-makers to explore the trade-offs that are often obscured in a benefit-cost analysis (BCA). Instead of aggregating a wide range of heterogeneous factors into a single monetary value, trade-off and positional analysis keep each factor in its natural units. By displaying these factors in a trade-off matrix, it is possible to assess who benefits and who is made worse off as the result of existing/new regulation. A benefit of non-aggregation is that the time period in which each effect is experienced is revealed and future (non-financial) benefits/costs are not discounted to a present value. Further, the trade-offs between environmental and/or health benefits and costs for a specific policy alternative are made explicit.

Disaggregating the impacts of a policy in a trade-off matrix has the added advantage of informing decision-makers and stakeholders about who is reaping the benefits and who is bearing the costs. This transparency means that decision-makers become more accountable for their decisions.

The history of trade-off analysis can be traced back to the 1970s when Ashford (1978) and Söderbaum (1973) independently offered trade-off analysis - what Söderbaum calls *positional analysis* (PA) - as an alternative to BCA. While there are important similarities between the two approaches, the way in which the trade-off matrix is used in each approach is different. Whereas Ashford (1978) views the trade-off matrix from the

perspective of the decision-maker, Söderbaum (2000) considers the trade-off matrix from a number of different ideological orientations. Given these differences, a hybrid framework (or set of *six steps*) for using a trade-off matrix to compare policy alternatives has been developed by the author (see Section 4.2.1.5).

The hybrid trade-off/positional analysis framework is generic and can be applied to any situation where a policy can affect equity within - or the state of - the system under analysis. The framework is *neutral* in that it does not specify a final decision. To guide decisions towards sustainable development the Rawlsian/utilitarian decision-making philosophy is used to create policy options/alternatives. While this approach requires the adoption of one ideological perspective for policy formulation, the final step in the trade-off/positional analysis framework requires the policies to be considered from different values and/or ideological orientations. Therefore, any important value conflicts can be identified and addressed.

The decision whether to use BCA or trade-off/positional analysis is likely to depend upon one's values and beliefs. While BCA provides a structured framework for decision-making, it does so by considering only *one* perspective/ideology - i.e., that of neo-classical economics. In contrast, trade-off/positional analysis is able to consider a wide range of perspectives/ideologies, but this flexibility comes at the expense of being able to provide a single solution to a problem. Hence, trade-off/positional analysis is a *decision-support* (rather than decision-making) tool. Further, while trade-off/positional analysis disaggregates costs and benefits, at some point the decision-maker must *implicitly* co-measure factors in order to make a decision. What the trade-off matrix does is make the value system behind this co-measurability explicit.

In addition to evaluating the multivariate impacts of different *policy alternatives*, a trade-off matrix can also be used to assess the impacts of different *technology options* (see Section 4.2.1.6). The strength of combining both in a trade-off matrix is that it can be used to compare multivariate criteria - such as economic, social, and environmental and health/safety factors - to determine how new technology options compare with each other and with the 'business as usual' scenario. Further, the impacts of each technology option on different stakeholders are made explicit.

If the trade-off matrix is used in a *dynamic* sense, it can compare *available* technology with technology that *could* be developed. Using the trade-off matrix in this manner leads to a form of dynamic environmental economics that includes the consideration of technological change over time (see Section 4.2.3.3). Achieving dynamic efficiency requires the analyst/decision-maker to focus on the transformation *process*, paying special attention to *path dependency* and *bounded rationality* of institutions and stakeholders.

Given that changing a socio-technical (or large-scale engineering) system is likely to require a long timeframe, the role of government in setting technology and environmental policy to guide innovation is of particular importance (see the discussion in the previous section). Adopting an approach that *guides* technological change means that decision-

makers are not relying on serendipitous technological development. Instead, they are pursuing an approach where the development of technology is more likely to progress along a desired pathway. Therefore, it is the dynamic use of a trade-off matrix that is likely to lead to system transformations towards sustainable development.

In an effort to identify whether important steps within the hybrid trade-off/positional analysis framework are used in regional transportation planning and decision-making, several questions related to the framework were included in the MPO questionnaire (see Section 7.2.5). Two general conclusions can be drawn from the responses to these questions. First, a generic form of trade-off analysis was the most popular technique selected for assessing the impacts of a transportation policy/project. This result indicates that there is likely to be significant interest in the proposed framework among planners and decision-makers. Second, the scope of issues considered when developing transportation policies/projects appears to be limited. An important step in the hybrid trade-off/positional analysis framework is to consider whether a problem is caused by failures or inadequacies in economics and markets, in legislation and the political process, in public/private sector management, or in technology. Since the actions of MPOs are constrained by their delegated authority, planning guidance, and available funding, this finding was not unexpected. However, it does reinforce the need to develop ways to assess the primary cause of a problem rather than considering its symptoms using traditional, and perhaps inadequate, tools and approaches.

In conclusion, an important area for future work would be to apply the proposed hybrid trade-off/positional analysis framework to a real transportation planning and decision-making process. In particular, a valuable contribution would be to compare the process and its outcome to that which might be achieved using BCA.

9.2.7 Indicators

An important contribution of this research was the creation of an integrated framework of sustainable development and sustainable transportation indicators. The basic idea was to show how a national framework of sustainable development indicators that incorporates the ideas developed throughout this dissertation could inform the creation of a set of sustainable transportation indicators. In addition, the indicators identified were seen by the author to provide a comprehensive set of indicators that could be used in the hybrid trade-off/positional analysis framework.

The framework of sustainable development indicators is developed in Chapter 5 (see Section 5.7). The chapter provides some structure to the extensive literature on sustainable development indicators and introduces a framework based on the work of the UN Commission on Sustainable Development (UNCSD). The rationale for focusing on the UNCSD indicator framework was that [1] the stated purpose of the framework is to *harmonize* national-level indicator initiatives, and [2] it aligned with four of the five elements of sustainable development articulated in Chapter 3. The modified set of indicators is referred to as the 'Hall-revised UNCSD indicator framework.'

Having selected and revised a national indicator framework, the framework was used to develop a set of sustainable transportation indicators (see Section 6.4). Specific attention was paid to identifying the gaps that exist between the Hall-revised UNCSD indicator framework and a representative set of indicators of sustainable transportation developed by others. The outcome of this exercise was the creation of an up-to-date set of indicators that integrates a holistic national perspective with a transportation-centered perspective on sustainable development. This approach aligns with the author's conceptualization of sustainable transportation discussed in Section 9.2.4.

The indicators included in - and the process of integrating - the two frameworks provide a valuable source of information for future research and government initiatives that focus on measuring sustainable development/transportation.

9.2.8 The Sustainable Transportation Decision-Support Framework

Since the multidimensional sustainable transportation decision-support framework is presented in Section 9.1.4 (Table 9.1), this final section provides a brief discussion of future research related to this framework.

Given the focus of the latter part of this dissertation, the sustainable transportation decision-support framework was designed primarily for transportation decision-makers in the federal government (specifically, members of Congress and senior U.S. DOT staff). In this regard, the framework is intended to provide signposts to important issues that should be considered when developing federal transportation policy. However, given the generic nature of many elements included in the framework, it can also be used by state and regional transportation planners and decision-makers. Therefore, future research should be undertaken to refocus the framework to support these unique transportation planning and decision-making environments.

Finally, the purpose of the proposed decision-support framework was to pull together a wide variety of approaches, ideas, tools, and concepts. In this regard, the framework should be seen as the 'tip of the iceberg' that stands upon the research presented throughout the dissertation. However, the framework is also a working document that will require revision as the organizing frameworks and ideas - such as the Rawlsian/utilitarian decision-making philosophy and the hybrid trade-off/positional analysis framework - are tested and new information arises. Thus, the ideas presented in the decision-support framework should be considered as an outline for an ambitious research agenda in the field of sustainable development/transportation.

9.3 Epilogue

Since my early career as a civil engineer, I have been intrigued by how to build things. This dissertation represents the development of my interest in building physical structures to the creation of both physical *and* social structures. My research aims to bridge the gaps between different approaches and organizing frameworks that can be used to fashion policies to address one of the most critical contemporary issues facing the global community - achieving sustainable development.

The seed for this research was planted in 2001 when I was undertaking an internship at the Office of the Secretary of Transportation (OST) in Washington, D.C. During this placement, I was asked to write a briefing paper on how the OST might integrate the core ideas of sustainable transportation into surface transportation legislation. At this point in time, I had little appreciation of the complexity of the task and approached it in a rather simplistic manner. I hope my dissertation addresses this shortcoming by providing a foundation on which real and tangible progress towards sustainable transportation can be made in the U.S. At the very least, I hope this work will provoke and move forward the sustainable development/transportation debate.

Undertaking such a broad research topic presented many challenges. Perhaps the greatest challenge of all was to stay true to the initial objective of approaching the concept of sustainable development/transportation in a transdisciplinary manner.

As a doctoral student, one must think independently and freely; however, there are limits to how broad in scope a doctoral dissertation can be. I would argue that the value of this research lies in the breadth of issues that have been synthesized and integrated in a coherent and systematic way. While this approach to a dissertation requires a certain amount of courage on the part of the student, it also requires a doctoral committee that provides both challenge and support. I was fortunate to have a committee that afforded both of these essential elements in equal measure. Overcoming intellectual barriers and developing new ways of thinking is a difficult process. However, it can be one of the most rewarding aspects of research, especially given the right learning environment. In many ways, the selection of a doctoral committee is one of the most important decisions a doctoral student makes.

It is important to acknowledge how the emerging Engineering Systems Division (ESD) at MIT enabled me to pursue this ambitious research topic. Having considered several Ph.D. programs at MIT, it became evident that the Technology, Management, and Policy (TMP) program within ESD offered the most conducive academic environment for multidisciplinary systems-related research. Further, the ideas that lie at the heart of ESD mirror those embodied in this research. For example, Prof. Moses - the acting Director of ESD - has described 'engineering systems' as a *mode of thought* that encompasses the following fundamental aspects:

- Holistic thinking;
- Life cycle analysis;
- The management of change;

- The internalization of externalities; and
- The consideration of feedback.[853]

All of the above aspects are essential for sustainable development/transportation and are themes that recur throughout this dissertation.

Finally, for those students who wish to pursue research in sustainable transportation, I hope that this dissertation presents an exciting array of future research opportunities. I believe that sustainable transportation - as a field of study - can only grow in importance as the U.S. and other nations face ever more pressing transportation-related environmental, social, and economic problems. Identifying the root causes of these problems and finding and implementing solutions to overcome them are major challenges for the twenty-first century.

[853] Source: Prof. Moses, ESD.83 lecture entitled '*ESD History and Its Symposia on Foundations*,' MIT, Cambridge, 16th February, 2006.

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Appendix A: Sustainable Development Indexes and Indicator Frameworks

A1 Introduction

The purpose of this appendix is to show how the *Hall-revised* UNCSD (United Nations Commission of Sustainable Development) framework of indicators of sustainable development relates to existing international/national/regional indicator initiatives.

The appendix has been broken down into six main categories. Section A2 presents the Hall-revised UNCSD indicator framework. Section A3 presents various *indexes* that pull a wide variety of information together into a single metric. Section A4 presents *holistic indicator frameworks* that attempt to measure a wide range of issues - e.g., environmental, economic, social, and institutional concerns - using a variety of indicators. Section A5 focuses on what might be called *partial sets* of indicators that focus specifically on certain environmental and social issues. Section A6 presents the OECD *causal indicator framework*. Finally, Section A7 looks at selected national initiatives designed to measure sustainable development.

The methodology adopted in the analysis is relatively straightforward. Each time an indicator in the initiative being studied is identical or similar to those included in the *original* and *Hall-revised* UNCSD indicator frameworks it is marked with one of two symbols shown below. It is important to recognize that the Hall-revised UNCSD indicator framework uses virtually all of the indicators in the original UNCSD framework. Therefore, each time an indicator is marked as being identical or similar to one included in the original UNCSD framework, it will most likely be included in the Hall-revised framework as well.

✓ **Indicator is identical or similar to one included in the original UNCSD indicator framework**

✓★ **Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework**

The value of this analysis is that it highlights which indicators consistently appear in a wide variety of indicator initiatives and, of equal importance, which indicators are not included in the Hall-revised UNCSD framework. Given that the UN has called for the *harmonization* of national indicator frameworks, it is believed that this analysis provides insight into the extent to which a number of well known national-level indicator initiatives are integrated.

The following sections (excluding Section A2) provide a brief description of each indicator initiative that is followed by either a table or box containing relevant information on the indicator(s)/index(es).

A2 Hall-revised UNCSD Framework of Indicators of Sustainable Development[854]

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Equity	Poverty (3)	Percent of Population Living below Poverty Line	(EC 2004b; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b; SDI Group 2001)
		Gini Index of Income Inequality	(EC 2004b; Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004)	(EPA 2005b; SDI Group 2001)
		Human Poverty Index for Developing Countries (HPI-1)	(UNDP 2004)	
		Human Poverty Index for Selected OECD Countries (HPI-2)	(UNDP 2004)	
	Gender Equality (24)	~~Ratio of Average Female Wage to Male Wage~~		
		Gender-Related Development Index (GDI)	(UNDP 2004)	
		Gender Empowerment Measure (GEM)	(UNDESA 2005; UNDP 2004)	
Human Development	-	**Human Development Index (HDI)**	(UNDP 2004)	
Health (6)	Nutritional Status	Nutritional Status of Children	(Esty et al. 2005; EC 2004b; UNDESA 2004; 2005; UNDP 2004; World Bank 2004)	
	Mortality	Mortality Rate under 5 Years Old	(Esty et al. 2005; EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2005a; 2005b)
		Life Expectancy at Birth	(EC 2004b; Henderson et al. 2000; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; SDI Group 2001)
	Sanitation	Percent of Population with Adequate Sewage Disposal Facilities	(OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	
	Drinking Water	Population with Access to Safe Drinking Water ***[also see 'Fresh Water/Water Quality' theme/sub-theme under the 'Environmental' category for related indicators]***	(Esty et al. 2005; UNDESA 2004; 2005; UNDP 2004; World Bank 2004)	
	Healthcare Delivery	Percent of Population with Access to Primary Health Care Facilities		(SDI Group 2001)
		Immunization against Infectious Childhood Diseases		
		Contraceptive Prevalence Rate	(UNDESA 2004; 2005)	

[854] The original version of the UNCSD indicator framework can be accessed from the UN Department of Economic and Social Affairs, Division for Sustainable Development, *The CSD Theme Indicator Framework*, http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm (accessed on 04/09/06).

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
	Safety	**Accident Rates (by activity and sector)** ***[also see 'Employment/Health and Safety' theme/sub-theme (below) for worker health and safety indicator]***		(DEFRA 2005b)
Education (36)	Education Level	Children Reaching Grade 5 of Primary Education	(EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; WRI 2004)	(NRTEE 2003; SDI Group 2001)
		Adult Secondary Education Achievement Level	(EC 2004b; Henderson et al. 2000; UNDP 2004; UNDP et al. 2004; WRI 2004)	(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
	Literacy	Adult Literacy Rate	(EC 2004b; Henderson et al. 2000; UNDESA 2004; 2005; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004)	(SDI Group 2001)
Housing (7)	Living Conditions	Floor Area per Person	(Henderson et al. 2000)	
		Proportion of Households with Access to Secure Tenure (slum/homeless population as a percent of urban population)	(Henderson et al. 2000; 2005) (UNDESA 2005)	(DEFRA 2005b; EPA 2005b)
	Urbanization (Neighborhood/ Community)	**Urban Sprawl (index combining residential density; neighborhood mix of homes, jobs, and services; strength of activity centers and downtowns; and accessibility of the street network)** ***[also see 'Land/Urbanization' theme/sub-theme under the 'Environmental' category for an additional urbanization indicator]***	(Ewing et al. 2002)	
Security	Crime (36, 24)	Number of Recorded Crimes per 100,000 Population		(DEFRA 2004; 2005a; 2005b; EPA 2005b; SDI Group 2001)
Population (5)	Population Change	Population Growth Rate	(Esty et al. 2005; Henderson et al. 2000; OECD 2003; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
		Population of Urban Formal and Informal Settlements	(WRI 2004)	
Employment	**Health and Safety**	**Rates of Occupational Injuries and Disease for Job Type**	(Ashford et al. 2002; Henderson et al. 2000; ILO 2005)	
	Skill Enhancement and Creativity of Job	**Years of Schooling Required for Job Type**	(Ashford 2005; Ashford et al. 2002)	
		Percent of Work Time Devoted to Continuing Professional Education (CPE) for Job Type ***[also see 'Competitiveness/Inherent Cost' theme/ sub-theme under the 'Economic' category for a related indicator]***	(Ashford 2005; Ashford et al. 2002; Henderson et al. 2000)	

Social				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
	Job Satisfaction	**Level of Satisfaction with Job Type (measured using psychometrics)**	(Ashford et al. 2002)	
	Job Security	**Average Time in Job Type before Involuntary Redundancy**	(Ashford 2005; Ashford et al. 2002)	
		Does Labor Law Allow for Immediate Dismissal? (employment at will)	(Ashford 2005; Ashford et al. 2002)	
	Purchasing Power	**Average Wage (by Job Type)/Consumer Product Index**	(Ashford 2005; Ashford et al. 2002; Henderson et al. 2000; ILO 2005)	
	Number of Jobs	**Total Number Employed (including contingent/temporary, informal sector, and unpaid employment)**	(Ashford et al. 2002; EC 2004b; Henderson et al. 2000; ILO 2005)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
		Numbers of Jobs Held by Individual	(Ashford et al. 2002; EC 2004b; Henderson et al. 2000; ILO 2005)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
	Underemployment	**Level of Underemployment (measured using compensation, hours, and extent to which existing skills and/or experience are utilized)**	(Ashford 2005; Henderson et al. 2000)	
	Unemployment	Unemployment Rate [*moved from 'Equity/Poverty' theme sub-theme*]	(Henderson et al. 2000; ILO 2005; UNDESA 2004; 2005; UNDP 2004; WRI 2004)	(DEFRA 2005a; 2005b; SDI Group 2001)
Happiness	**Satisfaction with Life**	**Subjective Well-Being (SWB)**	(Diener and Suh 2000; Diener et al. 1997; Meadows 1998)	(DEFRA 2005a)
Capital	**Human Capital**	**Population Demographics (could be extended to include measures of health and education)**	(EC 2004b; Meadows 1998; World Bank 1997)	
	Social Capital	**Qualitative Measures of Social Integration, Knowledge, Trust, and Honesty in Society**	(Meadows 1998; World Bank 1997)	(SDI Group 2001)

The numbers in brackets refer to the relevant chapters in Agenda 21.

Environmental				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Atmosphere (9)	Climate Change	Emissions of Greenhouse Gases **[by sector and source - e.g., Methane (CH_4), Nitrous Oxide (N_2O), Carbon Tetra-Chloride (CCl_4), Methyl Chloroform (CH_3CCl_3), CFC-11 (CCl_3F), CFC-12 (CCl_2F_2), and CFC-113 ($C2Cl_3F_3$)]**	(Esty et al. 2005; EC 2004a; EC 2004b; Henderson et al. 2000; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances	(OECD 2003; UNDESA 2004; 2005)	(SDI Group 2001)
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas **[e.g., Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Carbon Monoxide (CO), Non-methane Volatile Organic Compounds (VOCs), and Ozone]**	(Esty et al. 2005; EC 2004a; 2004b; Henderson et al. 2000; OECD 2003; WRI 2004)	(DEFRA 2004; 2005b; EPA 2005a; NRTEE 2003; SDI Group 2001)
Land (10)	Agriculture (14)	Arable and Permanent Crop Land Area	(WRI 2004)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
		Use of Fertilizers	(Esty et al. 2005; EC 2004b; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b)
		Use of Agricultural Pesticides	(Esty et al. 2005; OECD 2003; WRI 2004)	(SDI Group 2001)
	Forests (11)	Forest Area as a Percentage of Land Area	(Esty et al. 2005; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(NRTEE 2003; SDI Group 2001)
		Wood Harvesting Intensity	(OECD 2003; WRI 2004)	(SDI Group 2001)
	Desertification (12)	Land Affected by Desertification	(OECD 2003)	
	Urbanization (7)	Area of Urban Formal and Informal Settlements	(Esty et al. 2005; OECD 2003)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
Oceans, Seas, and Coasts (17)	Coastal Zone	Algae Concentration in Coastal Waters		
		Percentage of Total Population Living in Coastal Areas		
	Fisheries	Annual Catch by Major Species	(Esty et al. 2005; EC 2004a; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005a; 2005b; SDI Group 2001)
Fresh Water (18)	Water Quantity	Annual Withdrawal of Ground and Surface Water as a Percentage of Total Available Water	(Esty et al. 2005; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; EPA 2005a; SDI Group 2001)
	Water Quality	BOD in Water Bodies	(Esty et al. 2005; EC 2004b; Henderson et al. 2000; OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; NRTEE 2003; SDI Group 2001)

Environmental				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
		Concentration of Faecal Coliform in Freshwater		(DEFRA 2004; 2005a; 2005b; NRTEE 2003; SDI Group 2001)
Biodiversity (15)	Ecosystem	Area of Selected Key Ecosystems	(EC 2004b; Meadows 1998; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; NRTEE 2003)
		Protected Area as a Percent of Total Area	(OECD 2003; UNDESA 2004; 2005; WRI 2004)	
	Species	Abundance of Selected Key Species	(Esty et al. 2005; EC 2004a; 2004b; OECD 2003; UNDP et al. 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
		Living Planet Index (LPI)	(WWF 2004)	
Waste	**Waste Generation and Management**	***[see 'Consumption and Production Patterns/Waste Generation and Management' theme/sub-theme for indicators]***		
Natural Capital	**Non-renewable/ Renewable Resources**	**Non-renewable/Renewable Resource Stocks and Flows**	(EC 2004b; Meadows 1998; World Bank 1997)	
	Assimilative Capacity	**Assimilative Capacity of the Natural Environment**	(EC 2004b; Meadows 1998; World Bank 1997)	
Sustainability of Human Activity		**Environmental Sustainability Index (ESI)**	(Esty et al. 2005)	
		Ecological Footprint	(Esty et al. 2005; Meadows 1998; Wackernagel 2001; Wackernagel et al. 2002; WWF 2004)	

The numbers in brackets refer to the relevant chapters in Agenda 21.

Economic				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Economic Structure (2)	Economic	GDP per Capita **($ and PPP$)**	(Henderson et al. 2000; OECD 2003; UNDP 2004; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004; 2005a; 2005b; SDI Group 2001)
		Genuine Progress Indicator (GPI) per Capita ($ and PPP$)	(Venetoulis and Cobb 2004)	
	Performance	Investment Share in GDP		(DEFRA 2004; 2005b)
	Trade	Balance of Trade in Goods and Services	(UNDP et al. 2004; World Bank 2004; WRI 2004)	
		Average Tariffs Imposed on Agricultural Products, Textiles, and Clothing	(Esty et al. 2005) (UNDESA 2004; 2005)	
	Financial Status (33)	Debt to GNP Ratio	(UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	
		Total ODA Given or Received as a Percent of GNP	(Esty et al. 2005; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(DEFRA 2005b)
Consumption and Production Patterns (4)	Material Consumption	Intensity of Material Use	(OECD 2003)	(DEFRA 2005a; 2005b; SDI Group 2001)
		Annual per Capita Consumption (or Throughput) of Passenger Cars, Gasoline and Diesel, Electricity, Meat, Fish, Paper, Coffee, etc.	(WRI 2004) (Meadows 1998)	
		Import[/Export] of Polluting Goods and Raw Materials as Percentage of Total Imports[/Exports] of Goods and Services	(Esty et al. 2005)	
	Energy Use	Annual Energy Consumption per Capita **[and by economic sector]**	(Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004)	(EPA 2005a; SDI Group 2001)
		Share of Consumption of Renewable Energy Resources	(Esty et al. 2005; EC 2004a; OECD 2003; UNDP et al. 2004; WRI 2004)	(DEFRA 2005b; EPA 2005a)
		Intensity of Energy Use **[energy use per unit of GDP]**	(Esty et al. 2005; EC 2004a; Henderson et al. 2000; OECD 2003; UNDESA 2004; 2005; UNDP et al. 2004; WRI 2004)	(SDI Group 2001)
	Waste Generation and Management (19-22)	Generation of Industrial and Municipal Solid Waste	(OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; SDI Group 2001)
		Generation of Hazardous Waste	(Esty et al. 2005; OECD 2003)	(DEFRA 2005a; 2005b; SDI Group 2001)
		Management of Radioactive Waste		

Economic				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
		Waste Recycling and Reuse	(Esty et al. 2005; OECD 2003)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b)
	Transportation	Distance Traveled per Capita by Mode of Transport	(EC 2004a)	(DEFRA 2004; 2005a; 2005b; EPA 2005a; 2005b; SDI Group 2001)
		Distance Traveled per category of Freight by Mode of Transport (Ton-miles)		
	Advertising	**Advertising Spending (encouraging unnecessary/excessive throughput)**	(Worldwatch Institute 2003)	
Competitiveness (market share)	**Lower Cost (inherent)**	**Cost Savings Attributed to Enhanced Capital, Labor, and Labor-Capital Interface Productiveness**	(Ashford 2005; Ashford et al. 2002)	(DEFRA 2005b)
	Lower Cost (derived from environmental or social factors)	**Cost Savings Attributed to Environmental, Health, and Employment Factors**	(Ashford 2005; Ashford et al. 2002)	
	Performance	**Rate of Increase in Performance by Industry Sector/Product Type**	(Ashford 2005; Ashford et al. 2002)	
Capital	**Human-made/Built Capital**	**Physical Stock of Productive Capacity of an Economy**	(EC 2004b; Henderson et al. 2000; Meadows 1998; World Bank 1997)	(SDI Group 2001)
	Financial Capital	**Available Financial Capital**		

The numbers in brackets refer to the relevant chapters in Agenda 21.

Institutional				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Institutional Framework (38, 39)	Strategic Implementation of Sustainable Development (8)	National Sustainable Development Strategy		
	International Cooperation	Implementation of Ratified Global Agreements	(Esty et al. 2005; UNDP et al. 2004; WRI 2004)	
	Information Access (40)	Number of Internet Subscribers per 1000 Inhabitants	(Esty et al. 2005; UNDESA 2004; 2005; UNDP et al. 2004; World Bank 2004; WRI 2004)	(SDI Group 2001)
Institutional Capacity (37)	Communication Infrastructure (40)	Main Telephone Lines **[and Cellular Subscribers]** per 1000 Inhabitants	(UNDESA 2004; 2005; World Bank 2004)	
	Science and Technology (35)	Expenditure on Research and Development as a Percent of GDP	(World Bank 2004)	(DEFRA 2004; SDI Group 2001)
	Disaster Preparedness and Response	Economic and Human Loss due to Natural Disasters	(Esty et al. 2005)	
Governance	**Corruption**	**Corruption Perceptions Index**	(Esty et al. 2005; Kaufmann et al. 2003; UNDP et al. 2004; WRI 2004)	
	Democracy	**Polity Index of Democracy**	(Esty et al. 2005; Marshall et al. 2005; UNDP et al. 2004; WRI 2004)	
	Civil Liberties	**Level of Civil Liberties**	(Esty et al. 2005; Freedom House 2004; UNDP et al. 2004; WRI 2004)	
	Rule of Law	**Perceptions of the Incidence of Crime**	(Esty et al. 2005; Kaufmann et al. 2003)	
		Effectiveness and Predictability of the Judiciary	(Esty et al. 2005; Kaufmann et al. 2003)	
		Enforceability of Contracts	(Esty et al. 2005; Kaufmann et al. 2003)	
	Government Effectiveness	**Quality of Public Service Provision**	(Esty et al. 2005; Kaufmann et al. 2003)	
		Quality of the Bureaucracy	(Esty et al. 2005; Kaufmann et al. 2003)	
		Competence of Civil Servants	(Esty et al. 2005; Kaufmann et al. 2003)	
		Independence of the Civil Service from Political Pressures	(Esty et al. 2005; Kaufmann et al. 2003)	
		Credibility of the Government's Commitment to Policies	(Esty et al. 2005; Kaufmann et al. 2003)	

The numbers in brackets refer to the relevant chapters in Agenda 21.

Peace and Security				
Theme	**Sub-theme**	**Indicator**	**Other frameworks that use indicator or some variant**	
			Partial and Comprehensive	**National**
Peace	**Conflicts**	**Number of Violent Conflicts**	(Henderson et al. 2000; Worldwatch Institute 2003)	
	Peace Keeping Efforts	**Peace Keeping Expenditures and Number of Completed and Ongoing Peace Keeping Missions**	(Henderson et al. 2000; Worldwatch Institute 2003)	
	Treaties	**Ratification of Treaties or Conventions Relating to the Use of Nuclear, Biological, Chemical, and other Weapon Systems**	(Henderson et al. 2000)	
Investment in Peace and Security	**Government Expenditure**	**Government Expenditure on Military/Security, Public Health, and Education (expressed in GDP and Percent of GDP)**	(Henderson et al. 2000; UNDP et al. 2004; World Bank 2004; WRI 2004; Worldwatch Institute 2003)	(DEFRA 2004)

A3 Indexes

A3.1 Environmental

A3.1.1 Environmental Sustainability Index (ESI)

The first set of indicators (or variables) considered is the *Environmental Sustainability Index* (ESI) (Esty et al. 2005). The ESI is prepared by the Center for International Earth Science Information Network (CIESIN) at Columbia University and the World Economic Forum. The objective of the ESI is to track "*a diverse set of socioeconomic, environmental, and institutional indicators that characterize and influence environmental sustainability at the national scale.*"[855]

While the ESI provides a snapshot of the ability of a nation to protect its environment over the next several generations, the focus of this analysis is to determine which of the variables used to construct the index correlate to those included in the original and Hall-revised UNCSD indicator frameworks.[856]

The ESI consists of 5 main components of sustainability (environmental systems, environment stresses, human vulnerability to these stresses, society's capacity to respond to these environmental challenges, and global stewardship) that are supported by 21 indicators and 76 variables (Esty et al. 2005). The table below presents the ESI structure. Those variables that are identical or similar to the indicators included in the original and Hall-revised UNCSD indicator frameworks have been marked.

Structure of the Environmental Sustainability Index			
Components (5)	**Indicators (21)**	**Variables (76)**	
Environmental Systems	Air Quality	— Nitrogen dioxide concentration✓ — Sulfur dioxide concentration✓	— Particulates concentration✓ — Indoor air pollution from solid fuel use
	Biodiversity	— Percentage of country's territory in threatened ecoregions — Threatened bird species as percentage of known breeding bird species in each country✓ — Threatened mammal species as percentage of known mammal species in each country✓	— Threatened amphibian species as percentage of known amphibian species in each country✓ — National Biodiversity Index

[855] Source: The Environmental Performance Measurement Project, http://www.yale.edu/esi/ (accessed on 04/09/06).

[856] Since the variables used to calculate the ESI index are initially measured in their natural units, it is possible to compare them with the UNCSD indicators. This type of comparison cannot be undertaken for indexes that translate the issues measured into a single value such as dollars for the *Genuine Progress Indicator (GPI).*

Structure of the Environmental Sustainability Index			
Components (5)	**Indicators (21)**	**Variables (76)**	
	Land	— Percentage of total land area (including inland waters) having very low anthropogenic impact	— Percentage of total land area (including inland waters) having very high anthropogenic impact ✓
	Water Quality	— Dissolved oxygen ✓ — Electrical conductivity	— Phosphorus concentration — Suspended solids
	Water Quantity	— Freshwater availability per capita ✓	— Internal groundwater availability per capita
Reducing Stress	Reducing Air Pollution	— Anthropogenic NOx emissions per populated land area ✓ — Anthropogenic SO2 emissions per populated land area ✓ — Anthropogenic VOC emissions per populated land area ✓	— Coal consumption per populated land area — Vehicles in use per populated land area
	Reducing Ecosystem Stress	— Annual average forest cover change rate from 1990 to 2000 ✓	— Acidification exceedance from anthropogenic sulfur deposition
	Reducing Population Pressure	— Percentage change in projected population 2004-2050 ✓	— Total fertility rate
	Reducing Waste and Consumption Pressures	— Ecological footprint per capita ✓ — Waste recycling rates ✓	— Generation of hazardous waste ✓
	Reducing Water Stress	— Industrial organic water pollutant (BOD) emissions per available freshwater ✓ — Fertilizer consumption per hectare of arable land ✓	— Pesticide consumption per hectare of arable land ✓ — Percentage of country under severe water stress
	Natural Resource Management	— Overfishing ✓ — Salinized area due to irrigation as percentage of total arable land — Percentage of total forest area that is certified for sustainable management	— World Economic Forum Survey on subsidies ✓ ★ — Agricultural subsidies ✓ ★
Reducing Human Vulnerability	Environmental Health	— Death rate from intestinal infectious diseases — Child death rate from respiratory diseases	— Children under five mortality rate per 1,000 live births ✓
	Basic Human Sustenance	— Percentage of undernourished in total population ✓	— Percentage of population with access to improved drinking water source ✓
	Exposure to Natural Disasters	— Average number of deaths per million inhabitants from floods, tropical cyclones, and droughts ✓	— Environmental Hazard Exposure Index

Structure of the Environmental Sustainability Index		
Components (5)	**Indicators (21)**	**Variables (76)**
Social and Institutional Capacity	Environmental Governance	— Percentage of total land area under protected status — Ratio of gasoline price to world average — Percentage of variables missing from the CGSDI "Rio to Joburg Dashboard" — Knowledge creation in environmental science, technology, and policy — IUCN member organizations per million population — Local Agenda 21 initiatives per million people — Corruption measure — Rule of law — Civil and political liberties — World Economic Forum Survey on environmental governance — Government effectiveness — Democracy measure
	Eco-efficiency	— Hydropower and renewable energy production as a percentage of total energy consumption✓ — Energy efficiency✓
	Private Sector Responsiveness	— Dow Jones Sustainability Group Index (DJSGI) — Average Innovest EcoValue rating of firms headquarted in a country — Number of ISO 14001 certified companies per billion dollars GDP (PPP) — World Economic Forum Survey on private sector environmental innovation — Participation in the Responsible Care Program of the Chemical Manufacturer's Association
	Science and Technology	— Innovation Index — Digital Access Index✓ — Female primary education completion rate — Gross tertiary enrollment rate — Number of researchers per million inhabitants
Global Stewardship	Participation in International Collaborative Efforts	— Number of memberships in environmental intergovernmental organizations — Contribution to international and bilateral funding of environmental projects and development aid✓ — Participation in international environmental agreements✓
	Greenhouse Gas Emissions	— Carbon emissions per million US dollars GDP — Carbon emissions per capita✓
	Reducing Transboundary Environmental Pressures	— Import of polluting goods and raw materials as percentage of total imports of goods and services✓★ — SO2 exports

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Esty, D. C., Levy, M., Srebotnjak, T., and de Sherbinin, A. (2005). "2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship." Yale Center for Environmental Law & Policy, New Haven.

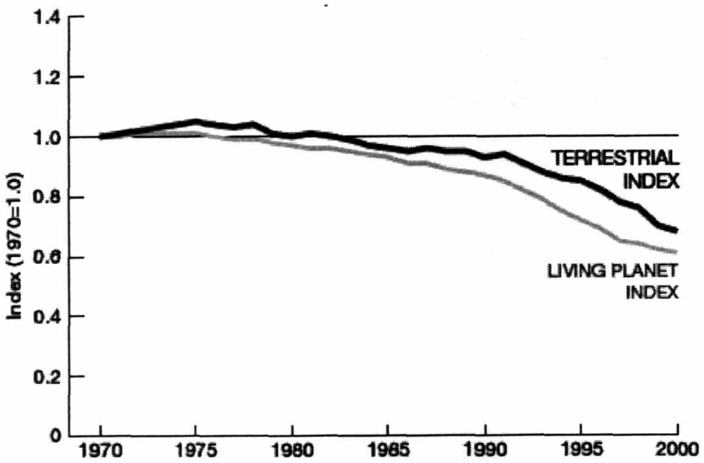
URL: http://www.yale.edu/esi/ (accessed on 04/09/06).

A3.1.2 Living Planet Index (LPI)

The Living Planet Index (LPI), developed by the World Wildlife Fund (WWF), measures trends in the population of some 1,100 vertebrate species living in ecosystems throughout the world (WWF 2004). The LPI combines three separate indicators that measure changes in the population of species which live in terrestrial, freshwater, and marine ecosystems.[857]

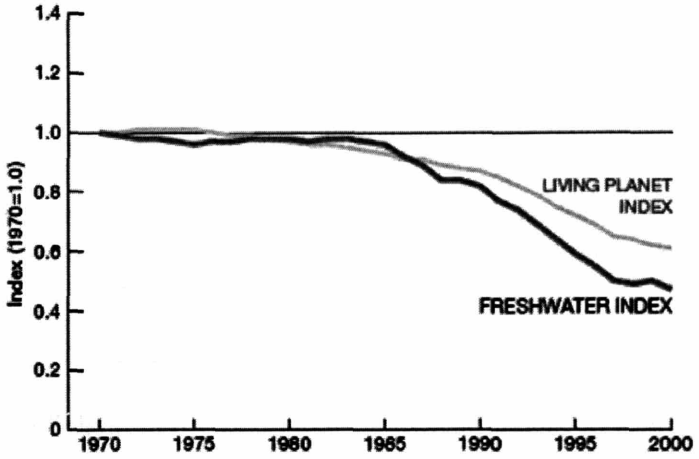
The LPI currently tracks the populations of 555 terrestrial species of mammals, birds, and reptiles (found in forest, grassland, savanna, desert, and tundra), 323 freshwater species of mammals, birds, reptiles, amphibians, and fish (found in wetlands, rivers, and lakes), and 267 marine species of mammals, birds, reptiles, and fish (found in oceans, seas, and coastal areas) (SBSTTA 2004; WWF 2004).

The LPI has been added to the original UNCSD indicator framework since it provides a valuable way to track changes in the world's biodiversity. The three graphs below - extracted from the WWF's *Living Planet Report 2004* - show the LPI along with the terrestrial, freshwater, and marine indexes over a thirty year period.

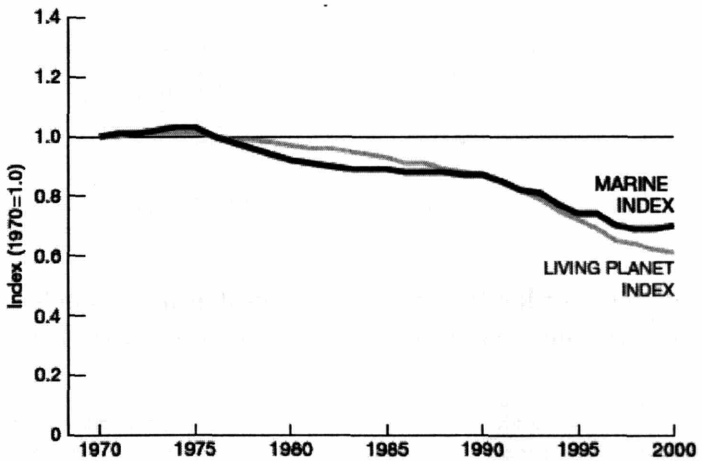


Terrestrial Species Population Index: 1970-2000 (WWF 2004, p. 2)

[857] While the LPI is called an index, it might also be considered as an 'indicator' since it simply tracks the total increase/reduction in populations of animal species.



Freshwater Species Population Index: 1970-2000 (WWF 2004, p. 2)



Marine Species Population Index: 1970-2000 (WWF 2004, p. 2)

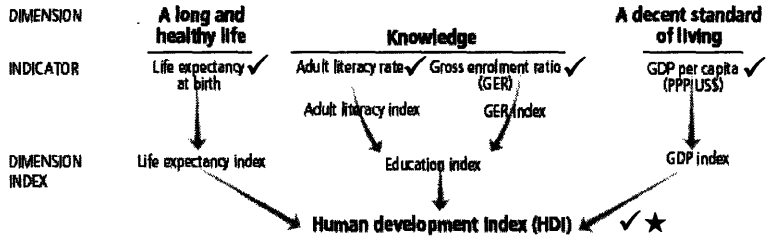
A3.2 Social

A3.2.1 Human Development Indicators

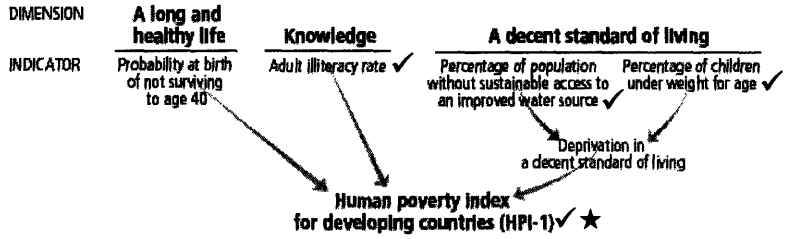
The United Nations Development Programme (UNDP) uses five core indexes to measure human development. All five have been included in the Hall-revised UNCSD indicator framework.

The diagrams below are extracted from the *Human Development Report 2004: Cultural liberty in today's diverse world* (UNDP 2004, p. 340) and provide an overview of how the five indexes are calculated. Those indicators/indexes that relate to the original (✓) and Hall-revised (✓★) UNCSD indicator frameworks have been marked.

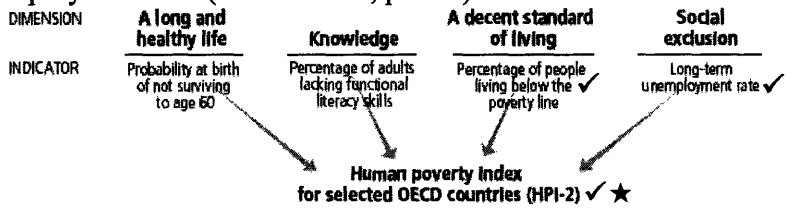
HDI (Human Development Index) (UNDP 2004, p. 340).



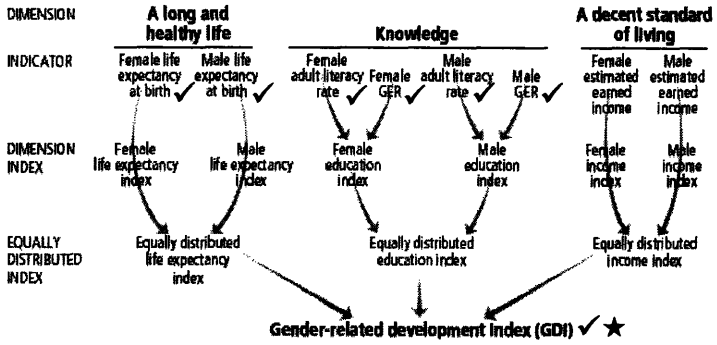
HPI-1 (Human Poverty Index for developing countries) - this index measures *deprivations* in the three human development indicators of the HDI (UNDP 2004, p. 340).



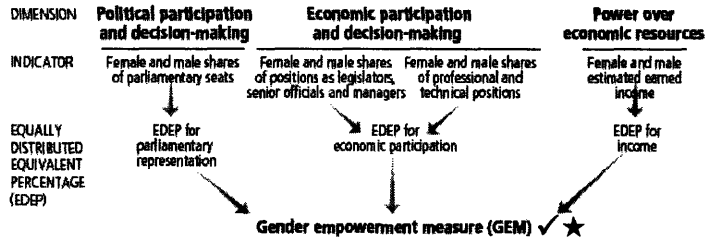
HPI-2 (Human Poverty Index for selected OECD countries) - this index measures deprivations in the same manner as HPI-1, but also includes social exclusion through a long-time unemployment rate (UNDP 2004, p. 340).



GDI (Gender-related Development Index) - this index adjusts the HDI to reflect inequalities between men and women (UNDP 2004, p. 340).



GEM (Gender Empowerment Measure) - this index measures female participation in *political* and *economic* decision-making, and female power over economic resources (UNDP 2004, p. 340).



Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: United Nations Development Programme (UNDP). (2004). *Human Development Report 2004: Cultural liberty in today's diverse world*, UNDP, New York.

URL: http://hdr.undp.org/reports/global/2004/ (accessed on 04/09/06).

A3.2.2 Subjective Well-Being (SWB)

Over the past two decades, interest in measuring an individual's happiness has been gathering momentum (Argyle 1987; Argyle 2002; Diener and Oishi 2000; Diener and Suh 2000; Layard 2005). Including some measure of happiness (i.e., subjective well-being) in the UNCSD indicator framework provides a lens through which a purely social element of sustainable development could be measured. The basic argument is that if development in a region is leading to unhappiness, then one could legitimately ask the question whether this form of progress is healthy for society and is sustainable over the long-term.

Unlike the other environmental and social metrics presented so far, the measurement of happiness, or subjective well-being (SWB), cannot easily be refined to a single measurement. The reason for this is that the determination of an individual's well-being is partly a cognitive process. However, it is possible to evaluate how a person feels using surveys. A useful description of SWB, including a simple example of how it can be measured, is shown in the box below. It is believed that developing an internationally agreed upon metric for measuring SWB (or happiness) would be a valuable addition to the UNCSD indicator framework.

Subjective Well-Being (SWB) - Excerpt from Diener, E., Suh, E., and Oishi, S. (1997). "Recent Findings on Subjective Well-Being." *Indian Journal of Clinical Psychology*, 24(1), 25-41.

Defining Subjective Well-Being

Subjective well-being (SWB) refers to how people evaluate their lives, and includes variables such as life satisfaction and marital satisfaction, lack of depression and anxiety, and positive moods and emotions. The idea of SWB or happiness has intrigued thinkers for millennia, although it is only in recent years that it has been measured and studied in a systematic way. A person's evaluation of his or her life may be in the form of cognitions (e.g., when a person gives conscious evaluative judgments about his or her satisfaction with life as a whole, or evaluative judgments about specific aspects of his or life such as recreation). However, an evaluation of one's life also may be in the form of affect (people experiencing unpleasant or pleasant moods and emotions in reaction to their lives). Thus, a person is said to have high SWB if she or he experiences life satisfaction and frequent joy, and only infrequently experiences unpleasant emotions such as sadness and anger. Contrariwise, a person is said to have low SWB if he or she is dissatisfied with life, experiences little joy and affection, and frequently feels negative emotions such as anger or anxiety. The cognitive and affective components of SWB are highly interrelated, and only recently are we beginning to understand the relations between various types of SWB.

Most people evaluate what is happening to them as either good or bad, so they are normally able to offer judgments about their lives. Furthermore, people virtually always experience moods and emotions, which have an hedonic component that is pleasant, signalling a positive reaction, or unpleasant, signalling a negative reaction. Thus, people have a level of SWB even if they do not often consciously think about it, and the psychological system offers virtually a constant evaluation of what is happening to the person.
...

Measuring Subjective Well-Being

The usual method of measuring SWB is through self-report surveys in which the respondent judges and reports his life satisfaction, the frequency of her pleasant affect, or the frequency of his unpleasant

Subjective Well-Being (SWB) - Excerpt from Diener, E., Suh, E., and Oishi, S. (1997). "Recent Findings on Subjective Well-Being." *Indian Journal of Clinical Psychology*, 24(1), 25-41.

emotions. For example, Pavot and Diener (1993) review evidence on the Satisfaction with Life Scale, which is shown below:

Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

7 - Strongly agree
6 - Agree
5 - Slightly agree
4 - Neither agree nor disagree
3 - Slightly disagree
2 - Disagree
1 - Strongly disagree

_____ In most ways my life is close to my ideal.
_____ The conditions of my life are excellent.
_____ I am satisfied with my life.
_____ So far I have gotten the important things I want in life
_____ If I could live my life over, I would change almost nothing.

Reference:
Pavot, W., & Diener, E. (1993). Review of the Satisfaction with Life Scale, *Psychological Assessment*, Vol.5 No.2 164-172.

Reference: Diener, E., Suh, E., and Oishi, S. (1997). "Recent Findings on Subjective Well-Being." *Indian Journal of Clinical Psychology*, 24(1), 25-41.

URL: http://www.psych.uiuc.edu/~ediener/hottopic/paper1.html (accessed on 04/09/06).

A3.3 Economic

A3.3.1 The Genuine Progress Indicator (GPI)

The Genuine Progress Indicator (GPI) is included in the Hall-revised UNCSD indicator framework as an alternative way to measure the economic health of a nation. It is argued that the traditional way of measuring economic well-being using Gross Domestic Product (GDP) overestimates the true value added to an economy from economic growth (Venetoulis and Cobb 2004). For example, while GDP measures the yearly amount of money spent by households, businesses, and government, it does not take into account the environmental and social costs associated with this spending. The box below provides an overview of the GPI developed for the U.S. and explains how it is calculated.

While GPI is expressed in monetary terms (and is in fact called an 'indicator'), it is considered under the 'index' heading since only part of its calculation is based upon real market prices (GNP). The remainder is synthesized through a number of adjustments that reflect whether a certain category of spending enhances or detracts from national well-being.

The Genuine Progress Indicator: Summary of Method (Venetoulis and Cobb 2004, p. 8)

The Genuine Progress Indicator (GPI) takes from the GDP the financial transactions that are relevant to well-being. It then adjusts them for aspects of the economy that the GDP ignores. The GPI thus reveals the relationship between factors conventionally defined as purely economic and those traditionally defined as purely social and environmental.

Like the GDP, the GPI begins with the nation's personal consumption expenditures. But the GPI assesses the well-being of households, rather than focusing exclusively on the number of dollars they spend. While the GDP then adds the nation's spending on investment and government, the GPI considers those expenditures defensive, and thus begins with personal consumption expenditures as its base.

Personal consumption expenditures are then adjusted for income distribution using the Gini coefficient. It is often assumed that the rising GDP lifts all boats, but this is not necessarily true. From 1973 to 1993, for example, while the GDP rose by 55%, real wages declined by 3.4%. In the 1980s alone, the poorest fifth of American families lost 0.5% of their income each year, while the top 5% of households increased their real income by 3.9% per year. *Growth did not benefit everyone, and a true measure of well-being should take this inequality into account.*

Using personal consumption expenditures adjusted for income inequality as its base, the GPI then adds or subtracts categories of spending based on whether they enhance or detract from our nation's well-being.

The following nonmonetary benefits—ignored by the GDP—are included in the GPI:

1. the value of time spent on household work, parenting, and volunteer work;
2. the value of services of consumer durables (such as cars and refrigerators); and
3. services of highways and streets.

The GPI then subtracts three categories of expenses that do not improve well-being:

1. defensive expenditures, defined as money spent to maintain the household's level of comfort, security, or satisfaction, in the face of declines in quality of life due to such factors as crime, auto accidents, or pollution. Examples include personal water filters, locks or security systems,

The Genuine Progress Indicator: Summary of Method (Venetoulis and Cobb 2004, p. 8)

hospital bills from auto accidents, or the cost of repainting houses damaged by air pollution.

2. social costs, such as the cost of divorce, crime, or loss of leisure time.
3. the depreciation of environmental assets and natural resources, including loss of farmland, wetlands, and old-growth forests; reduction of stocks of natural resources, such as fossil fuels; and damaging effects of wastes and pollution.

A4 Holistic Indicator Frameworks

A4.1 WRI EarthTrends Database and the World Resources 2002 - 2004 Report

A reliable source of online information covering environmental, economic, and social concerns relating to sustainable development is provided by the World Resource Institute (WRI). The WRI's *EarthTrends* database[858] is structured using ten topic areas and presents its information through five formats (a searchable database, data tables, country profiles, maps, and feature stories).

A good example of the validity given to the *EarthTrends* data is the recent *World Resources 2002 - 2004* report that was jointly prepared by the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), The World Bank, and the World Resources Institute (WRI). The report uses 12 of the 39 tables prepared by the WRI (see table below). The purpose of the report is to identify actions that government, industry, and society could take to balance the needs of people with the protection of ecosystems and to address persisting inequalities.

Structure of the WRI *EarthTrends Database* showing which data tables have been used in the *World Resources 2002-2004* Report

Topic Areas	Title of Indicator Table	Is Indicator Table Included in *World Resources 2002-2004*?
Coastal & Marine Ecosystems	— Capture and Aquaculture Production Totals for Marine and Inland Fisheries	No
	— **Fisheries and Aquaculture**	**Yes**
	— Trends in Marine and Inland Fisheries Capture by Species	No
Water Resources & Freshwater Ecosystems	— **Freshwater Resources**	**Yes**
	— Groundwater and Desalinization	No
	— Major Wastersheds of the World	No
Climate & Atmosphere	— **Climate and Atmosphere**	**Yes**
	— Emissions of Common Anthropogenic Pollutants	No
	— Greenhouse and Ozone-Depleting Gases in the Atmosphere, 1744-2001	No No
	— Greenhouse Gas Emissions by Sector	No
	— Greenhouse Gas Emissions by Source	No
Population, Health, & Human Well-Being	— Demographic Indicators	No
	— Education and Literacy	No
	— **Population, Health, and Human Well-Being**	**Yes**
	— Transportation: Selected City-Level Indicators	No
	— Trends in Mortality and Life Expectancy	No
Economics, Business, & the Environment	— **Economic Indicators**	**Yes**
	— Exports, Debt, and Development Assistance	No
	— **Financial Flows, Government Expenditures, and Corporations**	**Yes**
	— Income Distribution and Poverty	No

[858] See the World Resource Institute, *EarthTrends* database, http://earthtrends.wri.org/index.cfm (accessed on 02/18/05).

Topic Areas	Title of Indicator Table	Is Indicator Table Included in *World Resources 2002-2004*?
Energy & Resources	— Energy Consumption by Economic Sector	No
	— Energy Consumption by Source	No
	— **Energy Overview**	**Yes**
	— Energy Production by Source	No
	— Resource Consumption	No
Biodiversity & Protected Areas	— **Biodiversity and Protected Areas Overview**	**Yes**
	— Known and Threatened Species	No
	— Legal Trade in Selected Wildlife Products and CITES Status	No
	— Protected Areas	No
Agriculture & Food	— Agricultural Inputs	No
	— Agricultural Production	No
	— **Agriculture and Food**	**Yes**
Forests, Grasslands, & Drylands	— **Forests, Grasslands, and Drylands**	**Yes**
	— Land Area Classification by Ecosystem Type	No
	— Livestock Populations, Grains Consumed as Feed, and Meat Production	No
	— PAGE Ecosystems: Area, Population, Carbon Stocks, and Protected Areas	No
	— Production and Trade of Selected Forest Products	No
Environmental Governance & Institutions	— **Financial Flows, Government Expenditures, and Corporations**	**Yes**
	— **Global Governance: Participation in Major Multilateral Agreements**	**Yes**
	— **Governance and Access to Information**	**Yes**

The 'headings' of the 12 tables presented in the *World Resources 2002 - 2004* report are shown below. Although, the rows of each table provide country specific data that is grouped by geographic region, this data is not shown below. The table headings have been marked to identify which indicators correlate to those included in the original and Hall-revised UNCSD indicator frameworks.

Key:

✓ **Indicator is identical or similar to one included in the original UNCSD indicator framework.**

✓★ **Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.**

Fisheries and Aquaculture

Marine Catch (a) ✓ (annual average)		Freshwater Catch (b) (annual average)		Total Aquaculture Production (annual average)		Trade in Fish and Fish Products (c) (annual average million US$)		Food Supply from Fish and Fish Products (kg/person/year) (d)	Fish Protein as a Percent of All Animal Protein	Number of Fishers	Number of Decked Fishery Vessels (e)	Population within 100 km of the Coast (percent)
Metric Tons (000) 1998-00	Percent Change Since 1988-90	Metric Tons (000) 1998-00	Percent Change Since 1988-90	Metric Tons (000) 1998-00	Percent Change Since 1988-90	Exports 1998-00	Imports 1998-00	1997-99	1997-99	2000	1995	1995

Source: (UNDP et al. 2004, p. 266; WRI 2004, see "Coastal and Marine Ecosystems")

Freshwater Resources

Renewable Water Resources (annual) (a)							Water Withdrawals (annual) ✓						
Internal Renewable Water Resources (IRWR)				Natural Renewable Water Resources (b)					as a %				Desalinated Water Production (million m^3) (g)
Ground-water Recharge (km^3) (c)	Sur-face Water (km^3) (c)	Over-lap (km^3)	Total (d) (km^3)	Total (km^3)	Per Capita (m^3 per person) (f)	Year	Total (million m^3)	Per Capita (m^3 per person)	of Renew-able Water Resources	Sectoral Share (percent) (c) Agri-culture	Dom-estic	Indus-try	

Source: (UNDP et al. 2004, p. 274; WRI 2004, see "Water Resources and Freshwater Ecosystems")

Climate and Atmosphere

Carbon Dioxide (CO_2) Emissions ✓					Emissions of		CO_2 Emissions by Economic Sector (million metric tons), 1999			Carbon Intensity: CO_2 Emissions per GDP (PPP) (tons CO_2 per million $ intl)			
Total		Per Capita		Cumu-lative	Methane	Nitrous Oxide				All Economic Sectors		Industry Sector	
(million metric tons) 1999	(percent change since 1990)	(metric tons per person) 1999	(percent change since 1990)	(million metric tons) 1900-2000	(million metric tons CO_2 equivalent) 1995	1995	Industry	Resid-ential	Road Trans-portation	Public Electricity and Heat	1990	1999	1990	1999

Source: (UNDP et al. 2004, p. 258; WRI 2004, see "Climate and Atmosphere")

Population, Health, and Human Well-Being

Total Population ✓ (thousands) (a)		Percent of Population in Specific Age Groups 2002		Total Fertility Rate (a) ✓ (children per woman)	Mortality Under Age 5 ✓ (per 1000 live births)	Life Expect-ancy at ✓ Birth (years)	Health-Adjusted Life Expect-ancy (b) (years)	Adults Ages 15-49 Living HIV or AIDS (percent)	Access to Improved Sanitation ✓ (percent of population)		Net School Enrollment ✓ Ratio 1998-1999		Adult Literacy Rate (percent) (c) ✓	
		Under 15	65 & Over	2000-2005	2000	2000-2005	2000	2001	2000		Pri-mary	Secon-dary	2002	
2002	2025								Urban	Rural			Women	Men

Source: (UNDP et al. 2004, p. 278; WRI 2004, see "Population, Health and Human Well-being")

Economic Indicators

Gross Domestic Product (GDP)								Income Inequality ✓				International Poverty ✓ Line		Savings Rate (percent of GNI)	
Total GDP (1985 US$)		GDP per Capita (1985 US$) ✓		GDP per Capita ✓	Distribution by Sector (a) (percent)			Gini Index (b) (0= perfect equality)		Percent Share of Income			Percent Under		
Total Value (millions) 2000	Average Annual Growth Rate (percent) 1991-2000	Total Value (dollars) 2000	Average Annual Growth Rate 1991-2000	PPP (current Int'l $) 2000	Agri-culture 2000	Ind-ustry 2000	Ser-vices 2000	Sur-vey year		Poorest 20%	Richest 20%	Sur-vey year	$1/ Day	$2/ Day	Net National Savings 2000	Adjusted Net Savings 2000

Source: (UNDP et al. 2004, p. 246; WRI 2004, see "Economics, Business, and the Environment")

Energy Overview

Energy Consumption by Source ✓								Energy Intensity: Energy Use ✓			Energy Consumption (as a percent of total consumption), 1999		Electricity Cons-umption per Capita (kgoe) (e)
Total from all sources			Total			Renewables ✓		per GDP PPP (a)		Residential			
(1000 metric toe) (d)	Percent Change Since	Per Capita (kgoe) (e)	Fossil Fuels	Nuclear	Hydro-electric	Mod-ern (b)	Tradi-tional (c)	All Economic Sectors	Industry Sector	per Capita (kgoe per person) (e)	Indus-trial	Trans-portation	
1999	1980	1999	(1000 metric toe) (d) 1999			1999	1999	(toe per million $ intl) 1999		1999			1999

Source: (UNDP et al. 2004, p. 262; WRI 2004, see "Energy and Resources")

Biodiversity and Protected Areas Overview

Nationally Protected Areas ✓					Known and Threatened Species (1992-2002) ✓						International Legal Net Trade Reported by CITES, 2000 (imports minus exports) (b)		
Protected Areas Under IUCN Management Categories I - VI (1992-2003) (a)			Wetlands of Int'l Importance	Biosphere Reserves	Mammals		Birds		Higher Plants				
Total Number	Percent of Land Protected	Number of Marine Areas (c)	Area (000 ha) 2002	Area (000 ha) 2002	Known Species	Number Threat-ened	Breeding Bird Species	Number Threat-ened	Known Species	Number Threat-ened	Live Pri-mates	Live Parrots	Animal Skins (d)

Source: (UNDP et al. 2004, p. 254; WRI 2004, see "Biodiversity and Protected Areas")

Agriculture and Food

Average Production of Cereals		Average Cereal Crop Yields		Variation in Domestic Cereal Production	Net Trade of Cereals (Imports - exports) as a Percent of Consumption	Average Meat Production Per Capita (a)		Irrigated Land as a Percentage of Total Cropland	Average Annual ✓ Fertilizer Use		Average Daily Per Capita Calorie Supply (a,b) Kilocalories, 1999	
000 Metric Tons 1999-2001 (c)	Percent Change Since 1989-91	Kg Per Hectare 1999-2001 (c)	Percent Change Since 1989-91	(% variation from mean) 1992-2001	2000 (d)	Kg Per Person 1999-2001 (c)	Percent Change Since 1989-91	1999	Kg/ha of Cropland 1997-99 (c)	Percent Change Since 1987-89	Total	From Animal Products

Source: (UNDP et al. 2004, p. 250; WRI 2004, see "Agriculture and Food")

Forests, Grasslands, and Drylands

Forest Area						Certified Forest Area			Drylands (a)		Grassland Area		
Total Forest ✓		Natural Forest		Plantations		FSC (b) Certified		All Certification Schemes					
Area (1000 ha) 2000	Annual % Change 1990-2000	Area (1000 ha) 2000	Annual % Change 1990-2000	Area (1000 ha) 2000	Annual % Change 1990-2000	Area (1000 ha) 2002	Annual % Change 1998-2002	(1000 ha) 2000	Average Area (1000 ha) 1950-1981	Percent of Total Land Area	Shrublands (1000 km²) 1992-93	Savannas (1000 km²) 1992-93	Herbaceous Grasslands (1000 km²) 1992-93

Source: (UNDP et al. 2004, p. 270; WRI 2004, see "Forests, Grasslands and Drylands")

Financial Flows, Government Expenditures, and Corporations

Foreign Direct Investment, Net Inflows (million current $US) (a)		Exports as a Percent of GDP 1998-2000 (a)	Balance ✓ of Trade (million current $US) 1998-2000 (a)	External ✓ Debt as a Percent of GNI 1998-2000 (a)	Government ✓★ Expenditure as a Percent of GDP			Off'l. Development Assistance (ODA) ✓ Receipts 1998-2000 (a)		Number of Transnational Corporations 1994-2000 (b)		Corporations With ISO 14000 Certification (number) 2000
1988-1990 (a)	1998-2000 (a)				Military 2000	Public Health 1998	Education 1998	Million Current $US	as a % of GNI	Parent Corporations	Foreign Affiliates	

Source: (UNDP et al. 2004, p. 242; WRI 2004, see "Environmental Governance and Institutions")

Global Governance: Participation in Major Multilateral Agreements

Year of Ratification of Major Multilateral Agreements ✓ (year in brackets = country is signatory to treaty; "n.p."= country is not a party to treaty)										Year of WTO (f) Membership (or status of membership)	Agenda 21 Process	
Covenant on Civil and Political Rights	Covenant on Economic, Social, and Cultural Rights	CITES (a) (species trade)	UNFCCC (b) (climate change)	Kyoto Protocol (CO_2)	CBD (c) (biodiversity)	Bio-Safety Protocol	CCD (d) (desertification)	Stockholm Convention (POPs) (e)	Aarhus Convention		National Reporting Status in 2002 (n.r.= non-reporting)	Number of Municipalities Involved in Local Agenda 21 1996	2001

Source: (UNDP et al. 2004, p. 238; WRI 2004, see "Environmental Governance and Institutions")

Governance and Access to Information

Level of Freedom (free (F), partly free (PF), not free (NF))		Level of Civil Liberties ✓★ (1=most free, 7= least free)		Polity Index of Democracy/ Autocracy ✓★ (-10=fully autocratic, 10=fully democratic) 2000	Percent of Parliamentary Seats Held by Women 2002	Corruption Perceptions Index ✓★ (10=least corrupt, 0= most corrupt) 2001	Non-Governmental Organizations (NGOs) Per Million Population		Press Freedom (1-30=free, 31-60=partly free, 61-100= not free) 2001	Freedom of Information Legislation, Status in 2002	Radios Per 1,000 Population 1997	Internet Users ✓ Per 1,000 Population 2001
1991-1992	2001-2002	1991-1992	2001-2002				1990	2000				

Source: (UNDP et al. 2004, p. 234; WRI 2004, see "Environmental Governance and Institutions")

The following indicator tables are found only in the WRI *EarthTrends* database (WRI 2004). The tables under each 'topic area' are shown in the order they appear in the *EarthTrends* database. Those tables that have already been covered (in the *World Resources 2002-2004* report) are listed, but are not included again.

Topic Area: Coastal & Marine Ecosystems

Capture and Aquaculture Production Totals for Marine and Inland Fisheries

Total Capture and Aquaculture Production for all Species (thousand metric tons)			Marine Aquaculture Production (thousand metric tons)			Inland Aquaculture Production (thousand metric tons)			Marine Capture Production (thousand metric tons)			Inland Capture Production (thousand metric tons)		
1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001

Source: (WRI 2004, see "Coastal and Marine Ecosystems")

Fisheries and Aquaculture [table shown previously]

Trends in Marine and Inland Fisheries Capture by Species

Total Capture (thousand metric tons)																	
Aquatic Plants			Crustaceans			Diadromous Fish			Freshwater Fish			Marine Fish ✓			Molluscs (includes cephalopods)		
1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001	1979-1981	1989-1991	1999-2001

Source: (WRI 2004, see "Coastal and Marine Ecosystems")

Topic Area: Water Resources & Freshwater Ecosystems

Freshwater Resources [table shown previously]

Groundwater and Desalinization

Average Annual Groundwater Recharge		Annual Groundwater Withdrawals						Desalinated Water Production
Total (cubic km)	Per Capita (cubic meters)			Percentage of Annual	Per Capita (cubic	Sectoral Share (percentage) [x]			(million cubic meters)
Years Vary	Year 2000	Year	Total (cubic km)	Recharge	meters)	Domestic	Industry	Agriculture	1990

Source: (WRI 2004, see "Water Resources and Freshwater Ecosystems")

Major Watersheds of the World

Major Watersheds	Modeled Watershed Area [a] (km²)	Countries within the Watershed (number)	Average Population Density (per km²)	Percent of Watershed that is: Crop-land	Forest	Grass-land	Built-up Area [b]	Irrigated Area	Arid Area	Wetlands	Ramsar Sites [c] (number)	Water Available Per Person (m³/person/year)	Large Dams in Progress (number)	Degree of River Fragmentation [d]

Source: (WRI 2004, see "Water Resources and Freshwater Ecosystems")

Topic Area: Climate & Atmosphere

Climate and Atmosphere [table shown previously]

Emissions of Common Anthropogenic Pollutants

Sulfur Dioxide ✓ (thousand metric tons SO2)		Nitrogen Oxides ✓ (thousand metric tons NOx)		Carbon Monoxide ✓ (thousand metric tons CO)		Non-methane Volatile Organic Compounds ✓ (thousand metric tons VOCs)	
1990	1995	1990	1995	1990	1995	1990	1995

Source: (WRI 2004, see "Climate and Atmosphere")

Greenhouse and Ozone-Depleting Gases in the Atmosphere, 1744-2001

Atmospheric Concentration of Carbon Dioxide, 1744-2000
Source: Carbon Dioxide Information Analysis Center

Year	Carbon Dioxide (CO_2) Concentration ✓ ppm

Atmospheric Concentration of Non-CO_2 Greenhouse and Ozone-Depleting Gases ✓
Source: Carbon Dioxide Information Analysis Center, ALE/GAGE/AGAGE Network

Year	Methane (CH_4) ppb	Nitrous Oxide (N_2O) ppb	Carbon Tetra-Chloride (CCl_4) ppt	Methyl Chloro-form (CH_3CCl_3) ppt	CFC-11 (CCl_3F) ppt	CFC-12 (CCl_2F_2) ppt	CFC-113 ($C_2Cl_3F_3$) ppt

Source: (WRI 2004, see "Climate and Atmosphere")

Greenhouse Gas Emissions from Fossil Fuel Burning by Sector

Carbon Dioxide Emissions from Selected Sectors (thousands metric tons of carbon dioxide) ✓

Industry				Domestic Transportation				Agriculture		Public Electricity and Heat		Commercial and Public Sectors		Residential	
All Industries		Iron & Steel		Total		Road									
	Percent Change Since		Percent Change Since		Percent Change Since		Percent Change Since		Percent Change Since		Percent Change Since		Percent Change Since		Percent Change Since
1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990

Source: (WRI 2004, see "Climate and Atmosphere")

Greenhouse Gas Emissions by Source

Carbon Dioxide (CO2) Emissions ✓								Per Capita CO2 Emissions		Methane Emissions		Nitrous Oxide Emissions	
All Fuels		Solid Fuels		Liquid Fuels		Gaseous Fuels							
(1000 metric tons)	Percent Change Since	(1000 metric tons)	Percent Change Since	(1000 metric tons)	Percent Change Since	(1000 metric tons)	Percent Change Since	(kilo-grams per person)	Percent Change Since	(1000 metric tons CO2 equivalent) (a)	Percent Change Since	metric tons CO2 equivalent) (a)	Percent Chan ge Since
1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1995	1990	1995	1990

Source: (WRI 2004, see "Climate and Atmosphere")

Topic Area: Population, Health, & Human Well-Being

Demographic Indicators

Total Population (thousands) ✓		Average Annual Population Change ✓ (percent)				Population Density (people per square kilometer)		Percent of Population in Urban Areas ✓		Total Fertility Rate (average total number of children per woman) ✓	
		Total		Urban	Rural						
1975	2002 (a)	1975-80	2000-05 (b)	2000-05 (b)	2000-05 (b)	1975	2002 (a)	1975	2000 (b)	1975-80	2000-05 (b)

Source: (WRI 2004, see "Population, Health and Human Well-being")

Education and Literacy

Primary School, ✓ Net Enrollment Ratio (a)				Secondary School, ✓ Net Enrollment Ratio (a)				Tertiary School, Gross Enrollment Ratio		Literacy Rate of Youths Ages 15 to 24 (percent)		Literacy Rate of Adults ✓ Older Than Age 15 (percent)	
Female (percent)		Male (percent)		Female (percent)		Male (percent)		Total (percent)	Female (percent of total enrollment)				
1988	1998	1988	1998	1988	1998	1988	1998	1998	1996	1980	2002	1980	2002

Source: (WRI 2004, see "Population, Health and Human Well-being")

Population, Health, and Human Well-Being [table shown previously]

Transportation: Selected City-Level Indicators

Urban Population		Transport Modes to Work				Travel Time to Work (minutes)			
(000 people) 1998	Annual Population Growth (Percent) 1993-98	Private Motorized (Percent) 1998	Train/ Tram (Percent) 1998	Bus/ Minibus (Percent) 1998	Bicycle/ Walking/ Other (Percent) 1998	1993	1998	Unemployment ✓ (percent) 1998	Civil Society Involvement in Road/Highway Projects 1998

Source: (WRI 2004, see "Population, Health and Human Well-being")

Trends in Mortality and Life Expectancy

Infant Mortality Rate (per 1000 live births)	Under-5 Mortality Rate ✓ (per 1000 live births)			Life Expectancy at Birth (years) ✓			
				Female		Male	
2000	1960	1980	2000	1955-1960	1985-2000	1955-1960	1985-2000

Source: (WRI 2004, see "Population, Health and Human Well-being")

Topic Area: Economics, Business, & the Environment

Economic Indicators [table shown previously]

Exports, Debt, and Development Assistance

Goods and Services ✓ (millions of current US dollars)		Food Exports as a Percent of Total Exports	Fuel Exports as a Percent of Total Exports	International Tourism Receipts as a Percent of Total Exports	Debt and Official Development Assistance (ODA) ✓					
Exports 2001	Imports 2001	2001	2001	2001	Total Debt Service (millions of current US$) 2001	Total External Debt (millions of current US$) 2000	Debt as a Percent of Export Earnings (a) 2001	Present Value of Debt as a Percent of GNI 2001	ODA (millions of current US$) 2000	ODA as a Percent of GNI 2000	ODA per capita (current US dollars) 2000

Source: (WRI 2004, see "Economics, Business, and the Environment")

Income Distribution and Poverty

Income Distribution							International Poverty Line ($1) ✓				
		Percentage Share of Total Income (or Total Consumption) in Each Quintile of Population						Population Living on Less Than		Poverty gap at ($)	
Survey Year	Gini ✓ Index (a)	Poorest 0-20	20-40	40-60	60-80	Richest 80-100	Survey Year	$1/day (%)	$2/day (%)	$1/day (%)	$2/day (%)

Source: (WRI 2004, see "Economics, Business, and the Environment")

Topic Area: Energy & Resources

Energy Consumption by Economic Sector

Total Final Consumption (1000 metric toe) (a)		Energy Consumption by Economic Sector (% of Total Consumption) ✓															
		All Industries		Iron & Steel		Transportation						Agriculture		Commercial & Public Sectors		Residential	
						Total		Air		Road							
1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999

Source: (WRI 2004, see "Energy and Resources")

Energy Consumption by Source

Total Consumption From:															
All Sources			Non-Renewable Energy Sources								Renewable Energy Sources				
			Solid Fuels (a)		Liquid Fuels (b)		Gaseous Fuels (c)		Nuclear Fuels		Hydroelectric		Other (d)		
(1000 metric toe) (e) 1999	Percent Change Since 1989	Per Capita (kg oil equivalent) 1999	(1000 metric toe) (e) 1999	Percent Change Since 1989	(1000 metric toe) (e) 1999	Percent Change Since 1989	(1000 metric toe) (e) 1999	Percent Change Since 1989	(1000 metric toe) (e) 1999	Percent Change Since 1989	(1000 metric toe) (e) 1999	Percent Change Since 1989	(1000 metric toe) (e) 1999	Percent Change Since 1989

Source: (WRI 2004, see "Energy and Resources")

Energy Overview [table shown previously]

Energy Production by Source

Energy Production From:														
All Sources			Non-Renewable Energy Sources								Hydroelectric Plants		Renewables (excl. Hydroelectric)	
			Solid Fuels (a)		Liquid Fuels (b)		Gaseous Fuels (c)		Nuclear Fuels					
(1000 Metric TOE) (d) 1999	Percent Change Since 1989	Per Capita (kg oil equivalent) 1999	(1000 Metric TOE) (d) 1999	Percent Change Since 1989	(1000 Metric TOE) (d) 1999	Percent Change Since 1989	(1000 Metric TOE) (d) 1999	Percent Change Since 1989	(1000 Metric TOE) (d) 1999	Percent Change Since 1989	(1000 Metric TOE) (d) 1999	Percent Change Since 1989	(1000 Metric TOE) (d) 1999	Percent Change Since 1989

Source: (WRI 2004, see "Energy and Resources")

Resource Consumption ✓

Passenger Cars Per 1000 People		Total Annual Energy Consumption per capita (toe) (a)		Annual Gasoline & Diesel Consumption per capita (liters per person)		Annual Electricity Consumption per capita (kg oil equivalent)		Annual Meat Consumption (kg per person)		Annual Fish Consumption (kg per person)		Annual Paper Consumption (kg per person)		Annual Coffee Consumption (kg per person)
1990	1999	1989	1999	1989	1999	1989	1999	1989	1998	1989	1999	1989	1999	2000

Source: (WRI 2004, see "Energy and Resources")

Topic Area: Biodiversity & Protected Areas

Biodiversity and Protected Areas Overview [table shown previously]

Known and Threatened Species

Year Convention on Biological Diversity Ratified (a)	Number of: ✓											
	Mammals		Birds (b)		Plants (c)		Reptiles		Amphibians		Fish	
	Known 1992-2002	Threatened 2002	Known 1992-2002	Threatened 2002	Known 1992-2002	Threatened 2002	Known 1992-2003	Threatened 2002	Known 1992-2003	Threatened 2002	Known 1992-2003	Threatened 2002

Source: (WRI 2004, see "Biodiversity and Protected Areas")

Legal Trade in Selected Wildlife Products and CITES Status

Year CITES Ratified	Net International Legal Trade Reported by CITES, 2000 (a)							
	Number of:				Number of:			
	Live Lizards	Live Snakes	Live Primates	Live Parrots	Lizard Skins	Snake Skins	Crocodilian Skins	Cat Skins

Source: (WRI 2004, see "Biodiversity and Protected Areas")

Protected Areas

Number and Extent of Protected Areas by IUCN Category, 2003 (a) ✓						Protected Areas ✓ as a % of Total Land Area (b) 2003	Number of Protected Areas		Number of Marine or Littoral Protected Areas 2003	Ramsar Sites (Wetlands of International Importance), 2002		Trans-frontier Protected Area Complexes, Number 1999
Nature Reserves, Wilderness Areas, and National Parks (Ia, Ib, and II)		Natural Monuments, Species Mgmt Areas, & Protected Land/Seascapes (III, IV, and V)		Areas Managed for Sustainable Use and Areas not Classified by IUCN (VI and other)			Larger Than 100,000 Hectares 2003	Larger Than One Million Hectares 2003		Number	Total Area (000 ha)	
Number	Area (000 ha)	Number	Area (000 ha)	Number	Area (000 ha)							

Source: (WRI 2004, see "Biodiversity and Protected Areas")

Topic Area: Agriculture & Food

Agricultural Inputs

Arable and Permanent Cropland ✓ (000 hectares) 2000	Agricultural Labor (a)		Tractor Use		Irrigated Land, % of Total Cropland (b) 2000	Average Fertilizer ✓ Use (kg per ha of cropland) 2000	Average Pesticide ✓ Use (kg per ha of cropland) 2000	Cropland Under Organic Management	
	as a Percent of Total Labor Force 2001	Workers per Hectare of Cropland 2000	Number of Tractors 2000	Tractors per 1000 Hectares of Cropland 2000				Total (hectares) 2003	as a % of all Cropland (c) 2003

Source: (WRI 2004, see "Agriculture and Food")

Agricultural Production

Agricultural production index (1989-1991 = 100)		Cereals				Pulses Production		Roots and Tubers Production		
		Production		Yield						
Total 2002	Per Capita 2002	Total (000 metric tons) 2002	Percent Change Since 1992	kg per hectare 2002	Percent Change Since 1992	Total (000 metric tons) 2002	Percent Change Since 1992	Total (000 metric tons) 2002	Percent Change Since 1992	Meat Production (metric tons) 2001

Source: (WRI 2004, see "Agriculture and Food")

Agriculture and Food [table shown previously]

Topic Area: Forests, Grasslands, & Drylands

Forests, Grasslands, and Drylands [table shown previously]

Land Area Classification by Ecosystem Type

Total Area (in square kilometers) classified as:								
Forests					Shrublands		Savannas	
Evergreen		Deciduous						
Needleaf	Broadleaf	Needleleaf	Broadleaf	Mixed	Closed	Open	Woody	Non-Woody

Source: (WRI 2004, see "Forests, Grasslands and Drylands")

Livestock Populations, Grains Consumed as Feed, and Meat Production

Cattle (a)		Sheep and Goats (a)		Equines (a)		Buffaloes and Camels (a)		Grains Fed to Livestock as Percent of Total Grain Consumption (a)		Meat Production (000 metric tons) Beef and Veal		Sheep and Goats	
Annual Average (000) 1996-98	Percent Change Since 1986-88	Annual Average (000) 1996-98	Percent Change Since 1986-88	Annual Average (000) 1996-98	Percent Change Since 1986-88	Annual Average (000) 1996-98	Percent Change Since 1986-88	1988	1998	Annual Average 1996-98	Percent Change Since 1986-88	Annual Average 1996-98	Percent Change Since 1986-88

Source: (WRI 2004, see "Forests, Grasslands and Drylands")

PAGE Ecosystems: Area, Population, Carbon Stocks, and Protected Areas

International Geosphere-Biosphere Programme (IGBP) Classification (000 km2)			Pilot Analysis of Global Ecosystems (PAGE) Classification		
IGBP Land Area	Urban Area (a)	Agri-cultural Mosaic Area (b)	PAGE Area (000 km2) (c)	Population (000) (d)	Protected Area (000 km2) (e)

Source: (WRI 2004, see "Forests, Grasslands and Drylands")

Production and Trade of Selected Forest Products

Forest Harvest ✓ (annual average)				Selected Forest Products (annual average)						Forest Product Trade (a) (annual average)			
		Total Roundwood		Wood-based Panels and Sawnwood		Paper and Paperboard		Recovered Paper		Imports		Exports	
Industrial roundwood	Wood Fuel	Cubic Meters	Percent Change	Cubic Meters	Percent Change	Metric Tons	Percent Change	Metric Tons	Percent Change	Value, US$	Percent Change	Value, US$	Percent Change
Cubic Meters (000) 1999-01		(000) 1999-01	since 1989-91	(000) 1999-01	since 1989-91	(000) 1999-01	since 1989-91	(000) 1999-01	since 1989-91	(000) 1999-01	since 1989-91	(000) 1999-01	since 1989-91

Source: (WRI 2004, see "Forests, Grasslands and Drylands")

Topic Area: Environmental Governance & Institutions

Financial Flows, Government Expenditures, and Corporations [table shown previously]

Global Governance: Participation in Major Multilateral Agreements [table shown previously]

Governance and Access to Information [table shown previously]

Reference: United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), The World Bank, and World Resources Institute (WRI). (2004). *World Resources 2002 - 2004: Decisions for the Earth. Balance, Voice, and Power*, WRI, Washington, D. C.
URL: http://pubs.wri.org/pubs_pdf.cfm?PubID=3764 (accessed on 04/09/06).

Reference: World Resources Institute (WRI). (2004). "EarthTrends: The Environmental Information Portal." WRI, Washington D.C.
URL: http://earthtrends.wri.org (accessed on 02/18/05).

A4.2 Millennium Development Goals (MDGs)

In September 2000, the heads of state met at the United Nation's (UN's) headquarters in New York to reaffirm their commitment to the "*Organization and its Charter as indispensable foundations of a more peaceful, prosperous and just world.*"[859] The resulting United Nations Millennium Declaration laid the foundation for the eight Millennium Development Goals (MDGs) that are presented in the box below. To track progress towards the MDGs, the UN, IMF, OCED, and the World Bank adopted 18 targets and 48 indicators (UNDESA 2004; 2005).

A comparison of the Hall-revised UNCSD indicator framework with the 48 indicators that support the MDG reveals that seven of the eight development goals have at least one supporting indicator that relates to those in the UNCSD framework. The MDG to *improve maternal health* is the only development goal that is not covered.

The Millennium Indicators Database (UNDESA 2005)

Goal 1. Eradicate extreme poverty and hunger

Target 1 - Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day

Indicators

1. Proportion of population below $1 (1993 PPP) per day (World Bank) ✓
2. Poverty gap ratio [incidence x depth of poverty] (World Bank)
3. Share of poorest quintile in national consumption (World Bank)

Target 2 - Halve, between 1990 and 2015, the proportion of people who suffer from hunger

Indicators

4. Prevalence of underweight children under five years of age (UNICEF-WHO) ✓
5. Proportion of population below minimum level of dietary energy consumption (FAO)

Goal 2. Achieve universal primary education

Target 3 - Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling

Indicators

6. Net enrolment ratio in primary education (UNESCO)
7. Proportion of pupils starting grade 1 who reach grade 5 (UNESCO) ✓
8. Literacy rate of 15-24 year-olds (UNESCO) ✓

Goal 3. Promote gender equality and empower women

Target 4 - Eliminate gender disparity in primary and secondary education, preferably by 2005,

[859] Source: United Nations, *United Nations Millennium Declaration*, http://www.un.org/millennium/declaration/ares552e.htm (accessed on 04/09/06).

The Millennium Indicators Database (UNDESA 2005)

and in all levels of education no later than 2015

Indicators

9. Ratio of girls to boys in primary, secondary and tertiary education (UNESCO)
10. Ratio of literate women to men, 15-24 years old (UNESCO)
11. Share of women in wage employment in the non-agricultural sector (ILO)
12. Proportion of seats held by women in national parliament (IPU) ✓★ [*part of GEM*]

Goal 4. Reduce child mortality

Target 5 - Reduce by two thirds, between 1990 and 2015, the under-five mortality rate

Indicators

13. Under-five mortality rate (UNICEF-WHO) ✓
14. Infant mortality rate (UNICEF-WHO)
15. Proportion of 1 year-old children immunized against measles (UNICEF-WHO)

Goal 5. Improve maternal health

Target 6 - Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio

Indicators

16. Maternal mortality ratio (UNICEF-WHO)
17. Proportion of births attended by skilled health personnel (UNICEF-WHO)

Goal 6. Combat HIV/AIDS, malaria and other diseases

Target 7 - Have halted by 2015 and begun to reverse the spread of HIV/AIDS

Indicators

18. HIV prevalence among pregnant women aged 15-24 years (UNAIDS-WHO-UNICEF)
19. Condom use rate of the contraceptive prevalence rate (UN Population Division) ✓
    19a. Condom use at last high-risk sex (UNICEF-WHO)
    19b. Percentage of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS (UNICEF-WHO)
    19c. Contraceptive prevalence rate (UN Population Division)
20. Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years (UNICEF-UNAIDS-WHO)

Target 8 - Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

Indicators

21. Prevalence and death rates associated with malaria (WHO)
22. Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures (UNICEF-WHO)
23. Prevalence and death rates associated with tuberculosis (WHO)
24. Proportion of tuberculosis cases detected and cured under DOTS (internationally recommended TB control strategy) (WHO)

The Millennium Indicators Database (UNDESA 2005)

Goal 7 - Ensure environmental sustainability

Target 9 - Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Indicators

25. Proportion of land area covered by forest (FAO) ✓
26. Ratio of area protected to maintain biological diversity to surface area (UNEP-WCMC) ✓
27. Energy use (kg oil equivalent) per $1 GDP (PPP) (IEA, World Bank) ✓
28. Carbon dioxide emissions per capita ✓ (UNFCCC, UNSD) and consumption of ozone-depleting CFCs (ODP tons) (UNEP-Ozone Secretariat) ✓
29. Proportion of population using solid fuels (WHO)

Target 10 - Halve, by 2015, the proportion of people without sustainable access to safe drinking water and sanitation

Indicators

30. Proportion of population with sustainable access to an improved water source, urban and rural (UNICEF-WHO) ✓
31. Proportion of population with access to improved sanitation, urban and rural (UNICEF-WHO) ✓

Target 11 - By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers

Indicators

32. Proportion of households with access to secure tenure (UN-HABITAT) ✓★

Goal 8 - Develop a global partnership for development

Indicators for targets 12-15 are given below in a combined list.

Target 12 - Develop further an open, rule-based, predictable, non-discriminatory trading and financial system. Includes a commitment to good governance, development and poverty reduction - both nationally and internationally

Target 13 - Address the special needs of the least developed countries. Includes: tariff and quota-free access for least developed countries' exports; enhanced programme of debt relief for heavily indebted poor countries (HIPC) and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction

Target 14 - Address the special needs of landlocked developing countries and small island developing States (through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly)

Target 15 - Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term

Some of the indicators listed below are monitored separately for the least developed countries (LDCs), Africa, landlocked developing countries (LLDCs) and small island

The Millennium Indicators Database (UNDESA 2005)

developing States (SIDS)

Indicators

Official development assistance (ODA) ✓
33. Net ODA, total and to LDCs, as percentage of OECD/Development Assistance Committee (DAC) donors' gross national income (GNI)(OECD)
34. Proportion of total bilateral, sector-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation) (OECD)
35. Proportion of bilateral ODA of OECD/DAC donors that is untied (OECD)
36. ODA received in landlocked developing countries as a proportion of their GNIs (OECD)
37. ODA received in small island developing States as proportion of their GNIs (OECD)

Market access
38. Proportion of total developed country imports (by value and excluding arms) from developing countries and from LDCs, admitted free of duty (UNCTAD, WTO, WB)
39. Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries (UNCTAD, WTO, WB) ✓★
40. Agricultural support estimate for OECD countries as percentage of their GDP (OECD)
41. Proportion of ODA provided to help build trade capacity (OECD, WTO)

Debt sustainability
42. Total number of countries that have reached their Heavily Indebted Poor Countries Initiative (HIPC) decision points and number that have reached their HIPC completion points (cumulative) (IMF-World Bank)
43. Debt relief committed under HIPC initiative (IMF-World Bank)
44. Debt service as a percentage of exports of goods and services (IMF-World Bank) ✓

Target 16 - In cooperation with developing countries, develop and implement strategies for decent and productive work for youth

Indicators
45. Unemployment rate of young people aged 15-24 years, each sex and total (ILO) ✓

Target 17 - In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries

Indicators
46. Proportion of population with access to affordable essential drugs on a sustainable basis (WHO)

Target 18 - In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

Indicators
47. Telephone lines and cellular subscribers per 100 population (ITU) ✓
48. Personal computers in use per 100 population and Internet users per 100 population (ITU)✓

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: United Nations Department of Economic and Social Affairs (UNDESA). (2004). "Progress towards the Millennium Development Goals, 1990-2004 (unofficial working paper)." United Nations, New York.

URL: http://millenniumindicators.un.org/unsd/mi/mi_coverfinal.htm (accessed on 04/09/06).

A4.3 Sustainability Impact Assessment (SIA)

Since 1999, the Director-General of Trade for the European Commission (EC) has been leading the development and implementation of the Sustainability Impact Assessment (SIA) framework (EC 2004b). The SIA is designed to support trade negotiations with the objective of widening the focus of the negotiations beyond trade-only considerations to include broader concerns of sustainable development.

The table below presents the SIA framework and shows which of the 'second tier' indicators correspond to those included in the original UNCSD indicator framework. None of the indicators shown below relate to *new* indicators included in the Hall-revised UNCSD framework.

Core and Second Tier Target and Process Sustainability Indicators (EC 2004b, p. 32)

Indicator	Core	Second Tier
A. Target		
Economic	Real income	savings, consumption expenditure
	Fixed capital formation	economic ✓, other (social ✓, environmental ✓) components of fixed capital formation
	Employment	self-employment; informal sector employment ✓
Social	Poverty	income and other social dimensions of poverty ✓
	Health and education	life expectancy; ✓ mortality rates; ✓ nutritional levels; ✓ literacy rates; ✓ primary, secondary and tertiary enrolment rates ✓
	Equity	income distribution; ✓ gender; other disadvantaged age-related groups (young, old); indigenous peoples, ethnic minorities
Environment	Biodiversity	designated eco-systems, ✓ endangered species ✓
	Environmental quality	air [*e.g., greenhouse gas emissions and other pollutants*], ✓ water [*e.g., BOD, COD*], ✓ and land quality [*e.g., use of fertilizers*] ✓ indicators
	Natural resource stocks	energy resources; other non-renewable and renewable resources ✓★
B. Process	Consistency with principles of sustainable development	polluter pays; user pays; precautionary principles
	Institutional capacities to implement sustainable development strategies	sustainable development mainstreamed and integrated into policy-making; high-level ownership and commitment to sustainable development objectives

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: European Commission (EC). (2004). "Sustainability Impact Assessment (SIA) Methodology: Towards an upgrade in 2004. SIA Methodology: Consultation Paper." European Commission, Directorate-General for Trade, Brussels.

URL: http://trade-info.cec.eu.int/consultations/documents/consul_114.pdf (accessed on 04/09/06).

A4.4 World Bank Key World Development Indicators

The World Bank provides one of the most comprehensive data sets that monitors development throughout the world. The *World Development Indicators* (WDI), published annually, consists of some 800 indicators in 87 tables that are organized into six sections: People, Environment, Economy, States and Markets, Global Links, and World View (World Bank 2004). While it is clearly not practical to compare the entire WDI database with the Hall-revised UNCSD indicator framework, it is possible to focus on a set of key indicators.

Under the 'Quick Reference Tables' section of the WDI online database (http://www.worldbank.org/data/), the World Bank presents a set of 'Key Indicators' that focus specifically on regional comparisons under five of its six sections - i.e., People, Environment, Economy, States and Markets, and Global Links. The headings of the table presented under each section are shown below. The indicators in the table that correspond to those included in the original and Hall-revised UNCSD indicator frameworks have been marked. It is clear that there is a strong overlap between the indicator frameworks.

People

Population ✓		Life		Youth literacy rate ✓		Child	Prevalence
	average annual	expectancy ✓ at birth	Under-5 ✓ mortality rate	Male	Female	malnutrition ✓ % under-	of HIV, female % ages
millions	growth %	years	per 1,000	% ages 15-24	% ages 15-24	weight	15-24
2002	1980-2002	2002	2002	2002	2002	1996-2002[a]	2001

Source: (World Bank 2004)

Environment

Surface area	Freshwater resources	Forest area ✓	Average annual de-	Energy use per capita ✓	CO_2 emissions ✓	Access to improved sanitation ✓	Access to improved water ✓
thousand sq. km	cubic meters per capita	% of total land area	forestation %	kg of oil equivalent	per capita metric tons	facilities %	source %
2002	2000	2000	1990-2000	2001	2000	2000	2000

Source: (World Bank 2004)

Economy

GNI	GNI per capita ✓		GDP per capita ✓		Gross	Exports of	Public and publicly
Atlas method[b]	Atlas[b]	PPP[c]	Average annual real	Services	capital formation	goods and services ✓	guaranteed debt service to exports
$ billions	$	$	growth %	% of GDP	% of GDP	$ millions	%
2002	2002	2001	2001-02	2002	2002	2002	2001

Source: (World Bank 2004)

States and Markets

Stock market capitalization $ millions 2003	Military ✓★ expenditures % of GDP 2002	Expenditures ✓ for R&D % of GDP 1996-2002[a]	Fixed line and mobile phone subscribers ✓ per 1,000 people 2002	Euromoney credit worthiness rating 100=low risk Sept. 2003	High-technology exports % of manufac-tured exports 2002	PCs per 1,000 people ✓ 2002	Paved roads % of total 1995-2001[a]

Source: (World Bank 2004)

Global Links

Trade in goods ✓ % of GDP 2002	Net private capital flows $ millions 2002	Total external debt ✓ $ millions 2002	Foreign direct investment $ millions 2002	Net aid flows ✓ [ODA] Total $ millions 2002	% of GNI 2002	per capita $ 2002	International tourism arrivals thousands 2002

Source: (World Bank 2004)

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: World Bank. (2004). "Key Indicators: Regional Data from the World Development Indicators Database." World Bank Publications, Washington, D.C.

URL: http://www.worldbank.org/data/databytopic/reg_wdi.pdf (accessed on 02/18/05).

A4.5 Vital Signs 2003 - Worldwatch Institute

Over the past decade the Worldwatch Institute has produced its annual *Vital Signs* report that tracks a number of important trends affecting the environment, economy, and society (Worldwatch Institute 2003). While a few of the indicators used in the publication vary from year to year, the core subject areas and topics assessed remain relatively constant.

The table below presents the contents of the *Vital Signs 2003* report and shows how the key indicator categories relate to indicators included in the original and Hall-revised UNCSD frameworks.

Vital Signs 2003: Table of Contents (Worldwatch Institute 2003)

PART ONE: Key Indicators	PART TWO: Special Features
Food Trends — Grain Production Drops — Meat Production and Consumption Grow **Energy and Atmosphere Trends** — Fossil Fuel Use Up — Nuclear Power Rises — Wind Power's Rapid Growth Continues — Carbon Emissions and Temperature Climb ✓ **Economic Trends** — Economic Growth Inches Up ✓ — Foreign Debt Declines ✓ — Advertising Spending Stays Nearly Flat ✓★ — Tourism Growing but Still Shaky — World Heritage Sites Rising Steadily **Transportation and Communications Trends** — Vehicle Production Inches Up — Bicycle Production Seesaws — Communications Networks Expand — Semiconductor Sales Rebound Slightly **Health and Social Trends** — Population Growth Slows ✓ — HIV/AIDS Pandemic Spreads Further — Cigarette Production Dips Slightly **Military Trends** — Violent Conflicts Continue to Decline ✓★ — Peacekeeping Expenditures Down Slightly ✓★	**Environmental Features** — Birds in Decline ✓ — Small Islands Threatened by Sea Level Rise **Economic Features** — Rich-Poor Divide Growing — Gap in CEO-Worker Pay Widens — Severe Weather Events on the Rise **Resource Economics Features** — High Farm Subsidies Persist — Harvesting of Illegal Drugs Remains High **Health and Social Features** — Number of Refugees Drops — Alternative Medicine Gains Popularity — Maternal Deaths Reflect Inequities — Consumption Patterns Contribute to Mortality — Orphans Increase Due to AIDS Deaths **Military and Governance Features** — Corruption Thwarts Development — International Criminal Court Starts Work — Military Expenditures on the Rise ✓★ — Resource Wars Plague Developing World

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Worldwatch Institute. (2003). *Vital Signs 2003: Trends that are shaping our future*, W. W. Norton & Company, New York.
URL: http://www.worldwatch.org/pubs/vs/2003/ (accessed on 04/09/06).

A4.6 Calvert-Henderson Quality of Life Indicators

The Calvert-Henderson quality of life indicators are the culmination of six years of research focused on how to measure quality of life in the U.S. (Henderson et al. 2000). The box below presents the 12 indicators along with their supporting indicators. The supporting indicators that are identical or similar to those included in the original and Hall-revised UNCSD indicator frameworks have been marked.

The 12 Calvert-Henderson Indicators [860]

— **Education Indicator** summarizes the quantity, quality and distribution of education in the U.S. defined as life-long learning and contributes to the broader dialogue on who learns what, where, when, and how throughout the life cycle.
  - *Key supporting indicators: educational attainment✓; education expenditures✓★; literacy rate✓; access; distribution; segregation; discrimination; life-long learning✓; alternative education* http://www.calvert-henderson.com/edu.htm

— **Employment Indicator** describes the structure of employment in the U.S. as developed by the government and amended by private research efforts and helps clarify basic questions as to what constitutes "employment" and "unemployment" and what it means when figures fluctuate over time.
  - *Key supporting indicators: civilian population in the labor force - employed✓★ and unemployed✓; civilian population not in the labor force - volunteer and unpaid workers✓★; and discouraged workers✓★* http://www.calvert-henderson.com/employ.htm

— **Energy Indicator** describes how much and how efficiently energy is consumed in the U.S. and provides feedback to the public on what can be done to reduce the environmental impact of energy consumption.
  - *Key supporting indicators: GDP per capita✓; population✓; energy/GDP✓; energy consumption✓; carbon intensity; and total carbon emissions✓* http://www.calvert-henderson.com/energy.htm

— **Environment Indicator** presents detailed information on the health of our environment with a special emphasis on the production-consumption process. A research focus on water and air quality offers data of primary interest to the general public.
  - *Key supporting indicators: water quality✓; air quality✓* http://www.calvert-henderson.com/enviro.htm

— **Health Indicator** initiates a discussion on what constitutes "health" and examines the overall state of health of the people in America by age, race and gender.
  - *Key supporting indicators: infant mortality✓ (by mother's race/ethnicity/education and by geographic location); percent of population with poor health (by race/ethnicity and income); life expectancy at birth✓* http://www.calvert-henderson.com/health.htm

— **Human Rights Indicator** examines the degree to which the Bill of Rights is protecting U.S. citizens and the level of citizen participation in the electoral process.
  - *Key supporting indicators: prisoners under sentence of death by race; prisoner executions by civil authority; percentage of population who voted during presidential election years; resident population by race (American Indian, Eskimo, and Aleut); number of poor and poverty rate by race* http://www.calvert-henderson.com/humanr.htm

— **Income Indicator** focuses on changes in the standard of living as reflected in monetary measures of family income. The indicator examines and explains trends in the level and distribution of family income and wealth along with stagnant and unequal wage growth over the past 25 years.

[860] See Calvert-Henderson Quality of Life Indicators, http://www.calvert-henderson.com/ (accessed on 04/09/06).

The 12 Calvert-Henderson Indicators [860]

- *Key supporting indicators: family income (by income group); wages✓★ (male/female and by wage percentile); wage inequality✓★* http://www.calvert-henderson.com/income.htm

— **Infrastructure Indicator** explains the importance of the physical infrastructure to our economy and provides an example of how to supplement our national accounts with an improved asset account to monitor our physical stock.

- *Key supporting indicator: annual change in per capita public and private infrastructure capital stocks✓★* http://www.calvert-henderson.com/infra.htm

— **National Security Indicator** explains the process our nation takes to achieve a state of national military security beginning with the President's National Security Strategy through the Congressional Budget Process. This includes both a diplomatic strategy and a military strategy, all of which are affected by public opinion and the perceived threat to security.

- *Key supporting indicators: names and dates of international treaties since 1948✓★; major armed conflicts✓★; value of world arms transfer deliveries; worldwide military expenditures✓★; completed peacekeeping missions✓★; current peacekeeping missions✓★; international terrorist incidents; casualties caused by international terrorism* http://www.calvert-henderson.com/natsec.htm

— **Public Safety Indicator** examines how effectively our society promotes private and public safety when faced with complex interrelationships between personal decisions, public actions, risks, and hazards in the environment that result in deaths from injuries.

- *Key supporting indicators: death rates from injuries (by cause)✓★ and infectious diseases; years of potential life lost before age 65 (by cause of death); death rates from motor vehicle crashes and firearms* http://www.calvert-henderson.com/pubsaf.htm

— **Re-creation Indicator** provides a novel approach to identifying the myriad ways that Americans chose to re-create the self, to be revitalized in body and mind, and to reestablish social contacts through leisure and/or recreational activities.

- *Key supporting indicators cover 13 areas: improvement of self or society; religious activities; patronized arts; amateur arts; hobbies; physical activity; attendance of spectator sports; vicarious (media) experiences; virtual recreation; socializing; recreational drugs; gambling; recreational travel for enjoyment or self improvement* http://www.calvert-henderson.com/recreat.htm

— **Shelter Indicator** explores the type of housing Americans have access to, the level of affordability of that housing, and how housing in turn affects broader social outcomes.

- *Key supporting indicators: homeownership rate✓; overcrowding of units✓; units lacking complete plumbing facilities; rental cost burdens; population of 100 largest cities living in extreme poverty neighborhoods* http://www.calvert-henderson.com/shelter.htm

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Henderson, H., Lickerman, J., and Flynn, P. (2000). "Calvert-Henderson Quality of Life Indicators: A New Tool for Assessing National Trends." Calvert Group, Ltd., Bethesda.

URL: http://www.calvert-henderson.com/ (accessed on 04/09/06).

A4.7 Meadows (1998) - Indicators for Sustainable Development

The box below presents a series of ten broad types of indicators that the late Donella Meadows (1998) argued should be considered when measuring sustainability. Interestingly, none of the indicators correspond to those included in the original UNCSD indicator framework. However, six of the ten indicators have been included in the Hall-revised UNCSD framework.

Meadow's Preliminary List of Ten Indicators of Sustainable Development
(Meadows 1998, p. 75)

— Ecological footprint and rate of change ✓★
— Aggregate measures of natural ✓★, built ✓★, human ✓★, and social ✓★ capital and rate of change
— Real well-being ✓★ - measured by survey data if necessary - and rate of change
— Physical throughput ✓★/well-being
— Four kinds of capital ✓★/well-being
— Built capital balances
— Most limiting sources and sinks and rates of change
— Most critical respite/response areas
— Untouched natural areas and rates of change ✓★
— Something wacky and human - smiles on faces on the street, hugs per day, clowns per capita

Key:
✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Meadows, D. H. (1998). "Indicators and Information Systems for Sustainable Development. A Report to the Balaton Group." The Sustainability Institute, Hartland.
URL: http://www.nssd.net/pdf/Donella.pdf (accessed on 04/09/06).

A4.8 Ashford et al. (2002) - Pathways to Sustainable Industrial Transformations

In 2002, an interdisciplinary group of researchers from the U.S. and the Netherlands undertook a study to rethink the practice of addressing negative environmental and employment externalities *after* the process of industrialization had been established (Ashford et al. 2002). The study developed three case studies that explored "*possible future industrial transformations in which improvements in competitiveness, environment, and employment are simultaneously achieved*" (ibid, p. 1). By co-optimizing (or integrating) these three important components of sustainable development, it is believed that the industrialization process would not only grow a strong, competitive economy, but also provide secure employment and a healthy environment.

The indicators used to measure the transformation process present a different view on what needs to be measured if sustainable industrial transformations are to be achieved. The box below presents the indicators used in the 'Pathways' project and shows which of them are included in the Hall-revised UNCSD indicator framework.

Category	Indicator
Environment	— Biodiversity — Climate change — Eco-efficiency — Waste production & treatment — Pollution
Competitiveness (market share)	— Lower cost (inherent) ✓★ — Lower cost (derived from environmental or social factors) ✓★ — Better performance ✓★
Employment	— Health and safety ✓★ — Skill enhancement/creativity of job ✓★ — Job satisfaction psychosocial factors ✓★ — Purchasing power/wages ✓★ — Job security ✓★ — Number of jobs ✓★

Key:
✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Ashford, N. A., Hafkamp, W., Prakke, F., and Vergragt, P. (2002). "Pathways to Sustainable Industrial Transformations: Cooptimising Competitiveness, Employment, and Environment." Ashford Associates, Cambridge.

A5 Partial Sets of Indicators

A5.1 Environmental

A5.1.1 EU Environment Related Indicators 2004 - European Commission

The European Commission recently published a list of 10 environment related indicators (EC 2004a). The leaflet provides a good example of how a wide range of data can be clearly displayed. However, when compared to the OECD set of *Core Environmental Indicators*, the limitations of a condensed set of indicators becomes evident. For example, environmental problems associated with the use of forest resources, the thinning of the ozone layer, and toxic pollution are not covered. The indicators that are related to the original UNCSD indicator framework have been marked (✓). None of the indicators shown below relates to *new* indicators included in the Hall-revised UNCSD framework.

1. **Public Opinion**
   — Two questions are asked: Is the environment as important as economic and social issues? Is enough importance given to the environment?
2. **Climate Change - Greenhouse Gas Emissions**
   — Indicator: Percent change in greenhouse gas emissions based upon 1990 emissions levels ✓
3. **Energy Intensity**
   — Indicator: Energy used per 1000 Euros of GDP ✓
4. **Electricity from Renewables**
   — Indicator: Percent of EU electricity that is obtained from renewable sources ✓
5. **Biodiversity - Bird Populations**
   — Indicator: Percent change in wetland, woodland, and farmland bird populations ✓
6. **Fisheries - Catches Outside Safe Limits**
   — Indicator: Weight of fish catches within and outside safe limits - millions of tons ✓
7. **Organic Farming**
   — Indicator: Percent of EU agricultural area that is used for organic farming
8. **Transport**
   — Indicator: Growth in passenger and freight volumes compared to growth in GDP ✓
9. **Air Emissions**
   — Indicator: Amount of sulfur dioxide (SO_2) and nitrogen oxides (NOx) produced each year - millions of tons ✓
10. **Urban Air Quality**
    — Indicator: Percent of population overexposed to particulate matter (PM_{10}) and ozone ✓

Reference: European Commission (EC). (2004). "EU Environment Related Indicators 2004." European Communities, Belgium.
URL: http://europa.eu.int/comm/environment/docum/pdf/leaflet_environment.pdf (accessed on 04/09/06).

A5.2 Social

A5.2.1 LABORSTA Internet Indicators - International Labor Organization (ILO)

The International Labor Organization (ILO) provides a series of statistics relating to labor that can be accessed using the LABORSTA online database (ILO 2005). The table below shows the structure of the LABORSTA indicators and has been marked to show which indicators are identical or similar to those included in the original UNCSD (✓) and Hall-revised UNCSD (✓★) indicator frameworks.

Description of the indicators[861]
For Yearly Data — Economically active population — Employment ✓★ — Unemployment ✓ — Hours of work — Wages ✓★ ← *Combined in revised UNCSD indicator framework* — Labour cost — Consumer price indices ✓★ — Occupational injuries ✓★ — Strikes and lockouts
For Periodical Data — Employment ✓★ — Unemployment ✓ — Hours of work — Wages ✓★ — Consumer price indices ✓★
For October Inquiry Data — Occupational wages and hours of work — Retail prices of selected food items
For Segregat Data — Data on employment by sex and detailed occupational groups
For ILO-Comparable Estimates — ILO-Comparable estimates - adjusted annual average employment and unemployment estimates
For Public Sector Data — ILO public sector employment

Key:
✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.
✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: International Labor Organization (ILO). (2005). "LABORSTA Internet." ILO, Geneva.
URL: http://laborsta.ilo.org/ (accessed on 04/09/06).

[861] Source: International Labor Organization (ILO), *LABORSTA online database*, http://laborsta.ilo.org/ (accessed on 04/09/06).

A5.2.2 Social Capital - World Bank

In 1997, the World Bank prepared a report - *Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development* - which explored a wide range of indicators of sustainable development. While the report covers ways to measure *built* (or human-made), *natural*, and *human capital* (all of which have been included in the Hall-revised UNCSD indicator framework) it is widely credited for its treatment of the relatively new topic (at that time) of *social capital*.

The box below presents the indicators of social capital that were presented in the report. Since the topic of social capital is clearly very broad and rests upon social and cultural norms, no one indicator has been selected for the Hall-revised UNCSD indicator framework. Instead, it is recommended that each nation use the indicators presented below as a guide to generate an indicator, or set of indicators, to measure their own level of social capital.

Indicators of Social Capital ✓★ (World Bank 1997, p. 88)

The following indicators have all been used in empirical studies. Indicators of horizontal associations take a microperspective and typically have been collected for analysis within a country. The other sets of indicators have been calculated at the national level and have been used in cross-country research.

Horizontal associations

- — Number and type of associations or local institutions
- — Extent of membership
- — Extent of participatory decisionmaking
- — Extent of kin homogeneity within the association
- — Extent of income and occupation homogeneity within the association
- — Extent of trust in village members and households
- — Extent of trust in trade unions
- — Perception of extent of community organization
- — Reliance on networks of support
- — Percentage of household income from remittances
- — Percentage of household expenditure for gifts and transfers
- — Old-age dependency ratio on government

Civil and political society

- — Index of civil liberties (Gastil, Freedom House)
- — Percentage of population facing political discrimination
- — Index of intensity of political discrimination
- — Percentage of population facing economic discrimination
- — Index of intensity of economic discrimination
- — Percentage of population involved in separatist movements
- — Gastil's index of political rights
- — Freedom House index of political freedoms
- — Index of democracy
- — Index of corruption
- — Index of government inefficiency
- — Strength of democratic institutions
- — Measure of "human liberty"
- — Measure of political stability
- — Degree of decentralization of government
- — Voter turnout
- — Political assassinations
- — Constitutional government changes
- — Coups

Social integration

- — Indicator of social mobility
- — Measure of strength of "social tensions"
- — Ethnolinguistic fragmentation
- — Riots and protest demonstrations
- — Strikes
- — Homicide rates
- — Suicide rates
- — Other crime rates
- — Prisoners per 100,000 people
- — Illegitimacy rates
- — Percentage of single-parent homes
- — Divorce rate
- — Youth unemployment rate

Legal and governance aspect

- — Quality of bureaucracy
- — Independence of court system
- — Expropriation and nationalization risk (currency/M2)
- — Repudiation of contracts by government
- — Contract enforceability
- — Contract-intensive money

Key:

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: World Bank. (1997). "Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development." World Bank, Washington, D.C.

URL: http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000009265_3971113150949 (accessed on 04/09/06).

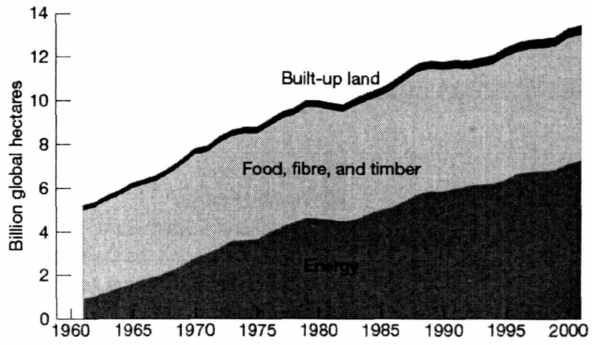
A5.3 Issue Based

A5.3.1 Ecological Footprint (EF)

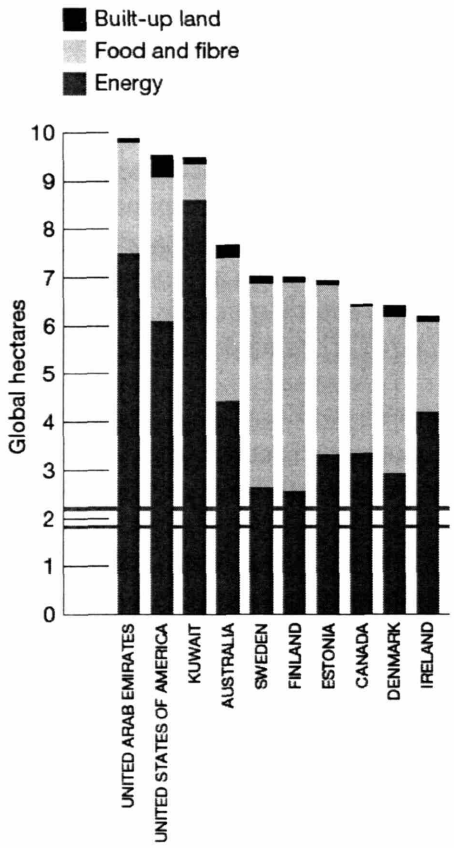
The premise behind the measurement of ecological footprint is relatively simple. The metric attempts to translate human activity into the corresponding ecological area (or biological capacity) required to sustain that activity (Wackernagel 2001). More specifically, an ecological footprint "*represent*[s] *the biologically productive area required to produce the food and wood people consume, to supply space for infrastructure, and to absorb the greenhouse gas carbon dioxide (CO2) emitted from burning fossil fuels*" (Wackernagel et al. 2002).

The calculation of ecological footprints is constantly evolving as new data becomes available and the methodology is refined over time. Today, a number of websites enable individuals to calculate their ecological footprint based upon their geographic location and lifestyle (e.g., the Ecological Footprint Quiz: http://www.ecofoot.org/ [accessed on 04/09/06]).

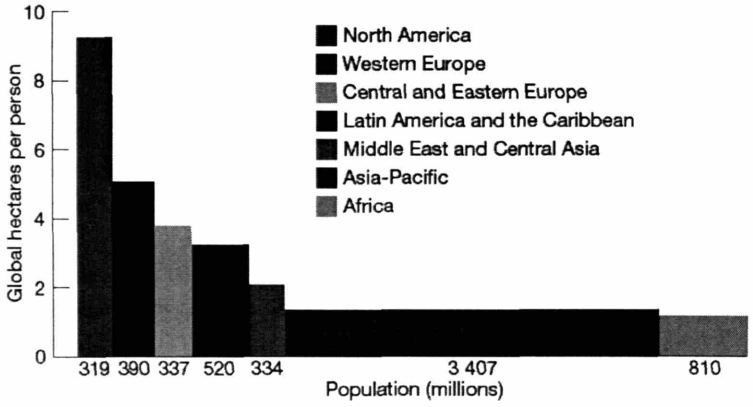
The ecological footprint index has been added to the original UNCSD indicator framework to provide a useful indicator of the environmental impact of a nation's way of living. The three graphs shown below provide an example of how ecological footprint data can be displayed. These graphs were extracted from the World Wildlife Fund's (WWF's) *Living Planet Report 2004* (WWF 2004). [Note: a global hectare corresponds to one hectare of biologically productive space with an average level of world productivity (Wackernagel et al. 2002).]



Humanity's Ecological Footprint, 1961-2001 (WWF 2004, p. 10)



Ecological Footprint per Person, by Country, 2001 [*the top ten consumers are shown*] (WWF 2004, p. 10)



Ecological Footprint by Region, 2001 (WWF 2004, p. 10)

A5.3.2 Urban Sprawl - Smart Growth America

In 2002, Smart Growth America (SGA) - a coalition of some 100 advocacy organizations connected to the development of metropolitan areas - concluded a three year study aimed at identifying a suitable way of measuring sprawl (Ewing et al. 2002).

'Sprawl' is defined as the "*process in which the spread of development across the landscape far outpaces population growth. The landscape sprawl creates has four dimensions: a population that is widely dispersed in low-density development; rigidly separated homes, shops, and workplaces; a network of roads marked by huge blocks and poor access; and a lack of well-defined, thriving activity centers, such as downtowns and town centers*" (ibid, p. 3).

In developing a suitable index to measure sprawl, the research group arrived at four measurable factors: residential density; neighborhood mix of homes, jobs, and services; strength of activity centers and downtowns; and accessibility of the street network (ibid, p. 3). Each factor is supported by several component indicators, some 22 in total. Using data from 83 metropolitan areas from across the U.S., the sprawl index provides a useful way to measure sprawl and to identify which factors appear to be driving change.

The indicator of urban sprawl has been added to the Hall-revised UNCSD framework since it provides a valuable way to track the development of urban form and its associated impact on quality of life.

Reference: Ewing, R., Pendall, R., and Chen, D. (2002). "Measuring Sprawl and its Impact." Smart Growth America, Washington, D.C.
URL: http://www.smartgrowthamerica.org/sprawlindex/MeasuringSprawl.PDF (accessed on 04/09/06).

A6 Causal Indicator Frameworks

A6.1 Core Environmental Indicators (CEI) - OECD

The Organisation for Economic Co-operation and Development (OECD) uses a number of indicator sets to track environmental progress and performance (OECD 2003). First are the *Core Environmental Indicators* (CEI), a set of some 50 indicators agreed upon by OECD countries. The CEI are designed to cover the major environmental concerns facing OECD members and have been developed following the Pressure-State-Response (PSR) model. Second are the *Key Environmental Indicators* (KEI), a more condensed set of indicators (from the CEI) designed to inform the public and guide decision-makers. Third are the *Sectoral Environmental Indicators* (SEI), a series of indicator sets based upon the CEI that attempts to integrate environmental concerns into decision-making within each of the major sectors (such as transportation, housing, energy, etc.). Fourth are the *indicators derived from environmental accounting* that present environmental concerns in a manner that facilitates economic and natural resource management decisions. The final set of indicators is known as the *Decoupling Environmental Indicators* (DEI). The DEI are designed to measure whether environmental progress and performance is separating from economic growth - i.e., whether environmental impacts are increasing at a smaller rate than economic growth.

The analysis here focuses on the CEI, since they lie at the center of the OECD indicator framework. The table below presents the CEI proposed by the OECD Working Group on Environmental Information and Outlooks (OECD 2003). The checks (✓) mark the indicators that are similar or identical to those in the original UNCSD indicator framework. The majority of the checks shown were marked on the original version of this table; those surrounded by square brackets were added by the author.

OECD Core Environmental Indicators (CEI): Overview of the Core Set by Environmental Issue (OECD 2003, pp. 22-23)

Issue		Core indicators
Climate change	Pressure	**Index of greenhouse gas emissions** ✓ - CO2 emissions - CH4 emissions - N2O emissions - CFC emissions
	Conditions	**Atmospheric concentrations of greenhouse gases; Global mean temperature**
	Responses	**Energy efficiency** - Energy intensity ✓ (total primary energy supply per unit of GDP or per capita) - Economic and fiscal instruments (e.g., prices and taxes, expenditures)
Ozone layer depletion	Pressure	**Index of apparent consumption of ozone depleting substances (ODP)** ✓ - Apparent consumption of CFCs and halons
	Conditions	**Atmospheric concentrations of ODP** **Ground level UV-B radiation** - Stratospheric ozone levels
	Responses	**CFC recovery rate**
Eutrophication	Pressure	Emissions of N and P in water and soil → **Nutrient balance** - N and P from fertilizer use ✓ and from livestock

Issue		Core indicators
	Conditions	**BOD/DO in inland waters, in marine waters** ✓ **Concentration of N & P in inland waters, in marine waters**
	Responses	**Population connected to biological and/or chemical sewage treatment plants** [✓] - Population connected to sewage treatment plants - User charges for waste water treatment - Market share of phosphate-free detergents
Acidification	Pressure	**Index of acidifying substances** - Emissions of NOx and SOx
	Conditions	**Exceedance of critical loads of pH in water and soil** - Concentrations in acid precipitation
	Responses	**% of car fleet equipped with catalytic converters** **Capacity of SOx and NOx abatement equipment of stationary sources**
Toxic contamination	Pressure	**Emissions of heavy metals** **Emissions of organic compounds** - Consumption of pesticides ✓
	Conditions	**Concentration of heavy metals and organic compounds in environmental media and in living species** - Concentration of heavy metals in rivers
	Responses	**Changes of toxic contents in products and production processes** - Market share of unleaded petrol
Urban environmental quality	Pressure	**Urban air emissions (SOx, NOx, VOC)** [✓] - Urban traffic density - Urban car ownership - Degree of urbanisation (urban population growth rates, urban land) ✓
	Conditions	**Population exposure to air pollution, to noise** Concentrations of air pollutants ✓ **Ambient water conditions in urban areas**
	Responses	**Green space** (areas protected from urban development) **Economic, fiscal, and regulatory instruments** - Water treatment and noise abatement expenditure
Biodiversity	Pressure	**Habitat alteration and land conversion from natural state to be further developed** (e.g., road network density, change in land cover, etc.)
	Conditions	**Threatened or extinct species as a share of total species known** ✓ **Area of key ecosystems** ✓
	Responses	**Protected areas as % of national territory** ✓ **and by type of ecosystem** - Protected species
Cultural landscapes		Indicators to be further developed (e.g. ,Presence of artificial elements; Sites protected for historical, cultural, or aesthetic reasons)
Waste	Pressure	**Generation of waste (municipal, industrial, hazardous, nuclear)** ✓ - Movements of hazardous waste
	Responses	**Waste minimisation** (to be further developed) - Recycling rates ✓ - Economic and fiscal instruments, expenditures
Water resources	Pressure	**Intensity of use of water resources** ✓ (abstractions/available resources)
	Conditions	**Frequency, duration, and extent of water shortages**
	Responses	**Water prices and user charges for sewage treatment**
Forest resources	Pressure	**Intensity of forest resource use** ✓ (actual harvest/productive capacity)
	Conditions	**Area** ✓**, volume, and structure of forests**
	Responses	**Forest area management and protection** (e.g., % of protected forest area in total forest area; % of harvest area successfully regenerated of afforested)
Fish resources	Pressure	**Fish catches** ✓
	Conditions	**Size of spawning stocks**

Issue		Core indicators
	Responses	**Fishing quotas**
Soil degradation (desertification and erosion)	Pressure	**Erosion risks: potential and actual use of land for agriculture** - Change in land use
	Conditions	**Degree of top soil losses [✓]**
	Responses	**Rehabilitated areas**
Material resources (new issue)		**Intensity of use of material resources ✓** (Indicators to be developed, link to Material Flow Accounting)
Socio-economic, sectoral and general issues (*not attributed to specific environmental issues*)	Pressure	**Population growth & density ✓** **Growth and structure of GDP ✓** **Private and government final consumption expenditure** **Industrial production** **Structure of energy supply ✓** **Road traffic volumes** **Stock of road vehicles** **Agricultural production**
	Responses	**Environmental expenditure** - Pollution abatement and control expenditure - Official Development Assistance ✓ (indicator added on the basis of experience with environmental performance reviews) **Public opinion**

Key:
✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

Reference: Organisation for Economic Co-operation and Development (OECD). (2003). "OECD Environment Indicators: Development, Measurement, and Use." OECD, Paris.

URL: http://www.oecd.org/dataoecd/7/47/24993546.pdf (accessed on 04/09/06).

A7 Selected National Indicator Frameworks

A7.1 Canada - Sustainability Indicators Initiative

In 2000, Canada's National Round Table on the Environment and the Economy (NRTEE) began its Environment and Sustainable Development Indicators (ESDI) Initiative (NRTEE 2003). The objective of the ESDI initiative was to develop a small set of national indicators to track how economic activity was affecting the environment and other important assets deemed critical to the health of the nation.

The final set of indicators released in 2003 is shown in the box below. The indicators which are identical or similar to those included in the original UNCSD indicator framework have been marked. None of the indicators shown below relate to *new* indicators included in the Hall-revised UNCSD framework.

Six sustainability indicators recommended for Canada by the National Round Table on the Environment and the Economy (NRTEE 2003, pp. xviii - xix)

Air Quality Trend Indicator - tracks the exposure of Canadians to a particularly harmful type of air pollutant - ground-level ozone (O3). ✓

Freshwater Quality Indicator - provides a national measure of the overall state of water quality as measured against major objectives for water use in Canada (such as water for drinking, aquatic life habitat, recreation, and agriculture). ✓

Greenhouse Gas Emissions Indicator – tracks Canada's total annual emissions of greenhouse gases, including carbon dioxide (CO2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. ✓

Forest Cover Indicator - tracks changes in the extent of Canada's forests. ✓

Extent of Wetlands Indicator - tracks changes in the total area of wetlands in Canada. ✓

Human Capital Indicator (Educational Attainment) - tracks the percentage of the workforce population with educational qualifications beyond the secondary school level. ✓

Key:
✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

Reference: National Round Table on the Environment and the Economy (NRTEE). (2003). *The Environment and Sustainable Development Indicators for Canada*, Renouf Publishing Co. Ltd., Ottawa.

URL: http://www.nrtee-trnee.ca/Publications/HTML/Complete-Documents/Report_Indicators_E/ESDI-Report-E.pdf (accessed on 04/09/06).

A7.2 UK - Headline Indicators of Sustainable Development

In 1999, the UK government published *A better quality of life - a strategy for sustainable development in the UK.*[862] An important component of the government's strategy was a set of headline indicators that were designed to track progress towards sustainable development (DEFRA 2004). The headline indicators (shown in the table below) are structured using the three pillars of sustainable development - economic growth (or development), social progress, and environmental protection. Today, these 15 headline indicators are continually updated and are available online.[863]

The measurements supporting the headline indicators that are identical or similar to those used in the original and Hall-revised UNCSD indicator frameworks have been marked.

UK Headline Indicators of Sustainable Development [864]

Indicator	Objective	Measurement
	Economic Growth	
H1: Economic output	Our economy must continue to grow	***Total output of the economy*** ▪ Gross Domestic Product (GDP) ▪ GDP per head of population ✓ [Index: Chained Volume Measures rebased to 1970 = 100]
H2: Investment	Investment (in modern plants and machinery as well as research and development ✓) is vital to our future	***Total investment and social investment relative to GDP*** ▪ Social investment current prices (Index 1977 = 100) ✓★ ▪ Total investment in chained volume measures, reference year 2000 (Index 1970 = 100)
H3: Employment	Maintain high and stable levels of employment so everyone can share greater job opportunities	***Proportion of working age people in employment*** ✓★ ▪ All persons ▪ Men ▪ Women
	Social Progress	
H4: Poverty and Social Exclusion	Tackle poverty and social exclusion	***Indicators of success in tackling poverty and social exclusion*** ▪ Percentage of single elderly households experiencing fuel poverty ▪ Percentage of working age people with no qualifications ▪ Percentage of working age people in workless households ▪ Percentage of children living in low-income

[862] See UK Government (1999) *A Better Quality of Life: A strategy for sustainable development for the United Kingdom*, http://www.sustainable-development.gov.uk/publications/uk-strategy99/index.htm (accessed on 04/09/06).
[863] See Department for Environment, Food and Rural Affairs, *Headline Indicators of Sustainable Development for the UK*, http://www.sustainable-development.gov.uk/indicators/headline/index.htm (accessed on 02/04/05).
[864] Supra note 863.

Indicator	Objective	Measurement
		households (after housing costs) ✓ ▪ Percentage of children living in low-income households (before housing costs) ✓
H5: Education	Equip people with the skills to fulfil their potential	***Qualifications at age 19*** ▪ Percentage of UK population with Level Two qualifications e.g. Five GCSEs at grade C or above ✓
H6: Health	Improve the health of the population overall	***Expected years of healthy life*** Men ▪ Life expectancy ✓ ▪ Healthy life expectancy Women ▪ Life expectancy ✓ ▪ Healthy life expectancy
H7: Housing	Reduce the proportion of unfit housing stock	***Housing*** ▪ All stock ▪ Social ▪ Private [Proportion of households living in non-decent housing]
H8: Crime	Reduce both crime and fear of crime	***Level of crime*** Number of incidents recorded by the British Crime Survey ✓ ▪ Vehicle related thefts ▪ Burglary Total crime recorded by the police ✓ ▪ Theft of or from vehicles ▪ Burglary in dwellings ▪ Robbery
	Environmental Protection	
H9: Climate Change	Continue to reduce our emissions of greenhouse gases now, and plan for greater reductions in the longer term	***Emissions of greenhouse gases*** ✓ ▪ Basket of greenhouse gases ▪ Carbon Dioxide (CO2) [Equivalent weight in Carbon (C) - Million tones]
H10: Air Quality	Reduce air pollution and ensure air quality continues to improve through the longer term	***Days when air pollution is moderate or high*** ✓ ▪ Rural average ▪ Urban average [Average number of days per site]
H11: Road Traffic	Improve choice in transport; improve access to education, leisure, and services; and reduce the need to travel	***Road traffic - volumes and intensity*** ✓ ▪ All motor vehicles ▪ Traffic intensity (traffic km per GDP) [Billion vehicle kilometers]
H12: Water Quality	Improve river quality	***Rivers of good or fair chemical quality*** ✓ ▪ England ▪ Wales ▪ Northern Island ▪ Scotland [Percentage of classified river length] ***Biological river quality*** ✓ ▪ England

Indicator	Objective	Measurement
		▪ Wales ▪ Northern Island ▪ Scotland [Percentage of classified river length]
H13: Wildlife	Reverse the long-term decline in populations of farmland and woodland birds	***Populations of wild birds*** ✓ ▪ All species (111) ▪ Woodland species (33) ▪ Farmland species (19) [Index (1970 = 100)]
H14: Land Use	Re-use previously developed land in order to protect the countryside and encourage urban regeneration	***New homes built on previously developed land*** ▪ Proportion of new homes on previously developed land
H15: Waste	Move away from disposal of waste towards waste reduction, reuse, recycling, and recovery	***Waste arisings and management: UK*** ✓ ▪ Landfill ▪ Other disposal ▪ Other recovery ▪ Energy recovery ▪ Recycling ▪ Total [million tones] ▪ Household waste o waste not recycled/composted o waste recycled/composted [kilograms per person per year]

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

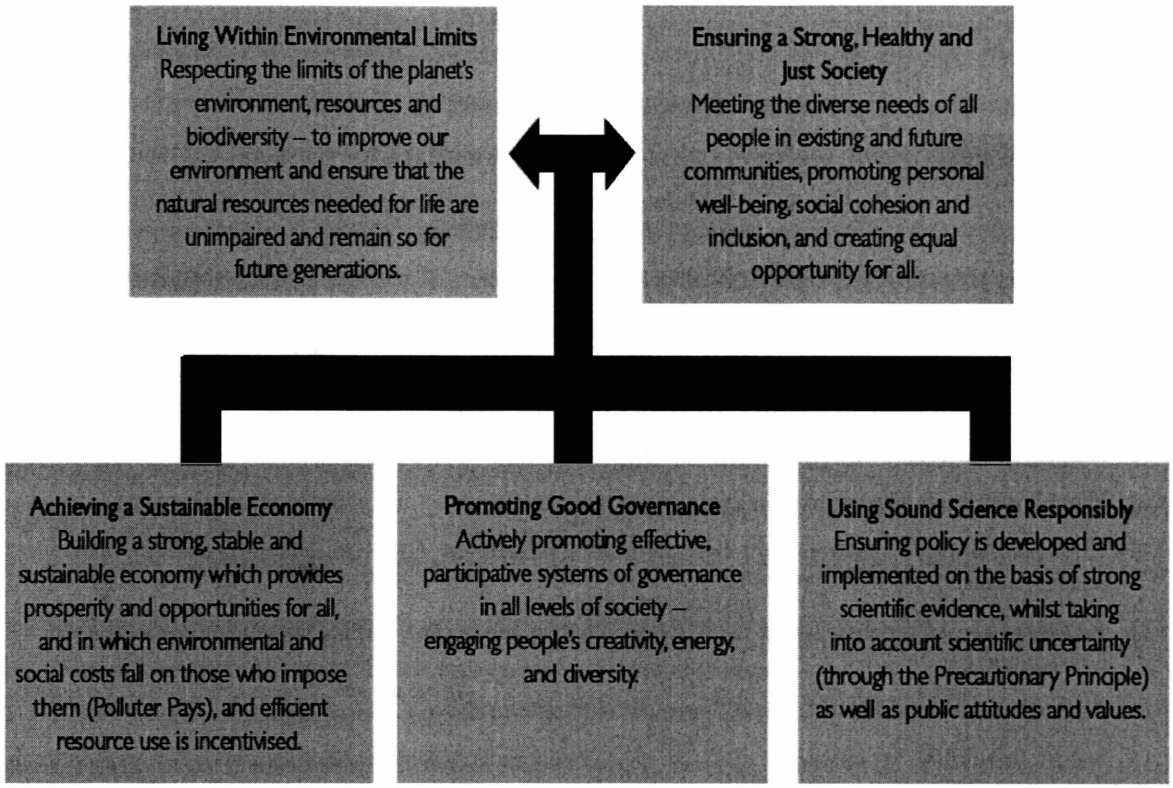
✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Department for Environment Food and Rural Affairs (DEFRA). (2004). "Quality of Life Counts: Indicators for a strategy for sustainable development for the United Kingdom. 2004 Update - Updating the baseline assessments made in 1999." DEFRA, London.

URL: http://www.sustainable-development.gov.uk/sustainable/quality04/maind/pdf/qolc2004.pdf (accessed on 04/09/06).

A7.3 UK Framework Indicators and UK Government Indicators of Sustainable Development

In March 2005, the UK Government, Scottish Executive, Welsh Assembly Government, and the Northern Ireland Administration released a shared vision of sustainable development based upon the five principles shown in the figure below.



Principles That Will Form the Basis for Sustainable Development Policy in the UK (DEFRA 2005a, p. 8)

To support the above vision, a new set of high-level indicators of sustainable development has been introduced - the '*UK Framework Indicators*' - that emphasize 20 priority areas (see the box below). There is clearly a strong overlap between the new UK Framework Indicators and the UK Headline Indicators presented in the previous section. The indicators that are identical or similar to those used in the original and Hall-revised UNCSD indicator frameworks have been marked.

UK Framework Indicators of Sustainable Development (DEFRA 2005a, p. 12)

UK FRAMEWORK INDICATORS
1. **Greenhouse gas emissions**: Kyoto target and CO_2 emissions ✓
2. **Resource use**: Domestic Material Consumption and GDP ✓
3. **Waste**: arisings by (a) sector ✓ (b) method of disposal ✓
4. **Bird populations**: bird population indices (a) farmland birds (b) woodland birds (c) birds of coasts and estuaries ✓
5. **Fish stocks**: fish stocks around the UK within sustainable limits ✓
6. **Ecological impacts of air pollution**: area of UK habitat sensitive to acidification and eutrophication with critical load exceedences
7. **River quality**: rivers of good (a) biological ✓ (b) chemical quality ✓
8. **Economic output**: Gross Domestic Product ✓
9. **Active community participation**: civic participation, informal and formal volunteering at least once a month
10. **Crime**: crime survey and recorded crime for (a) vehicles ✓ (b) domestic burglary ✓ (c) violence ✓
11. **Employment**: people of working age in employment ✓★
12. **Workless households**: population living in workless households ✓ (a) children (b) working age
13. **Childhood poverty**: children in relative low-income households ✓ (a) before housing costs (b) after housing costs
14. **Pensioner poverty**: pensioners in relative low-income households ✓ (a) before housing costs (b) after housing costs
15. **Education**: 19 year-olds with Level Two qualifications and above ✓
16. **Health inequality**: (a) infant mortality (by socio-economic group) ✓ (b) life expectancy (by area) for men and women ✓
17. **Mobility**: (a) number of trips per person by mode (b) distance travelled per person per year by broad trip purpose ✓
18. **Social justice**: (social measures to be developed)
19. **Environmental equality**: (environmental measures to be developed)
20. **Well being**: (well being measures to be developed if supported by the evidence) ✓★

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

In addition to these 20 UK Framework Indicators, the UK Government has developed an additional 48 indicators as part of its national strategy (DEFRA 2005b). The table below presents the UK Government's 68 indicators of sustainable development (the 20 UK Framework Indicators are underlined). Again, the indicators that are identical or similar to those used in the original and Hall-revised UNCSD indicator frameworks have been marked.

UK Government's Indicators of Sustainable Development (DEFRA 2005b, pp. 168-175)

UK GOVERNMENT SUSTAINABLE DEVELOPMENT INDICATORS
1. **Greenhouse gas emissions**: Kyoto target and CO_2 emissions ✓
2. **CO2 emissions by end user**: industry,✓ domestic,✓ transport ✓ (excluding international aviation), other
3. **Aviation and shipping emissions**: greenhouse gases from UK-based international aviation ✓ and shipping fuel bunkers ✓
4. **Renewable electricity**: renewable electricity generated as a percentage of total electricity ✓
5. **Electricity generation**: electricity generated, CO_2,✓ NO_x,✓ and SO_2✓ emissions by electricity generators and GDP
6. **Household energy use**: domestic CO_2 emissions ✓ and household final consumption expenditure
7. **Road transport**: CO_2,✓ NO_x,✓ PM_{10}✓ emissions and GDP
8. **Private vehicles**: CO_2 emissions ✓ and car-km and household final consumption expenditure
9. **Road freight**: CO_2 emissions ✓ and tonne-km, tonnes, and GDP
10. **Manufacturing sector**: CO_2,✓ NO_x,✓ SO_2,✓ PM_{10}✓ emissions and GVA
11. **Service sector**: CO_2,✓ NO_x✓ emissions and GVA
12. **Public sector**: CO_2,✓ NO_x✓ emissions and GVA
13. **Resource use**: Domestic Material Consumption and GDP ✓
14. **Energy supply**: UK primary energy supply and gross inland energy consumption
15. **Water resource use**: total abstractions from non-tidal surface and ground water sources and GDP ✓
16. **Domestic water consumption**: domestic water consumption per head
17. **Water stress**: (*to be developed to monitor the impacts of water shortages*)
18. **Waste**: arisings by (a) sector ✓ (b) method of disposal ✓
19. **Household waste**: (a) arisings ✓ (b) recycled ✓ or composted
20. **Bird populations**: bird population indices (a) farmland birds ✓ (b) woodland birds ✓ (c) birds of coasts and estuaries ✓ (d) wintering wetland birds ✓
21. **Biodiversity conservation**: (a) priority species status ✓ (b) priority habitat status ✓
22. **Agriculture sector**: fertiliser input,✓ farmland bird population, and ammonia and methane emissions and output
23. **Farming and environmental stewardship**: (*to be developed to monitor progress in new stewardship schemes*)
24. **Land use**: area used for agriculture,✓ woodland, water or river, urban ✓ (contextual indicator)
25. **Land recycling**: (a) new dwellings built on previously developed land or through conversions (b) all new development on previously developed land
26. **Dwelling density**: average density of new housing
27. **Fish stocks**: fish stocks around the UK within sustainable limits ✓
28. **Ecological impacts of air pollution**: area of UK habitat sensitive to acidification and eutrophication with

UK GOVERNMENT SUSTAINABLE DEVELOPMENT INDICATORS
critical load exceedences
29. **Emissions of air pollutants**: SO_2,✓ NO_x,✓ NH_3, and PM_{10}✓ emissions and GDP
30. **River quality**: rivers of good (a) biological ✓ (b) chemical quality ✓
31. **Flooding**: (*to be developed to monitor sustainable approaches to ongoing flood management*)
32. **Economic output**: Gross Domestic Product ✓
33. **Productivity**: UK output per worker ✓★ [*note, productivity is not the same as productiveness*]
34. **Investment**: (a) total investment ✓ (b) social investment relative to GDP
35. **Demography**: population ✓ and population of working age (contextual indicator)
36. **Households and dwellings**: households, single person households, and dwelling stock (contextual indicator)
37. **Active community participation**: informal and formal volunteering at least once a month
38. **Crime**: crime survey and recorded crime for (a) vehicles ✓ (b) domestic burglary ✓ (c) violence ✓
39. **Fear of crime**: (a) car theft (b) burglary (c) physical attack
40. **Employment**: people of working age in employment ✓★
41. **Workless households**: population living in workless households ✓ (a) children (b) working age
42. **Economically inactive**: people of working age who are economically inactive
43. **Childhood poverty**: children in relative low-income households ✓ (a) before housing costs (b) after housing costs
44. **Young adults**: 16-19 year-olds not in employment,✓ education, or training
45. **Pensioner poverty**: pensioners in relative low-income households ✓ (a) before housing costs (b) after housing costs
46. **Pension provision**: working age people contributing to a non-state pension in at least three years out of the last four
47. **Education**: 19 year-olds with Level Two qualifications and above ✓
48. **Sustainable development education**: (to be developed to monitor the impact of formal learning on knowledge and awareness of sustainable development)
49. **Health inequality**: (a) infant mortality (by socio-economic group) ✓ (b) life expectancy (by area) for men and women ✓
50. **Healthy life expectancy**: healthy life expectancy (a) men (b) women
51. **Mortality rates**: death rates from (a) circulatory disease and (b) cancer, below 75 years and for areas with the worst health and deprivation indicators, and (c) suicides
52. **Smoking**: prevalence of smoking (a) all adults (b) 'routine and manual' socio-economic groups
53. **Childhood obesity**: prevalence of obesity in 2-10 year-olds
54. **Diet**: people consuming five or more portions of fruit and vegetables per day and in low-income households
55. **Mobility**: (a) number of trips per person by mode (b) distance travelled per person per year by broad trip purpose ✓

UK GOVERNMENT SUSTAINABLE DEVELOPMENT INDICATORS
56. **Getting to school**: how children get to school
57. **Accessibility**: access to key services
58. **Road accidents**: number of people and children killed or seriously injured ✓★
59. **Social justice**: (*social measures to be developed*)
60. **Environmental equality**: (*environmental measures to be developed*)
61. **Air quality and health**: (a) annual levels of particles ✓ and ozone ✓ (b) days when air pollution is moderate or higher
62. **Housing conditions**: (a) social sector homes below the decent homes standard (b) vulnerable households in the private sector in homes below the decent homes standard
63. **Households living in fuel poverty**: (a) pensioners (b) households with children (c) disabled/long-term sick
64. **Homelessness**: (a) rough sleepers ✓★ (b) households in temporary accommodation ✓★ (i) total (ii) households with children
65. **Local environment quality**: (to be developed using information from the Local Environmental Quality Survey of England)
66. **Satisfaction in local area**: households satisfied with the quality of the places in which they live (a) overall (b) in deprived areas (c) non-decent homes
67. **UK international assistance**: Net Official Development Assistance ✓ (a) percent of Gross National Income (comparison with selected countries) (b) per capita (comparison with selected countries)
68. **Well-being**: (*well-being measures to be developed if supported by the evidence*) ✓★

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: Department for Environment Food and Rural Affairs (DEFRA). (2005a). "One future – different paths. The UK's shared framework for sustainable development." *PB10591*, DEFRA, London.

URL: http://www.sustainable-development.gov.uk/publications/uk-strategy/framework-for-sd.htm (accessed on 04/09/06).

Reference: Department for Environment Food and Rural Affairs (DEFRA). (2005b). "Securing the Future: delivering UK sustainable development strategy. The UK Government Sustainable Development Strategy." *Cm 6467*, DEFRA, London.

URL: http://www.sustainable-development.gov.uk/publications/uk-strategy/index.htm (accessed on 04/09/06).

A7.4 U.S. - Sustainable Development in the United States: An Experimental Set of Indicators

In 1998, the U.S. Interagency Working Group on Sustainable Development Indicators (SDI Group) released its report *Sustainable Development in the United States - an Experimental Set of Indicators*. This report was later updated by the SDI Group in preparation for the 2002 World Summit on Sustainable Development (SDI Group 2001).

The table below presents the SDI Group's updated set of 39 indicators that are categorized into social, economic, or environmental measures. The indicators that are identical or similar to the original and Hall-revised UNCSD indicator frameworks have been marked.

U.S. Indicators of Sustainable Development [865]

Category	Indicator
Economic	
Long-term Endowments and Liabilities	1 Capital Assets ✓★ 2 Labor Productivity
Process	3 Energy Indicators ✓ 4 Materials Use per Dollar of Investment ✓ 5 Investment in R&D as a Percentage of GDP ✓
Current Results	6 Economy Management Index [*inflation rate, unemployment rate✓ and GDP✓*] 7 Personal and Governmental Consumption Expenditures per Capita 8 Homeownership Rates 9 Percentage of Households with Housing Problems 10 Vehicle Ownership, Fuel Consumption and Travel per Capita ✓
Environmental	
Long-term Endowments and Liabilities	11 Surface Water Quality ✓ 12 Land Use Trends ✓ 13 Contaminants in Biota [*pesticides ✓*] 14 Status of Stratospheric Ozone ✓ 15 The U.S. Greenhouse Climate Response Index

[865] Source: U.S. Interagency Working Group on Sustainable Development Indicators, 2001, *Sustainable Development in the United States: An Experimental Set of Indicators*, Chapter 3 - List of Indicators, http://www.sdi.gov/lpBin22/lpext.dll/Folder1/Infobase7/1?fn=main-j.htm&f=templates&2.0 (accessed on 04/09/06).

Category	Indicator
Processes	16 Ratio of Renewable Water Supply to Withdrawals ✓ 17 Fisheries Utilization ✓ 18 Invasive Alien Species 19 Soil Erosion Rates 20 Timber Growth to Removals Balance ✓ 21 Greenhouse Gas Emissions ✓ 22 Total Waste ✓
Current Results	23 Metropolitan Air Quality Non-attainment ✓ 24 Outdoor Recreational Activities
Social	
Long-term Endowments and Liabilities	25 U.S. Population ✓ 26 Teenage Pregnancy and Children Living in Family with Only One Parent Present 27 Teacher Training and Application of Qualifications 28 Access to the Internet ✓ 29 Wealth Distribution
Processes	30 Contributing Time and Money to Charities ✓★ 31 Educational Attainment by Level ✓ 32 Census Tracts with 40% Poverty ✓ 33 Citizen's Participation
Current Results	34 Crime Rate ✓ 35 Life Expectancy at Birth & Healthy Life Expectancy ✓ 36 Educational Achievement Rates ✓ 37 Children's Access to Health Care ✓ 38 Homelessness 39 Percentage Children Living in Poverty

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Reference: U.S. Interagency Working Group on Sustainable Development Indicators (SDI Group). (2001). "Sustainable Development in the United States: An Experimental Set of Indicators." U.S. Interagency Working Group on Sustainable Development Indicators, Washington, D.C.

URL: http://www.sdi.gov/lpBin22/lpext.dll/Folder1/Infobase7/1?fn=main-j.htm&f=templates&2.0 (accessed on 04/09/06).

A7.5 U.S. EPA - Green Communities Indicators

The U.S. Environmental Protection Agency (EPA) has established the Green Communities Program to provide communities across the U.S. with access to tools and information that can be used to help them transition towards sustainability.

The goals of the Program are:
— *"to promote innovative tools that encourage successful community-based environmental protection and sustainable community development.*
— *to establish partnerships with other organizations and agencies to help build community capacity and knowledge in order to create more livable communities.*
— *to provide technical assistance and training through the Assistance Kit, workshops, and the network of successful Green Communities throughout the country."*

An important component of the Green Communities Assistance Kit is two sets of example indicators (see the box below).[866] The *domain* set categorizes the indicators by three (of the five) pillars of sustainable development: environment; economy; and society. In contrast, the *goal based* set groups the indicators by areas of concern or policy focus: sustainability; economic prosperity; healthy community; and social well-being. While both sets are meant to be illustrative, they nevertheless provide two useful frameworks of indicators that can be compared with the original and Hall-revised UNCSD indicator frameworks.

Structure of the Green Communities Program Indicator Sets

Domain Based Examples	**Goal Based Examples**
— Environmental	— Sustainability
— Economic	— Economic Prosperity
— Social	— Healthy Community
	— Social Well-Being

The two tables below present the Green Communities Domain and Goal Based indicator sets. The indicators that are identical or similar to the original and Hall-revised UNCSD indicator frameworks have been marked.

[866] See the Green Communities Program, Indicators, http://www.epa.gov/greenkit/indicator.htm (accessed 04/09/06).

Domain Based Indicators of Green Communities (EPA 2005a)

INDICATOR	PURPOSE	LINKAGES
Environmental Indicators		
Vehicle Miles Traveled ✓	To encourage efficient development patterns	— Commuting time affects our quality of life — Air and water quality — Natural nonrenewable resource consumption — Social stress, declining sense of community — Transportation cost for road construction and maintenance — Loss of open space and wildlife habitat
Percentage of Land Preserved as Open Space	To encourage and monitor efficient development patterns	— Air quality — Mental health — Drainage control and improved water quality
Soil Erosion — bed load — suspended solids — turbidity	To track impact of our development patterns on the natural environment	— Degradation of water quality and aquatic habitat — Aesthetic quality and recreational capacity of our waters — Fertility and productivity of the land — Altered drainage patterns
Impervious Surface ✓ [urbanization]	To monitor stormwater impact on natural environment	— Biodiversity in wetlands — Economic loss due to flooding and fisheries decline — Vehicle miles traveled — Energy use due to "urban heat island" effect — Air quality
Farm Acreage ✓	To preserve productive agriculture land use	— Diminished economic and cultural diversity of the region — Impervious surface — Energy use — Vehicle miles traveled
Residential Water Consumption ✓	Efficient use of freshwater supplies	— Economic capacity to grow food, produce power, support industry — Increased demand for water has negative impacts on aquatic systems — Financial burden (infrastructure) to supply new water supplies and/or additional treatments
Tons of Solid Waste Generated✓ **and Solid Waste Recycled**✓ **per Capita**	To minimize the amount of solid waste that goes to landfills or is incinerated	— Population growth — Soil and groundwater contamination — Nonrenewable resource consumption

INDICATOR	PURPOSE	LINKAGES
Days in the Past Year with Air Quality Index (AQI) in the Good Range ✓	Good air quality is fundamental to public health	— Degradation of natural environment, forest health — Water and soil quality — Negative impact on aquatic ecosystems — Limited economic expansion, restriction of certain industrial activities — Denied federal government funding — Reduced agriculture productivity — Impact on marine and freshwater fisheries — Impact on tourism
Electricity Consumption Generated from Nonrenewable✓ & Renewable✓ Sources	To promote the conservation of our natural resources	— Air quality — Water quality — Soil quality — Global warming
Percentage of Area of Assessed Rivers and Streams That Do Not Meet State and Federal Water Quality Standards ✓	To restore degraded waterways	— Degradation of aquatic habitat — Aesthetic quality and recreational capacity of our waters — Biodiversity in wetlands — Economic loss due to flooding and fisheries decline
Number of Bald Eagle Nests and Young ✓	To measure conservation efforts to restore habitat and decrease pesticides	
Economic Indicators		
Ratio of Affordable Housing Cost	To evaluate affordable housing in the community Adequate affordable housing is necessary to foster economic sustainability	— Linkages to social well-being, economic stability, health and welfare issues, poverty
Percentage with Economic Access to Health Care	How much of our financial resources go towards caring for or preventing illness	— Health and self sufficiency — Increased costs to community — Decline in education spending — Decline in environmental spending
Percentage of Families Living Below Poverty Line ✓	Equal distribution of wealth	— Child poverty — Poor health — Juvenile crime — Low civic participation
Percentage of Total Employment by Industry ✓★	Resilience of the job market Diversified job market is less susceptible to changing market demands	— Environmental protection — Poverty — Homelessness — Consumer spending — Crime rate
Social Indicators		

INDICATOR	PURPOSE	LINKAGES
Voters Participating in Primary Elections	Participate fully in decisions about the way their community is governed	— Poverty levels — Crime — Political awareness — Improved government — Environmental health — Enhance economic health
Low Birth Weight Babies per 1000 Live Births	Adequate nurturing of future generations	— Literacy — Low income — Poor health — Inequity of ethnic groups — Economic imbalance
Suicide Rates per 1000 Population	To address the mental health of community and underlying social issues: age-, race-, and ethnic-inequity	— Economic imbalance
Demographics (population, race, age) ✓	Future sustainability must take into account the projected population Ensure population does not grow beyond environmental resources	— Land use patterns — Biodiversity — Water and air quality — Housing affordability
Child Abuse	Monitor quality-of-life in families	— Drug and alcohol abuse — Teen pregnancy — Crime — Unemployment

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

Goal-Based Indicators of Green Communities (EPA 2005b)

INDICATOR	PURPOSE	LINKAGES
Sustainability Indicators		
Percent of Population within Walking Distance of Public Transportation	To evaluate access to public transportation in an effort to reduce automobile use and dependency	This links to livability issue, land use, air pollution, etc.
Percent of Native Plant and Animal Species Endangered vs. Secure ✓	To evaluate natural resource diversity in your community To help ascertain sustainability of natural resources and related functions	Biodiversity provides links to natural resource protection, land use, recreational opportunities and economic benefits associated with open spaces, greenways and natural areas
Percent and Volume of Waste Converted back to Beneficial Uses ✓	To evaluate conservation and pollution prevention efforts of commercial and industrial sectors, as well as households	This indicator links to economic savings for the purchase and production of new materials, reduces toxic emissions to air, water and land Ensures sustainable use of limited resources
Progress toward Goal of 20% Reduction in Use of Potable Water	To measure reduction in water use, conservation measures implemented	This links to sustainable use of limited resources resulting in cost savings for homes, business and industry
Vehicle Miles Traveled ✓	To illustrate the effect of land use patterns on travel needs Shows whether people are inconveniently located to meet daily needs of work, home, children, and recreation	This indicator strongly links to land use; other links include air quality, consumption of non-renewable resources and costs (taxes) associated with highway construction and maintenance
Economic Prosperity		
Percent Employment in Locally-Owned and Operated Businesses ✓★	To evaluate investment that stays within the community A healthy economy results from "plugging the leaks"	Linkages to social well-being, civic participation, education
Distribution of Personal Income ✓	To evaluate the disparity between haves and have nots Communities are weakened by concentrations of poverty and unequal opportunity	Low incomes can be linked with child poverty, poor health, education levels, levels of civic participation, and inequitable distribution of services and opportunities

INDICATOR	PURPOSE	LINKAGES
Percent of Households Paying 30% or less of Income on Rent✓ ★ [secure tenure]	To evaluate affordable housing in the community Community members have diverse needs; adequate affordable housing is necessary to foster economic sustainability	Linkages to social well-being, economic stability, health and welfare issues, poverty
Number of Enterprises Adopting ISO 14000 Standards	To measure the progress of industry to incorporate standards to improve processes which lead to greater environmental protection	Linkages to resource conservation, health, education
Income Disparity between Urban Centers and Outlying Areas (suburbs)	Indicates urban decay and suburban sprawl	Linkages to land use, resource consumption, education, poverty, crime and safety, environmental justice
Healthy Community		
Percentage Living Below Poverty Line ✓	A healthy community has economic equity There should not be a disparity between the "haves" and the "have nots"	— crime — child abuse — welfare
Percentage who Volunteer at least 50 hrs/year to Civic, Community, or Nonprofit Activities ✓	To seek to improve the Quality of Life in our communities	— improved condition for poverty — economic renewal
Park and Facility Space (acres) per Capita (1000 people) by District. Within a ¼ mile radius	To reflect desired land use patterns To provide well integrated public open spaces in urban districts	— increase livability in high density residential and commercial areas — urban biodiversity — urban wildlife habitat — mental health — tourism — economic renewal — social gathering — air quality — water quality by decreasing impervious surface — reduce temperature — community gardens for produce
Hospitalization for Asthma per 10,000 Residents	-	— poverty — housing affordability — indoor and outdoor air quality — lack of health care — societal health costs — home cleanliness

INDICATOR	PURPOSE	LINKAGES
Percent of Community with Available Health Insurance	To reflect how much of our financial resources are being allocated toward caring for or preventing illness To ensure that affordable health care is available to everyone	— serious problems result in delay in obtaining medical attention — increase costs to people, business and government — excessive costs leave less for spending on education and environment
Young Female (10-17) Pregnancy Rate (birth rate/ 1000 female)	To reduce the incidence of teen pregnancy	— increase in prenatal and perinatal complications — impaired child development — cost to society of increase welfare dependents
Social Well-Being		
Percentage of Ethnic Groups Graduating High School	To produce a good citizen with the basic skills necessary to participate fully in the stewardship of our city and region	— parental involvement — economic vitality — social equity — public safety
Rate of Reported Violent Crimes per 1000 People during Calendar Year. Compare Difference of Urban and Rural Communities ✓	To measure the public safety of our community To make our communities a safe place to live. To live peaceably together	— economic decline by discouraging economic investment — environmental justice — child poverty — social diversity — vehicle miles traveled — health care cost — increase tax burden — distabilizes communities
Percent of Population within Walking Distance of Public Transportation	To increase the amount of pedestrian friendly streets To limit the dependence on car to provide transportation to work and shopping	— improved health — promotes social interactions — recreational opportunity — expand mobility — air quality — economic renewal
Distribution of Affordable Housing Throughout the Community	To provide affordable housing for everyone To increase community stability and self sufficiency	— distribution of wealth — impact on biodiversity — child poverty — crime rates — reduced mental health — homelessness

Key:

✓ Indicator is identical or similar to one included in the original UNCSD indicator framework.

✓★ Indicator is identical or similar to a *new indicator* that has been *added* to the Hall-revised UNCSD indicator framework.

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Appendix B: Sustainable Transportation Indicators

B1 Indicators Developed by Agencies, Organizations, or Programs

B1.1 Environmentally Sustainable Transport (EST)

In 1994, the OECD's Environmental Policy Committee's (EPC's) Working Group on Transport and Environment began its project on Environmentally Sustainable Transport (EST). The project had two broad objectives: [1] to clearly define the concept of EST by establishing criteria that have environmental and human health significance and are quantifiable; and [2] to develop a target-oriented policy approach to how EST can be achieved that can be of use to governments in OECD and other nations (OECD 2000).

In response to the first objective, the Working Group on Transport and Environment defined a sustainable transportation system as "*one that throughout its full life-cycle operation:*

— *allows generally accepted objectives for health and environmental quality to be met, for example, those concerning air pollutants and noise proposed by the World Health Organization (WHO);*
— *is consistent with ecosystem integrity, for example, it does not contribute to exceedence of critical loads and levels as defined by WHO for acidification, eutrophication and ground-level ozone; and*
— *does not result in worsening of adverse global phenomena such as climate change and stratospheric ozone depletion*" (OECD 2000, p. 35).

To operationalize the EST definition, six criteria (see table below) were selected as the minimum number required to cover the wide range of human health and environmental impacts from transportation.

An important conclusion from the EST project is that solutions to the transportation problems faced by OECD countries lies in a balanced mix of technology options and transportation management and modal shifts.

Long-term Environment and Health Quality Objectives, Criteria, and Derived Targets for EST (OECD 2000, p. 37)

CO_2 Climate change is prevented by reducing carbon dioxide emissions so that atmospheric concentrations of CO_2 are stabilised at or below their 1990 levels. Accordingly, total emissions of CO_2 from transport should not exceed 20% of such emissions in 1990.	*NO_x* Damage from ambient NO_2 and ozone levels and nitrogen deposition is greatly reduced by meeting WHO Air Quality Guidelines for human health and eco-toxicity. This implies that total emissions of NO_x from transport should not exceed 10% of such emissions in 1990.
VOCs Damage from carcinogenic VOCs and ozone is greatly reduced by meeting WHO Air Quality Guidelines for human health and ecosystem protection. Total emissions of transport-related VOCs should not exceed 10% of such emissions in 1990 (less for extremely toxic VOCs)	*Particulates* Harmful ambient air levels are avoided by reducing emissions of fine particulates (especially those less than 10 microns in diameter). Depending on local and regional conditions, this may entail a reduction of 55% to 99% of fine particulate (PM_{10}) emissions from transport, compared with 1990 levels.
Noise Noise from transport no longer results in outdoor noise levels that present a health concern or serious nuisance. Depending on local and regional conditions, this may entail a reduction of transport noise to no more than a maximum of 55 dB(A) during the day and 45 dB(A) at night and outdoors.	*Landuse/Landtake* Land use and infrastructure for the movement, maintenance, and storage of transport vehicles is developed in such a way that local and regional objectives for air, water and eco-system protection are met. Compared to 1990 levels, transport activity will likely entail a smaller proportion of land devoted to transport infrastructure.

B1.2 Mobility 2001 & 2030

In 2001, the World Business Council for Sustainable Development (WBCSD) released *Mobility 2001*, a report it commissioned on behalf of several of its member firms to capture the pulse of mobility at the end of the twentieth century. The report covers passenger, freight, energy, and technology patterns and trends over the past 20-30 years with a specific focus on urban areas and intercity travel in both developed and developing nations.

Rather than use the phrase 'sustainable transportation,' the WBCSD refers to 'sustainable mobility' which it defines as "*the ability to meet the needs of society to move freely, gain access, communicate, trade, and establish relationships without sacrificing other essential human or ecological values today or in the future*" (WBCSD 2001, p. 1-2).

The report's description of sustainable mobility is Faustian in nature in that "*any assessment of mobility's sustainability must include not only a judgment as to its effectiveness in improving accessibility but also a judgment as to the magnitude and consequence of any associated disruptions in social, environmental, or economic well-being*" (WBCSD 2001, p. 1-7). This conceptualization of sustainable mobility accepts social and environmental impacts as an unavoidable consequence of mobility.

The report has been criticized as viewing sustainable mobility from the perspective of automobile manufacturers and oil companies - who commissioned the report and have a great interest in ensuring that current forms of mobility remain 'sustainable' (Hook 2001). Notwithstanding this potential problem, the report does provide a number of useful measures (or indicators) that should be *increased* or *reduced* to achieve sustainable mobility (see the box below).

Sustainable Mobility Measures to Be Increased and Reduced
(also known as the "sustainability scorecard")

Measures to be increased
— Access to means of personal mobility
— Equity in access
— Appropriate mobility infrastructure
— Inexpensive freight transportation
Measures to be reduced
— Congestion
— "Conventional" emissions
— Greenhouse gas emissions
— Transportation noise
— Other environmental impacts
— Disruption of communities
— Transportation-related accidents
— Transportation's demand for nonrenewable energy
— Transportation-related solid waste

Source: WBCSD (2001, pp. 1-7 to 1-15).

In 2004, the WBCSD published the final study from its sustainable mobility project.[867] *Mobility 2030* used the mobility patterns and trends identified in the first report to project what these might look like over the next several decades. The main focus of the study was to identify what actions were likely to guide trends towards sustainable mobility (in developed and developing nations) and what supporting mechanisms might help these actions succeed (WBCSD 2004).

An important contribution of *Mobility 2030* is a set of 12 sustainable mobility indicators (see table below) that were developed from the 'sustainability scorecard' presented in *Mobility 2001*. The WBCSD argues that these 12 indicators "*ought to be central to any vision of sustainable mobility and the route to get there. They are the key dimensions that sustainable mobility systems should perform well on. They also constitute a yardstick against which the effectiveness of various approaches can be measured*" (WBCSD 2004, p. 18). The indicators are intended to be 'people-centered' and have been created to reflect the three pillars of sustainable development - i.e., environment, society, and economy.

Indicators of Sustainable Mobility (WBCSD 2004, pp. 18-24)
1. Accessibility — **Personal Mobility**: The percentage of households having access to motorized personal vehicles plus the percentage of households located within a certain distance of public transport of a given minimum quality. — **Goods Mobility**: Some combination of response time (time to pick up shipment after requesting service, or time to deliver shipment after arrival) and the distance that a shipper or customer must travel to drop off or receive the shipment.
2. Financial outlay required of users — **Personal mobility**: Share of individual (or family) budget devoted to personal travel. — **Goods mobility**: Total logistics costs per unit (weight or value) moved per unit of distance: alternatively, share of a good's price that represents all logistics costs associated with its production and final delivery.
3. Travel time — **Personal mobility**: Average time required from origin to destination, including all switches of vehicle/mode and all "waiting" time. — **Goods mobility**: Average origin to destination time required for shipment.
4. Reliability — **Personal mobility**: Variability in door-to-door travel time for a "typical" mobility system user. — **Goods mobility**: Variability in origin-to-destination time for "typical" shipments of different types.

[867] For more information see the WBCSD Sustainable Mobility Project, http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=ODE&doOpen=1&ClickMenu=LeftMenu (accessed on 04/09/06).

Indicators of Sustainable Mobility (WBCSD 2004, pp. 18-24)

5. Safety

- **Personal mobility**: The probability that an individual will be killed or injured in an accident while using a mobility system, **and** the total number of deaths and serious injuries (expressed as DALY – disability-adjusted life years) per year by category (air transport, automobile, truck, bus, moped, bicycle, pedestrian, etc.).
- **Goods mobility**: The probability that a given shipment will be damaged or destroyed **and** the total value of goods damaged or destroyed in a crash.

6. Security

- **Personal mobility**: For individuals, the probability that one will be harassed, robbed, or physically assaulted during a journey. For society, in addition to this, the total number of incidents (perhaps weighted by severity).
- **Goods mobility**: For individuals, the probability that a shipment will be stolen or damaged through pilferage. For society, in addition to this, the total value of goods lost to theft and/or pilferage.

7. Greenhouse gas emissions (GHGs)

- GHG emissions per time period measured in carbon-equivalent units.

8. Impact on the environment and on public well-being

- **Transport-related "conventional" emissions**: Emissions of NOx, CO, particulates, unburned hydrocarbons, and lead per time period.
- **Impact on eco-systems**: Transportation-related impacts on eco-systems (e.g. habitats, water) in addition to land use.
- **Transport-related noise**: The number of individuals (or percent of population) exposed to various transport-related noise levels over various time periods.

9. Resource use

- **Transport-related energy use and energy security**: For energy use, total transport-related use of particular fuels. For energy security, the percentage of a region's energy supply coming from outside the region or from "insecure" sources.
- **Transport-related land use**: The amount (or share) of land devoted to transportation activities.
- **Transport-related material use**: Total volume of material use by transport sector; transport sector's share of total use; actual recycling rates.

10. Equity implications

- We believe it is desirable that information be developed reflecting the distribution of sustainable mobility "values" across different population groupings. Examples include access to means of mobility, the cost of obtaining personal and goods mobility, exposure to the effects of "conventional" emissions and noise, and threats to safety and security.

11. Impact on public revenues and expenditures

- The level and change in level of public capital and operating expenditures for providing transportation services and transportation infrastructure. This includes "launching aid," public infrastructure capital, operating subsidies, revenues collected by government from transport operations and user fees, and reduction in other government outlays due to the quantity and quality of transport services.

Indicators of Sustainable Mobility (WBCSD 2004, pp. 18-24)

12. Prospective rate of return to private business

— The prospective return on investment available to an efficient private business from offering particular mobility-related goods and services – includes costs (capital and operating), private revenues, government provided revenues ("launching aid," operating subsidies, grants of pubic funds to finance capital, etc.), and costs imposed by government regulatory policies.

B1.3 KonSULT, the Knowledgebase on Sustainable Urban Land Use and Transport

An important project funded by the European Commission - PROSPECTS (Procedures for Recommending Optimal Sustainable Planning of European City Transport Systems)[868] - has produced several deliverables that are designed to help European cities meet the challenges outlined in the 'Common Transport Policy.'[869] Of particular interest is deliverable 13, a web-based *Policy Guidebook* known as *KonSULT* (Knowledgebase on Sustainable Urban Land Use and Transport)[870] that provides information on the performance of a wide range of urban transport policy instruments.

To help city authorities develop quantifiable objectives to support their planning activities, KonSULT suggests the following set of indicators as a useful starting point.

Suggested Performance Indicators[871]	
Economic efficiency	Delays for vehicles (by type) at junctions Delays for pedestrians at road crossings Time and money costs of journeys actually undertaken Variability in journey time (by type of journey) Costs of operating different transport services
Environmental protection	Noise levels Vibration Levels of different local pollutants Visual intrusion Townscape quality (subjective) Fear and intimidation Severance (subjective)
Safety	Personal injury accident by user type per unit exposure (for links, junctions, networks) Insecurity (subjective)
Accessibility	Activities (by type) within a given time and money cost for a specified origin and mode Weighted average time and money cost to all activities of a given type from a specified origin by a specified mode
Sustainability	Environmental, safety and accessibility indicators as above CO_2 emissions for the area as a whole Fuel consumption for the area as a whole
Economic regeneration	Environmental and accessibility indicators as above, by area and economic sector

[868] See *PROSPECTS*, http://www.its.leeds.ac.uk/research/projectDetails.php?id=135 (accessed on 04/09/06).
[869] See the European White Paper, *European transport policy for 2010: time to decide*, http://europa.eu.int/comm/transport/white_paper/index_en.htm (accessed on 04/09/06).
[870] See KonSULT, *Knowledgebase on Sustainable Urban Land Use and Transport*, http://www.elseviersocialsciences.com/transport/konsult/index.html (accessed on 04/09/06).
[871] Source: KonSULT, *Objectives*, http://www.elseviersocialsciences.com/transport/konsult/public/level1/l1_obje.htm (accessed on 04/09/06).

Suggested Performance Indicators[871]	
Finance	Operating costs and revenues for different modes Costs and revenues for parking and other facilities Tax revenue from vehicle use
Equity	Indicators as above, considered separately for different impact groups

B1.4 TERM (Transport and Environment Reporting Mechanism)

In 1998, the European heads of state and government (The European Council) met in Cardiff and charged the Transport, Energy, and Agriculture Councils with integrating environmental and sustainable development objectives into their respective policy areas.[872] Since this meeting, six other Council formations have been invited to develop similar integration strategies as part of the 'Cardiff Process.'[873] This section focuses on the subsequent work of the Transport Council.

In response to the European Council's mandate, the European Environment Agency (EEA) and the European Commission - specifically the Directorate-General for Transport and Energy, the Directorate-General for the Environment, and Eurostat - came together to jointly develop the *Transport and Environment Reporting Mechanism* (TERM). The principle objective of TERM is to integrate environmental and sustainable development concerns into transportation policy across Europe (EEA 2002). To achieve this objective, some 40 indicators have been developed to highlight the performance of an EU member state's transportation system and to identify potential problem areas to transportation policy makers (see the table below). It is hoped that TERM will encourage the creation of uniform data collecting procedures and recording mechanisms in all EU member states. As EU membership expands, TERM will facilitate comparisons between the performance of state transportation systems and ensure that environmental and sustainable development considerations are placed at the top of state agendas (JEGTE 2002).

The TERM indicators were developed following the Driving Force, Pressure, State of the Environment, Impact, and Societal Response (DPSIR) framework (JEGTE 2002). The position of each indicator within this framework is indicated on the right hand column of the table below.

A regular outcome from TERM is an indicator-based report that can be used to assess the effectiveness of environment integration strategies (JEGTE 2002). Two TERM reports have been published so far in 2001 and 2002.[874]

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[872] Source: European Commission, *Developing a Sustainable Transport System*, http://europa.eu.int/comm/environment/trans/ (accessed on 04/09/06).
[873] Source: European Commission, *Environmental Integration*, http://europa.eu.int/comm/environment/integration/integration.htm (accessed on 04/09/06).
[874] See the European Environmental Agency (EEA), *TERM 2001 - Indicators tracking transport and environment integration in the European Union* and *TERM 2002 - Paving the way for EU enlargement - Indicators of transport and environment integration*, http://reports.eea.eu.int/term2001/en/tab_abstract_RLR (accessed on 04/09/06).

Transport and Environment Reporting Mechanism (TERM) Indicators (EEA 2002, pp. 14-15; JEGTE 2002, pp. 44-45)

Group	Indicator	Position in DPSIR
Transport and Environment Performance		
Environmental Consequences of Transport	Transport final energy consumption and primary energy consumption, and share in total by mode and by fuel	D
	Transport emissions of greenhouse gases (CO_2 and N_2O) by mode	P
	Transport emissions of air pollutants (NO_x, NMVOCs, PM_{10}, SO_x, total ozone precursors) by mode	P
	Population exposed to exceedances of EU air quality standards for PM_{10}, NO_2, benzene, ozone, lead, and CO	S and I
	% of population exposed to and annoyed by traffic noise, by noise category and by mode	S and I
	Fragmentation of ecosystems and habitats	P and S
	Proximity of transport infrastructure to designated areas	P and S
	Land take by transport infrastructure by mode	P
	Number of transport accidents, fatalities, injured, and polluting accidents (land, air, and maritime)	I
	Illegal discharges of oil by ships at sea	P
	Accidental discharges of oil by ships at sea	P
	Waste from road vehicles (end-of-life vehicles)	P
	Waste from road vehicles (number and treatment of used tyres)	P
Transport Demand and Intensity	Passenger transport (by mode and purpose) — total passengers — total passenger-km — passenger-km per capita — passenger-km per GDP	D
	Freight transport (by mode and group of goods) — total tonnes — total tonne-km — tonne-km per capita — tonne-km per GDP	D
Determinants of the Transport/Environment System		
Spatial Planning and Accessibility	Access to basic services: average passenger journey time and length per mode, purpose (commuting, shopping, leisure), and location (urban/rural)	D
	Regional access to markets: the ease (time and money) of reaching economically important assets (e.g. consumers, jobs), by various modes (road, rail, aviation)	D
	Access to transport services: — vehicle ownership and number of motor vehicles per household — % of persons in a location having access to a public transport node within 500m	D
Supply of Transport Infrastructure and Services	Capacity of transport infrastructure networks, by mode and by type of infrastructure (motorway, national road, municipal road, etc.)	D
	Investments in transport infrastructure/capita and by mode	D and R
Transport Costs and	Real change in passenger transport price by mode	R

Group	Indicator	Position in DPSIR
Prices	Fuel prices and taxes	D
	Total amount of external costs by transport mode (freight and passenger); average external cost per passenger-km and tonne-km by transport mode	I
	Implementation of internalisation instruments - i.e. economic policy tools with a direct link with the marginal external costs of the use of different transport modes	R
	Subsidies	R
	Expenditure on personal mobility per person by income group	D
Technology and Utilisation Efficiency	Overall energy efficiency for passenger and freight transport (per passenger-km and per tonne-km and by mode)	P and D
	Emissions per passenger-km and emissions per tonne-km for CO_2, NO_x, NMVOCs, PM_{10}, SO_x by mode	P and D
	Occupancy rates of passenger vehicles	D
	Load factors for freight transport (LDV, HDV)	D
	Uptake of cleaner fuels (unleaded petrol, electric, alternative fuels) and numbers of alternative-fuelled vehicles	D
	Size of the vehicle fleet	D
	Average age of the vehicle fleet	D
	Proportion of vehicle fleet meeting certain air and noise emission standards (by mode)	D
Management Integration	Number of Member States that have implemented an integrated transport strategy	R
	Number of Member States with a formalised cooperation between the transport, environment, and spatial planning ministries	R
	Number of Member States with national transport and environment monitoring systems	R
	Uptake of strategic environmental assessment in the transport sector	R
	Public awareness and behaviour	R
	Uptake of environmental management systems by transport companies	R

B1.5 SUMMA (Sustainable Mobility, Policy Measures, and Assessment)

One of the most recent projects on indicators of sustainable transportation is the SUMMA (Sustainable Mobility, Policy Measures, and Assessment) project,[875] funded by the 5th Framework Programme of the European Commission. The objectives of the project are to:

1. "*Assess the scale and scope of the problems of sustainability in the transport sector,*
2. *Define and operationalise sustainable mobility and transport,*
3. *Develop a system of indicators for monitoring sustainable transport and mobility,* [and]
4. *Assess policy measures in the* [European Commission's] *White Paper on transport policy, as well as policy measures that can be used to promote sustainable transport and mobility in regions and cities.*"[876]

The table below presents the SUMMA project's 'wish list' of *outcome indicators*[877] that are categorized under economic, social, and environmental headings.

SUMMA: Economic, Social, and Environmental Outcome Indicators and Related Indicators (Rand Europe et al. 2004; 2005)

Outcomes of Interest	Indicator Name	Indicator Definition	Units
ECONOMIC OUTCOME INDICATORS			
EC1 ACCESSIBILITY	**EC11 Intermodal terminal facilities**	Terminal facilities with access by intermodal traffic system (road, rail, waterway)	Percentage of terminals with access by more than one mode
	EC12 Accessibility of origins/destinations	Accessibility Index between important economical centres and regions by mode	Index value (Aij)
	EC13 Access to basic services (SO11)	Average travel time for households to reach "basic" purposes	Minutes
	EC14 Access to public transport (SO12)	Percentage of households living within walking distance of 5 minutes from the next stop of public transport	Percentage of households
EC2 TRANSPORT OPERATION COSTS	**EC21 Supplier operating costs**	Monetary costs of transport operators (fixed and variable components)	Euro per year

[875] See SUMMA (Sustainable Mobility, Policy Measures, and Assessment), http://www.summa-eu.org/ (accessed on 04/09/06). [Note: The final SUMMA conference was held in Brussels, April 5, 2005, http://www.summa-eu.org/main.asp?hst=16 (accessed on 04/09/06).]

[876] Source: SUMMA, *Introduction, Objectives*, http://www.summa-eu.org/ (accessed on 04/09/06).

[877] While the SUMMA project identifies three types of indicators - i.e., outcome indicators, system indicators, and FDSCs (Forces Driving System Changes) - the project focuses on 'outcome indicators' since these are seen to provide specific information on the state of the transportation system and whether it is moving towards or away from a more sustainable state (Rand Europe et al. 2004).

Outcomes of Interest	Indicator Name	Indicator Definition	Units
	EC22 Transport-related expenditures of households (SO14)	Average transport-related share of household expenditures by type of household	Percentage of expenditures
	EC23 Transport prices	Transport prices for passenger transport by mode	Euro per passenger-km (public transport)
			Euro per vehicle-km (private transport)
		Transport prices for freight transport by mode	Euro per tonne-km
EC3 PRODUCTIVITY /EFFICIENCY	**EC31 Freight haulage-related costs on product costs**	Average share of freight haulage costs on product cost by sector	Percentage of product costs
	EC32 Utilisation rates	Average occupancy rate in passenger vehicles	Number of passengers per car trip (private transport)
			Percentage of capacity (public transport)
		Average loading rate of freight vehicles	Percentage of capacity
		Average utilisation rate of transhipment terminals	Percentage of capacity
	EC33 Energy consumption efficiency of transport sector	Energy consumption per unit of GVA generated by transport sector	Joule/Euro GVA
	EC34 Energy efficiency	Energy consumption intensities for passenger transport by mode	Toe/passenger-km
		Energy consumption intensities for freight transport by mode	Toe/tonnes-km
EC4 COSTS TO ECONOMY	**EC41 Infrastructure costs**	Traffic system-related public and private construction costs by mode	Euro/km per year (traffic network)
			Euro/tonne per year (transhipment terminals)
		Traffic system-related public and private improvement and maintenance costs by mode	Euro/km per year (traffic network)
			Euro/tonne per year (transhipment terminals)
	EC42 Public subsidies	Public expenditures/investments in transport and mobility-related sector (e.g. for development of vehicles, transhipment technologies, mobility-related information and communication technology, research, and transport operation)	Euro per year
	EC43 External transport costs	Accident costs by mode	Euro per year
		Delay costs due to congestion by mode	Euro per year
		Environmental costs by mode	Euro per year
	EC44 Final energy consumption (EN11)	Final energy consumption in transport by mode and by energy source	Million tonnes of oil equivalents
		Share of final energy consumption in transport produced from renewable energy sources	Percentage

Outcomes of Interest	Indicator Name	Indicator Definition	Units
EC5 BENEFITS TO ECONOMY	**EC51 Gross value added**	Share of an economy's gross value added (GVA) generated by transport	Percentage of GVA
	EC52 Public revenues from taxes and traffic system charging	Public revenues from traffic system charging (tolls and user charges)	Euro per year
		Public revenues from transport sector-related taxes (petroleum, vehicle, and emission taxes)	Euro per year
	EC53 Benefits of transport	Indirect positive growth and structure effects realised by the transport sector	Euro per year
ENVIRONMENTAL OUTCOME INDICATORS			
EN1 RESOURCE USE	**EN11 Energy consumption**	A. Final energy consumption in transport by mode and by energy source	Million tonnes of oil equivalents
		B. Share of final energy consumption in transport produced from renewable energy sources	Million tonnes of oil equivalents
	EN12 Consumption of solid raw materials	A. Raw materials used in building transport infrastructure by type of material	Tonnes
		B. Raw materials used in vehicles manufacture by type of material	Tonnes
	EN13 Land take	A. Land take by transport infrastructure by mode	Km^2
		B. Land take by transport infrastructure by mode percentage of country surfaces	Percentage of surface area
EN2 DIRECT ECOLOGICAL INTRUSION	**EN21 Fragmentation of land**	Effective mesh size (meff)	Km^2
	EN22 Damage of underwater habitats	Amount of dredging at ports, waterways, etc. by type of dredged area	M^3
	EN23 Losses of nature areas	Losses of nature areas due to construction of transport infrastructure by mode, and as % of total nature area losses	Km^2 and percentage of total nature area losses
	EN24 Proximity of transport infrastructure to designated nature areas	Designated nature areas in the proximity (unit has to be defined) of transport infrastructure in total and by mode	Km^2 and percentage of designated nature areas
	EN25 Light emissions	Area of lighted transport infrastructure	Km^2
	EN26 Collisions with wildlife	Annual number of collisions with animals by mode	Number of collisions per year
	EN27 Introduction of non-native species	Number of non-native species introduced by marine transport and in transport infrastructure construction	Number of species
EN3 EMISSIONS TO AIR	**EN31 Transport emissions of greenhouse gases**	Transport emissions of greenhouse gas by mode and by type of gas	Tonnes of CO_2 equivalent

Outcomes of Interest	Indicator Name	Indicator Definition	Units
	EN32 Greenhouse gas emissions from manufacture and maintenance	Greenhouse gas emissions from vehicle and parts manufacture, and transport maintenance by mode and by gas	Tonnes of CO_2 equivalent
	EN33 Transport emissions of air pollutants	Transport emissions of air pollutants by mode and by type of pollutant	Ktonnes
	EN34 Air pollutant emissions from manufacture and maintenance	Emissions of air pollutants from vehicle and parts manufacture, and transport maintenance by mode and by type of pollutant	Ktonnes
EN4 EMISSION TO SOIL AND WATER	**EN41 Hardening of surfaces**	Hardened surfaces in transport use by mode and as % of total land take by transport infrastructure	Km^2 and percentage of total land take
	EN42 Polluting transport accidents	Amount of pollutants released in transport accidents by type of pollutant and by mode	Litres or tonnes
	EN43 Runoff pollution from transport infrastructure	Amount of pollutants released by run-offs by type of pollutant and by mode	To be defined
	EN44 Wastewater from manufacture and maintenance of transport infrastructure	Amount of wastewater produced from manufacture and maintenance of transport infrastructure not treated in wastewater treatment plants	M^3 or litres or tonnes
	EN45 Discharges of oil at sea	Illegal discharges of oil by ships at sea	Number of observed oil slicks
	EN46 Discharges of wastewater and waste at sea	A. Amount of wastewater discharged into sea from ships	Litres or tonnes
		B. Amount of waste discharged into sea from ships	Tonnes or M^3
EN5 NOISE	**EN51 Exposure to transport noise**	A. Amount of population exposed to traffic noise levels detrimental to health (>65 dBA) by mode	Number and percentage of population
		B. Amount of population exposed to traffic noise levels affecting well-being (between 40 and 65 dBA) by mode	Number and percentage of population
EN6 WASTE	**EN61 Generation of non-recycled waste**	Total amount of non-recycled waste generated by transport by mode and by type of waste	Tonnes
SOCIAL OUTCOME INDICATORS			
SO1 ACCESSIBILITY AND AFFORDABILITY (users)	**SO11 Access to basic services**	Average travel time for households to reach "basic" purposes	Minutes
	SO12 Access to public transport	Percentage of households living within walking distance of 5 minutes from the next stop of public transport	Percentage of households

Outcomes of Interest	Indicator Name	Indicator Definition	Units
	SO13 Car independence	Percentage of households without cars	Percentage of households
	SO14 Affordability	Average percentage of household expenditures related to transport	Percentage of expenditures
	SO15 Trip length	Percentage of short trips from all trips	Percentage of trips
SO2 SAFETY AND SECURITY (users, drivers, the affected)	**SO21 Accident-related fatalities and serious injuries**	SO21a Number of transport accident-related fatalities and serious injuries per year and 1,000 inhabitants	Number of persons per year, per 1,000 inhabitants
		SO21b (based on SO21a) Number of children below 18 years seriously hurt or killed per 1,000 children in the same age group	Number of children per year, per 1,000 children
		SO21c (based on SO21a): Number of adults from 18 to 65 years seriously hurt or killed per 1,000 persons in the same age group	Number of adults per year, per 1,000 adults
		SO21d (based on SO21a): Number of persons older than 65 years seriously hurt or killed per 1,000 persons in the same age group	Number of elderly per year, per 1,000 elderly
	SO22 Vehicle thefts and other crimes	Recorded crimes against private vehicles per year and 1,000 inhabitants	Number of crimes per year, per 1,000 inhabitants
	SO23 Security on public transport	Number of incidents (property offences + offences against passengers + offences against operatives) per year and 1,000 km	Number of incidents per year, per 1,000 km
SO3 FITNESS AND HEALTH (users)	**SO31 Walking and cycling as transport means for short distance trips**	Percentage of short trips/journeys done by walking or cycling	Percentage of trips/journeys
SO4 LIVEABILITY AND AMENITY (inhabitants, society, the affected)	**SO41 Walkability, pedestrian friendliness**	Total length of separate walking paths and/or special pedestrian areas in % of the length of the whole transport network	Percentage of length of the whole transport network
	SO42 Traffic calming	Total length of city streets with speed limits of maximum 30 km per hour in % of the length of the whole city street network	Percentage of length of the city street network
	SO43 Children's journey to school	Percentage of children driven to school by car	Percentage of children
	SO44 Open space availability and accessibility	Percentage of inhabitants/households living within maximally 15 minutes walking distance from urban green areas	Percentage of inhabitants/households
SO5 EQUITY (users and the affected)	**SO51 Horizontal equity (fairness)**	Percentage of "self-financing" of transport costs by the users, differentiated by mode	Percentage of costs
	SO52 Vertical equity (income)	SO52a Ratio between richest/poorest 20% (quintile) for transport-related household expenditures (based on SO14)	Number

Outcomes of Interest	Indicator Name	Indicator Definition	Units
		SO52b Ratio between richest/poorest 20% (quintile) households for access to basic services (based on SO11)	Number
		SO52c Ratio between richest/poorest 20% (quintile) households for public transport reliance (based on SO13)	Number
	SO53 Vertical equity (mobility needs and ability)	SO53a Explicitly earmarked public transport expenditures for the disabled and elderly in % of total public transport expenditures	Percentage of expenditures
		SO53b Percentage of easily accessible low floor vehicles in % of the total urban transport fleet	Percentage of vehicles
	SO54 Intergenerational equity	Important outcomes of interest, but no indicators can be suggested here	
	SO55 Interregional (spatial) equity		
SO6 SOCIAL COHESION (inhabitants, society, the affected)	**SO61 Public opinion profile on transport and transport policy issues**	Percentage of adults supporting radical pro- and anti-car positions in the transport policy discourse	Percentage of adults
	SO62 Violation of traffic rules	Percentage of drivers violating traffic rules and regulations	Percentage of drivers
	SO63 Long distance commuting	Percentage of commuters commuting daily over distances of more than 10 km	Percentage of commuters
SO7 WORKING CONDITIONS IN TRANSPORT SECTOR (employees, drivers, operatives)	**SO71 Occupational accidents**	Number of recorded (notified) serious occupational accidents per year and 100,000 employees in the transport sector	Number of accidents
	SO72 Precarious employment conditions	Percentage of employees in precarious employment conditions	Percentage of employees
	SO73 Work absence due to accidents and illness	Number of reported work absence days per year and 100,000 employees	Number of work absence days

B1.6 Sustainable Transportation Performance Indicators (STPI)

In 2002, the Centre for Sustainable Transportation (CST) completed phase three of its project on 'Sustainable Transportation Performance Indicators' (STPI) (CST 2002).[878] The STPI project developed an initial set of 14 indicators (shown in the table below) in response to six of seven policy-oriented questions, each of which is categorized under a topic area. At the time of publication, no indicators had been developed for the seventh question. In addition to the initial set of indicators, the CST identified a number of additional indicators (or indicator areas) that it hoped to develop (over the short- and long-term) to expand the initial set of STPI.

Initial Set of STPI in Relation to the Framework Topics and Questions with Proposed Shorter-term and Longer-term Additions (CST 2002, p. 14)

Framework topic and question	Initial set of STPI	Shorter-term additions	Longer-term additions
1. Environmental and health consequences of transport *Is the performance of the transport sector improving in respect of its adverse impacts on environment and health?*	1. Use of fossil fuel energy for all transport 2. Greenhouse gas emissions from all transport 3. Index of emissions of air pollutants from road transport 4. Index of incidence of road injuries and fatalities	▪ Air quality ▪ Waste from road transport ▪ Discharges into water ▪ Land use for transport ▪ Proximity of infrastructure to sensitive areas and ecosystem fragmentation	▪ Noise ▪ Effects on human health ▪ Effects on ecosystem health
2. Transport activity *Is transport activity changing in directions consistent with positive answers to the other questions?*	5. Total motorized movement of people 6. Total motorized movement of freight 7. Share of passenger travel not by land-based public transport 8. Movement of light-duty passenger vehicles	▪ Utilization of passenger vehicles ▪ Urban automobile vehicle-kilometres ▪ Travel by non-motorized modes in urban areas ▪ Journey-to-work mode shares	▪ Urban and intercity person-kilometres ▪ Freight modal participation ▪ Utilization of freight vehicles

[878] See the Centre for Sustainable Transportation, *Sustainable Transportation Performance Indicators (STPI) project*, http://cst.uwinnipeg.ca/completed.html#indicators (accessed on 04/09/06).

Framework topic and question	Initial set of STPI	Shorter-term additions	Longer-term additions
3. Land use, urban form, and accessibility *Are land use, urban form, and transportation systems changing so as to reduce transportation effort?*	9. Urban land use per capita	▪ Urban land use by size class and zone ▪ Employment density by CMA, and urban size, class, and zone ▪ Mixed use (percent walking to work; ratio of jobs to employed labour force)	▪ Share of urban population and jobs served by transit ▪ Share of population and employment growth on already-urbanized lands ▪ Travel and modal split by urban zone
4. Supply of transport infrastructure and services *Are we increasing the efficiency of use of current infrastructure and changing the infrastructure supply in sustainable ways?*	10. Length of paved roads	▪ Length of sustainable infrastructure ▪ Transit seat-kilometres per capita	▪ Congestion index
5. Transportation expenditures and pricing *Are the patterns of expenditure by governments, businesses, and households, and the associated pricing systems, consistent with moving towards sustainability?*	11. Index of relative household transport costs 12. Index of the relative cost of urban transit	▪ Percent of net government transport expenditures spent on ground-based public transportation	▪ Transport-related user charges ▪ Expenditures by businesses on transportation
6. Technology adoption *Is technology being used more in ways that make vehicle transport systems and their utilization more sustainable?*	13. Index of energy intensity of cars and trucks 14. Index of emissions intensity of the road-vehicle fleet	▪ Percent of alternative fuel vehicles in the fleet	▪ Percent of passenger-km and tonne-km fuelled from renewable energy ▪ Percent of labour force regularly telecommuting
7. Implementation and monitoring *How effectively are environmental management and monitoring tools being used to support policy- and decision-making towards sustainability?*		▪ Number of sustainable transport indicators regularly updated and widely reported ▪ Public support for initiatives to achieve sustainable transportation	▪ Number of CMAs where planning and delivery of transport and related land use matters have a single authority

B1.7 UN Economic Commission for Europe (UN/ECE) - Sustainable Urban Transport Indicators

In 1999, the United Nations Economic Commission for Europe's (UN/ECE's) Working Party on Transport Statistics requested that a task force be convened to "*harmonize a set of basic indicators on sustainable urban transport, as well as to examine the related definitions used in this field*" (UN/ECE 1999, p. 9). The following year, the 'Task Force on Sustainable Urban Transport Indicators' published a set of policy objectives for sustainable urban transport along with a set of indicators that could be used to track progress towards the objectives (see the table below).

Draft List of Indicators for Sustainable Urban Transport (UN/ECE 2000, pp. 15-16)

Policy Objectives	Relevant Indicators
Reduction of locally-acting and globally-acting emissions	Energy consumption by mode in urban (built-up) areas, by fuel type. Estimates of mileage (passenger/kms and vehicle/kms), by public and private transport. Transport share of total emissions (CO_2, NO_X, VOC, PM, SO_X), by mode. Sales of transport fuels (although consumption may be outside urban area).
Urban transport safety	Number of accidents (fatalities and injuries) by mode (road, rail, intercity rail, bus, tram, trolley, cycles, pedestrians, goods vehicles), in built-up areas and by user group.
Access/accessibility	Proportion of urban population living within 500 meters (5-10 minute walk) from public transport access point.
Efficiency in public transport	Modal share of urban public transport. Passenger satisfaction. Public transport performance. Energy efficiency by public transport.
Noise reduction	Proportion of population exposed to greater than 65 db A, by source of noise (taking into account different sources of noise, including air traffic). Measure of on-street and off-street levels of noise.
Integration of land use and urban transport planning and transport services/environmentally-friendly zoning	Whether transport planning strategy is in place.
Modal shift (away from private car use)	Number of journeys made in alternatives to private car use (bike, foot, etc.). Priority in urban transport plan given to non-motorized modes (walking, bicycling, skating).
Improved efficiency in urban freight transport	Veh/kms by type of vehicle (not tonnes/kms because of empty loads). Noise emissions, particulates. Freight logistics, distribution, pricing (response indicators).
Preservation of cultural heritage/visual quality/	Levels of satisfaction (enquête). Level of communication between policy-makers and urban planners.

urban livability/citizen satisfaction	Rate of emigration from the city vs. employment opportunities.
Internalization of external costs/price signals	How much are real costs of urban transport covered by the user (road pricing/fuel pricing).

B1.8 U.S. DOT National Transportation System (NTS) Performance Measures

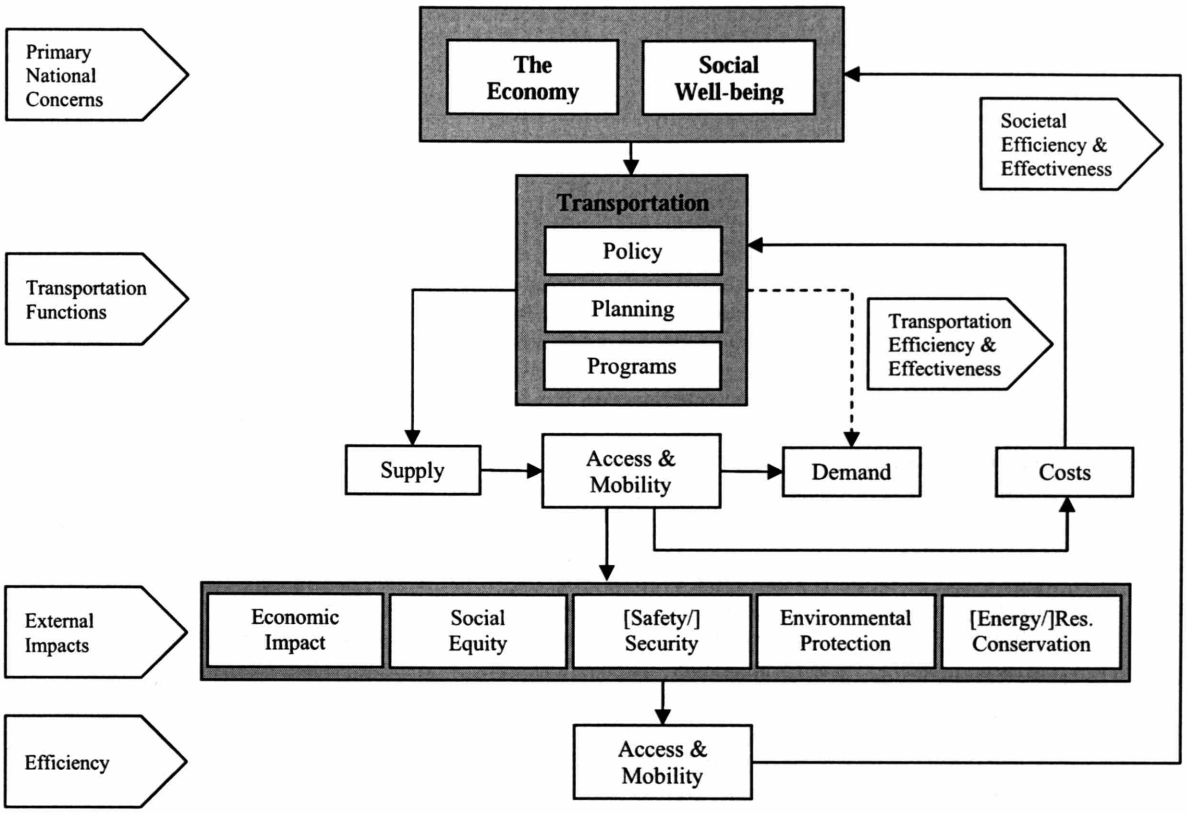
In 1996, Cambridge Systematics, Inc. delivered a report to the Office of the Secretary of Transportation (OST) entitled *National Transportation System Performance Measures.* The report was commissioned by the OST as part of the Secretary of Transportation's National Transportation System (NTS) Initiative - a central program in Secretary Peña's strategy to "Tie America Together."[879]

A core objective of the NTS Initiative was to develop "*an improved capability to monitor the condition and performance of the nation's transportation system, and its effectiveness in supporting the* [nation's] *various societal goals and needs*" (Cambridge Systematics 1996, p. 3-6). The provision of more accurate and up-to-date system information would also enhance the U.S. DOT's ability to make "*informed decisions about where best to direct future investments, and address key policy questions and their inherent tradeoffs*" (ibid, p. 3-6). Further, specific emphasis was placed upon measuring the performance of the transportation system using 'system-based' and 'user-based' indicators.

While the *National Transportation System Performance Measures* report does not use the phrase 'sustainable transportation indicators,' the conceptual framework used to develop the indicators incorporates many of the core elements of sustainable transportation (Figure 1).

The final shortlist of NTS performance measures was prepared following an extensive background study and the 1995 NTS Performance Measurement Conference in Washington, D.C. The shortlist is broken down into three categories: [1] Transportation System Performance; [2] External Impacts and Outcomes; and [3] Description of Supply and Demand. While the supply and demand indicators are not performance measures per se, they were included to provide information on the state/condition of the system. Each of the three sets of indicators is presented in the following three tables respectively.

[879] Source: U.S. Department of Transportation, TMIP (Travel Model Improvement Program), *Urban Transportation Planning in the United States: An Historical Overview,* http://tmip.fhwa.dot.gov/clearinghouse/docs/utp/ch13.stm (accessed on 04/09/06).



Source: Cambridge Systematics, Inc. (1996, p. 3-13)

Figure 1: National Transportation System Measurement Framework

Table 1: Transportation System Performance

ACCESSIBILITY
Coverage — Highway system supply (lane miles, by classification, condition, etc.) per "demand unit" (per capita, employee, square mile, VMT) — Public transit supply (e.g., route miles, seat miles, service hours) per "demand unit" (e.g., per capita, employee, square mile, disadvantaged resident, etc.) — Number/percent of cities with/without specific intercity/international passenger service (rail, bus, scheduled air) — Freight transportation system supply (route miles, capacity miles, number of carriers, number of ports/terminals) per "demand unit" (e.g., per dollar of manufacturing output, per ton-mile of commodity movement, per capita, per employee, etc.)
Proximity — Percent of potential passenger travelers within X miles or Y minutes of specified transportation service (interstate/4-lane highway; local public transit service; intercity bus or rail service; scheduled air service)
"Realistic" or "Functional Access" — [SURVEY] Number of persons who can reach a specified destination (local, intercity, international) by applicable mode (transit, intercity bus or rail, scheduled) within specified limiting service parameters (e.g., no more than 1 transfer, no more than X hours/minutes of delay, no more than Y% circuity) — Number of cities with/without direct scheduled air service by major carrier(s), i.e., not commuter only

— [SURVEY] Number/percent of shippers able to access desired suppliers or markets by preferred and secondary mode within specified service parameters (e.g., shipment time, cost, circuity)
QUALITY OF SERVICE
Level of Service — Percent of highway lane miles with peak hour V/C > 0.9; Change in percent of lane miles which are at V/C > 0.9 (1) outside of peak periods, and (2) for sub-expressway facilities — Average speed (passenger and commercial vehicles) on representative highway segments — [SURVEY] Average travel time, distance, speed, delay, and cost for passenger trips (urban and long-distance, business and pleasure, peak/off-peak, suburban/city, private vs. public mode); percent of trips by public modes spent "out of vehicle" (access, wait, transfer) — [SURVEY] Average shipment time, cost, variability in arrival time for freight shipments (local vs. long distance, by commodity, by mode) — [SURVEY] Percent of urban passenger trips which occur under congested conditions (peak/off-peak, size of city, suburb vs. city, mode) — Service reliability (number of "incidents" per VMT or lane mile of highway; number of transit vehicle breakdowns/service calls per seat-mile of service; number of intercity mode cancellations per seat mile or operation
User Satisfaction — [SURVEY] Passenger assessment of level of quality/satisfaction and/or degree of change in: travel time, speed, cost, number of alternatives, congestion, reliability, safety, etc. — [SURVEY] Shipper assessment of service in terms of shipment time, cost, reliability of on-time arrival, modal/scheduling flexibility, damage/loss, etc.
EFFICIENCY
— Carrying efficiency of passenger modes (private vehicle persons per vehicle mile; transit passengers per seat mile; intercity air, rail, bus load factors) — Passenger modal split (percent person trips by mode, local and long-distance, business vs. pleasure) — Urban highway temporal utilization efficiency (percent of person, freight trips occurring within peak periods) — Commodity shipment modal distribution (ton-miles of primary commodity by mode, distance, domestic/international) — [SURVEY] Shipment processing time at Intermodal terminals — Total hours of traveler delay due to congestion, system breakdowns (highway, transit, air system including air traffic control)

Table 2: External Impacts and Outcomes

ECONOMIC HEALTH AND COMPETITIVENESS
— Cost of transportation reflected in final cost of goods and services (transportation CPI vs. manufactured goods CPI) — US/International balance of trade — Value of Dow-Jones "Transportation Stocks" (reflects how well things are moving through the economy) — [SURVEY] Percent of businesses which cite problems with transportation (access, travel time, cost, flexibility, reliability, damage/losses) as major factor in productivity or expansion
SOCIAL EQUITY, MOBILITY, QUALITY OF LIFE
— Percent of day devoted to traveling for persons, households — Percent of income spent on travel, or, index of transportation costs to overall CPI (overall and segmented by local and intercity and personal travel) — Percentage of disadvantaged travelers (elderly, handicapped, poor) with public transportation alternatives for essential business and personal travel

SECURITY
— Number of incidents (terrorism, highjackings, theft, vandalism) associated with transportation activities per utilization unit (e.g., per capita, per person trip, per service operation, per dollar of travel/shipment expenditure, etc.) — Total value of transportation security-related losses
SAFETY
— Number of transportation accidents, injuries, fatalities per "demand unit" (e.g., per person trip, passenger mile, VMT, type of facility, major mode) — Number of accidents, injuries, and fatalities associated with special market intersections (i.e., airplane crashes, railroad grade crossings, railroad derailments, vehicular and non-motorized travelers [bike, walk]) — Total property, life, and collateral damages associated with transportation accidents — Accidents by mode and major cause (facility, vehicular, operator, control/management, drugs/alcohol, etc.)
ENVIRONMENT
— Emissions rates of transportation modes (passenger vehicles, transit, air, rail, freight modes), current year/models and fleet average — Air quality levels in non-attainment areas (concentrations by type of pollutant), and contributions by source (mobile vs. other, passenger vs. freight) — Percentage of population exposed to threshold levels of air pollution, transportation-related noise — Number and severity of incidents/accidents involving release of hazardous/toxic materials, by mode
ENERGY
— Fuel consumption rates (mpg or Btu per mile) of transportation modes (passenger and freight), current year and fleet average — Fuel efficiency in terms of person miles or ton miles per gallon/Btu — Technology shifts responsible for improved fuel economy or energy conservation (e.g., percent electric vehicles, alternative fuels, engine management improvements, etc.)

Table 3: Description of Supply and Demand

DEMAND DESCRIPTORS
Population — Population (total, (local: total, urban/rural, city/suburb)) — Persons, drivers over 65 years of age (local: total, urban/rural, city/suburb) — Persons, drivers between 16-21 years of age (local: total, urban/rural, city/suburb) — Number of transportation handicapped individuals (local: total, urban/rural, city/suburb) **Households** — Households (total, (local: total, urban/rural, city/suburb)) — Average size (local: total, urban/rural, city/suburb) — Workers (local: total, urban/rural, city/suburb) — Drivers (local: total, urban/rural, city/suburb) — Income (local: total, urban/rural, city/suburb) — Vehicles (local: total, urban/rural, city/suburb) **Personal Travel** — Person trips (local: total, urban/rural, city/suburb, business/pleasure), (intercity: business/pleasure, <=500 mile trips), (international: North America/overseas) — Transit trips (local: urban/rural, city/suburbs) — VMT (local: total, urban/rural, city/suburbs) **Freight Movements** — Commodity movements, ton-miles (total, (local: urban/rural, intercity: <,>=500 miles, international:

all))
- Intermodal transfers (total, (local: urban/rural)), (intercity: city/suburbs, <,>=500 miles), (international: North America/overseas, by commodity type, mode)
- Number of businesses, employment by sector (local: total, urban/rural)
- VMT (total, urban/rural, city/suburbs)

SUPPLY DESCRIPTORS

Highway Infrastructure

- Highway lane miles, by functional class (passenger - all, local, intercity, and international; freight - all, local, intercity, and international)
- Above [*Highway lane miles, by functional class*], percent in acceptable condition (passenger - all, local, intercity, and international; freight - all, local, intercity, and international)
- Number of bridges, tunnels, etc. in acceptable condition (passenger - all, local, intercity, and international; freight - all, local, intercity, and international)
- Freight-only facility/miles (freight - all, local, intercity, and international)

Mass Transportation Services

- Transit route/seat miles (passenger - all, local urban/rural, large/small community)
- Transit equipment inventory (passenger - local urban/rural, large/small community)
- Intercity rail route/seat miles age (passenger - all, intercity: greater or smaller than 500, international: North America)
- Intercity rail equipment inventory (passenger - intercity, international: North America)
- Intercity bus route/seat miles (passenger - all, intercity: greater or smaller than 500, international: North America)
- Intercity bus equipment inventory (passenger - all, intercity, international: North America)
- Scheduled air route/seat miles (passenger - all, intercity: greater or smaller than 500, international: North America/overseas)
- Scheduled air equipment inventory (passenger - all, intercity: greater or smaller than 500, international: North America/overseas)
- Charter air route/seat miles (passenger - all, intercity: greater or smaller than 500, international: North America/overseas)
- Charter air equipment inventory (passenger - all, intercity: greater or smaller than 500, international: North America/overseas)
- Number of operators

Freight Transportation Services

- Number/type of intermodal terminals (total, local, intercity, international)
- Number of trucking companies by type (total, local, intercity, international)
- Number of registered trucks, by type, asset (total)
- Number of freight railroads by class (total)
- Rail truck miles by class (total)
- Number of double-stack miles (total)
- Number of marine barge operators (total)
- Route miles served by marine barge operators (total)
- Number of package express carriers, capacity (total)
- Number of air cargo carriers (total)
- Air cargo carrier route/capacity miles of service (total)

B1.9 U.S. DOT Environmental Performance Measures

As part of its requirement to comply with the 1993 Government Performance and Results Act (GPRA), the U.S. DOT has published annual reports (since 1999) on how well its budgeted program activities are performing. The table below presents the environmental performance measures from the first and most recent U.S. DOT *Performance Reports.* The 'Human and Natural Environment' strategic outcomes from the *2004 Performance Report* have also been included since these indicate how two of the early environmental performance measures have evolved into strategic outcomes. Perhaps what is most surprising is that two of the most important environmental performance indicators - i.e., greenhouse gas emissions and energy use - are not included in the *2004 Performance Report.* This observation highlights a move away from the measurement of important social and environmental indicators and a reduction in the stringency of performance measures.

Environmental Performance Measures ***U.S. DOT's 1999 Performance Report*** (Gudmundsson 2001b, p. 9; U.S. DOT 1998)	**Human and Natural Environmental Performance Measures and Strategic Objectives** ***U.S. DOT's 2004 Performance Report*** (U.S. DOT 2004)
Wetlands Protection – Acres of wetlands replaced for every acre affected by federal-aid highway projects.	Acres of wetlands replaced for every acre affected by federal-aid highway projects.
Hazardous Waste – Percent DOT facilities categorized as No Further Remedial Action Planned under Superfund Act.	Percent DOT facilities needing no further remedial action under Superfund Amendments and Reauthorization Act.
Airport Noise Exposure – Number of people in U.S. exposed to significant aircraft noise levels.	Number of people in U.S. (in thousands) exposed to significant aircraft noise levels.
Toxic Materials – Tons of hazardous liquid materials spilled per million ton-miles shipped; and gallons of hazardous liquid spilled per serious transportation incident. *Maritime Oil Spills* – Gallons of oil spilled per million gallons shipped by maritime sources.	Tons of hazardous liquid materials spilled per pipeline million ton-miles shipped.
Emissions – Tons of mobile source emissions from on-road motor vehicles.	Monthly moving average number of area transportation emissions conformity lapses.
	HUMAN AND NATURAL ENVIRONMENT **Strategic Outcomes:**
Livable Communities/Transit Service – Percent urban population living within 1-mile of transit stop with service of 15 minutes or less.	— Improve the sustainability and livability of communities.
	— Reduce the adverse effects of transportation on ecosystems and the natural environment.
	— Improve the viability of ecosystems.
	— Reduce the adverse effects of transportation facilities on the natural environment.
Environmental Justice – Environmental justice cases that remain unresolved over one year.	— Improve equity for low-income and minority communities concerning the benefits and burdens of transportation facilities and services.

	— Reduce the amount of pollution from transportation sources.
Greenhouse Gas Emissions – Metric tons of carbon equivalent emissions from transportation sources.	
Energy – Transportation-related petroleum consumption per gross domestic product.	
Fisheries Protection – Compliance with federal fisheries regulations.	

B2 Indicators Developed by Individuals

B2.1 Henrik Gudmundsson

In an interesting report on *Indicators and Performance Measures for Transportation, Environment, and Sustainability in North America*, Gudmundsson (2001a) presents a useful list of environmental indicators for transportation (shown below).

Indicators of Sustainable Transportation (Gudmundsson 2001a, p. 75)

Impact	Indicator
Air Pollution and Air Quality	Tons of mobile source emissions from on-road motor vehicles
	Change in Criteria Pollutant Emissions compared to Vehicle Travel 1940-1997
	Criteria Pollutant Emissions from Transportation Vehicle and Equipment Manufacturing (car, rail, aircraft, etc.)
	VOC Emissions from Solvent Utilization in Surface Coating for Autos & Light Trucks
	Number of days the Pollution Standard Index is in an unhealthy range
	Number of urban areas/pollution classified as in nonattainment
	Customer perception of satisfaction with air quality
	Mobile Source Contribution to Hazardous Air Pollution Inventories (HAPs = causing serious human health effects or ecosystem damage)
Climate Change	Share of CO_2 Emissions from Transportation
	Full Fuel Cycle CO_2-equivalent Emissions for Light-duty Motor Vehicles (grams per mile)
	Estimated U.S. Emissions of CFC-12 and HFC-134a (all sources not only transportation)
Energy	Transportation energy use per dollar of GDP
	Daily energy use on the transportation system
	Fuel Consumption per VMT
	Average fuel consumption per trip for selected trips
	Company Average Fuel Consumption for passenger cars
	Number of vehicle manufacturers submitting complete and timely fuel consumption data
Noise	Percent of U.S. Population Exposed to Different Levels of Transportation Noise
	Number of noise receptor sites above threshold
	Number of people in U.S. exposed to significant aircraft noise levels
Habitat, Land Use, and Biological Resources	Land Area Occupied by Roadways
	Percent of region that is developed
	Conversion of resource lands to transportation facilities
	Wetland Losses and Creation Associated with the Federal Aid Highway Program
	Number of Animal Collisions with Motor Vehicles reported
Water Quality	Number of Fuel Spills and Total Volume of Fuel Discharged Annually
	Gallons of oil spilled by maritime sources per Million Gallons
	Highway Salt Sales
	Amount of salt used per VMT or lane mile
Hazardous Materials	Number of Hazardous Materials Incidents
	Gallons of hazardous liquid materials spilled per serious transportation incident
Waste/Recycling	Number of Motor Vehicles Scrapped Annually
	Estimated Annual Garbage Generation by U.S. Maritime Sectors
	Lead Acid Batteries in Municipal Solid Waste Streams

Impact	Indicator
	Disposition of Scrap Tires
	Amount of recycled material in road construction

B2.2 Todd Litman

In a short paper that reviews a range of environmental performance, sustainability, and sustainable transportation indicators, Litman (2003) presents a set of comprehensive sustainable transportation indicators (shown below). Litman's (2003) comments on the direction that trend data for an indicator should follow is a useful addition.

Comprehensive Sustainable Transportation Indicators (Litman 2003, pp. 11-12)

Goal and Objectives	Indicator	Direction
Economic		
Accessibility – Commuting	Average commute travel time	Less is better
Accessibility – Land use mix	Number of job opportunities and commercial services within 30-minute travel distance of residents	More is better
Accessibility – Land use	Average number of basic services (schools, shops, and government offices) within walking distance of homes	More is better
Accessibility – Smart growth	Implementation of policy and planning practices that lead to more accessible, clustered, mixed, multi-modal development	More is better
Accessibility – Children	Portion of children who can walk or bicycle to schools, shops, and parks from their homes	More is better
Accessibility – Electronic	Portion of population with Internet service	More is better
Transport diversity	Variety and quality of transport options available in a community	More is better
	Mode split: portion of travel made by walking, cycling, rideshare, public transit, and telework	More is better
Motor transport options	Quantity and quality of airline, rail, public transit, ferry, rideshare, and taxi services	More is better
Automobile-dependency	Per capita vehicle mileage	Ambiguous
Congestion delay	Per capita traffic congestion delay	Less is better
Travel costs	Portion of household expenditures devoted to transport	Less is better
Affordability	Portion of household expenditures devoted to transport by 20% lowest-income households	Less is better
Facility costs	Per capita expenditures on roads, traffic services, and parking facilities	Less is better
Freight efficiency	Speed and affordability of freight and commercial transport	More is better
Delivery services	Quantity and quality of delivery services (international/intercity courier, and stores that offer delivery)	More is better
Commercial transport	Quality of transport services for commercial users (businesses, public agencies, tourists, convention attendees)	Higher is better
Market principles	Degree to which transport systems reflect market principles, including prices that reflect full costs and neutral tax policies	More is better
Planning	Degree to which transport institutions reflect least-cost planning and investment practices	More is better
Crash costs	Per capita crash costs	Less is better

Goal and Objectives	Indicator	Direction
Planning process	Range of solutions considered in transport planning	More is better
Social		
Safety	Per capita crash disabilities and fatalities	Less is better
Health and fitness	Portion of population that regularly walks and cycles	More is better
Community livability	Degree to which transport activities increase community livability (local environmental quality)	More is better
Streetscape - Aesthetics	Aesthetic and safety quality of streets as experienced by residents, pedestrians, and motorists	More is better
Cultural preservation	Degree to which cultural and historic values are reflected and preserved in transport planning decisions	More is better
Equity – Fairness	Degree to which prices reflect full costs unless a subsidy is specifically justified	More is better
Equity – Progressive	Degree to which transport policies make lower-income people relatively better off	More is better
Equity – Non-drivers	Quality of accessibility and transport services for non-drivers	More is better
Equity – Disabilities	Quality of transport facilities and services for people with disabilities, such as wheelchair users and people with visual impairments	More is better
Nonmotorized transport	Quality of walking and cycling conditions	More is better
	Degree to which impacts on nonmotorized transport are considered in transportation modeling and planning	More is better
User rating	Overall rating of transport system and services by users	More is better
Citizen involvement	Public involvement in transport planning process	More is better
Environment		
Climate change emissions	Per capita fossil fuel consumption, and emissions of CO_2 and other climate change emissions	Less is better
Other air pollution	Per capita emissions of "conventional" air pollutants (CO, VOC, NOx, particulates, etc.)	Less is better
Noise pollution	Portion of population exposed to high levels of traffic noise	Less is better
Water pollution	Per capita vehicle fluid losses	Less is better
Land use impacts	Per capita land devoted to transportation facilities	Less is better
Habitat protection	Preservation of high-quality wildlife habitat (wetlands, old-growth forests, etc.)	More is better
Habitat fragmentation	Average size of roadless wildlife preserves	More is better
Resource efficiency	Non-renewable resource consumption in the production and use of vehicles and transport facilities	Less is better

In a recent paper on transportation indicators for sustainability, Litman (2005) builds upon his earlier work and presents the following set of indicators that he categorizes as most important, helpful, and specialized. In addition, he highlights a series of indicators/principles that can be applied to measure/improve the planning process and market efficiency.

Recommended Set of Indicators for Comprehensive and Sustainable Transport Planning (Litman 2005, p. 28)

	Economic	Social	Environmental
Most Important (Should usually be used)	Per capita mobility (person-miles or trips). Mode split. Average commute travel time. Per capita congestion costs. Portion of household budgets devoted to transport. Public/external costs of transport per capita.	Quality of accessibility for disadvantaged people. Per capita traffic crashes and fatalities. Community impacts. Portion of low-income household budgets devoted to transport. Inclusiveness of planning process.	Per capita energy consumption. Per capita air pollution emissions (various types). Per capita land devoted to transportation facilities. Air and noise pollution exposure and health damages. Quality of environmental analysis and planning.
Helpful (Should be used if possible)	Degree to which transport planning decisions reflect market principles. Relative quality of non-automobile modes (walking, cycling, ridesharing, public transit). Job opportunities and public services within 30-minute commute distance of residents.	Portion of residents who regularly walk or bicycle. Portion of children walking or cycling to school. Consideration of cultural resources in transport planning. Residents' overall satisfaction rating of transport system. Universal design (consideration of disabled people's needs in transport planning).	Community livability ratings. Water pollution emissions.
Specialized (Used to address particular needs or objectives)	Portion of households with Internet access. Change in property values.	Transit affordability. Housing affordability in accessible locations.	Impacts on special habitats and environmental resources.
Planning Process	Comprehensive (takes into account all significant impacts, using best current evaluation practices). Unbiased (applies objective, least-cost planning and investment practices). Inclusive (substantial involvement of affected people, with special efforts to ensure that disadvantaged and vulnerable groups are involved). Application of smart growth land use policies.		
Market Efficiency	Portion of total roadway and parking costs borne directly by road users. Implementation of pricing reforms such as congestion pricing, distance-based vehicle insurance and registration fees, Parking Cash Out, unbundled parking, tax reforms, etc.		

B2.3 John Whitelegg

In his classic work on sustainable transportation, *Critical Mass: Transport, Environment, and Society in the Twenty-first Century*, Whitelegg (1997, p. 109) suggests a set of indicators "*that may be relevant to monitoring the impact of transport policy in an average city.*" His set of indicators shown below is divided into three categories: primary; secondary; and tertiary. In the words of Whitelegg (1997, p. 109), "*Primary indicators are those that measure key indicators of global sustainability. They reflect principal pressures that are being exerted by human society on the planet's ecosystems. Secondary indicators measure the smaller scale, more localised impacts, and measure the actual physical state of the area being monitored. Tertiary indicators can embrace more social and economic trends that may be influenced by particular policies. These reflect societal response to the policy changes.*"

Indicators to Monitor the Impact of Transportation Policy at the City Level
(Whitelegg 1997, pp. 109-110)

Primary Indicators

- energy use per capita;
- CO_2 emissions;
- SO_2 emissions;
- NO_x emissions;
- hydrocarbon emissions;
- levels of tropospheric ozone;
- emissions of heavy metals;
- loss of biodiversity or greenspace from transport infrastructure construction.

Secondary Indicators

- annual fuel consumption by the transport sector;
- vehicle kms per annum;
- number of cars per household;
- number of new vehicles sold per annum;
- tones-km of freight moved per annum by each transport mode;
- ratio of funds spent on private and public transport (including cycling and walking facilities);
- availability (and cost to user) of public/private parking bays in the central business district;
- average commuting distance and modal choice of commuters;
- percent of total road journeys in single occupancy vehicles;
- total road capacity;
- total route kms of mass transit systems;
- total route kms of dedicated cycleway;
- percentage of inner area with access for pedestrians, cyclists, and buses only;
- number and capacity of park and ride schemes;
- number and percentage of journeys of less than 5km by mode.

Tertiary Indicators

— road accident rate;
— asthma sufferers per 1000 population;
— percentage of community living with noise background rates greater than 55 dB(A);
— percentage of children driven to school;
— percentage of women who feel safe using public transport at night;
— percentage of population living within 500m of bus/tramstop/railway station/cycleway;
— percentage of population living within 5km of essential services (shops, hospital, school, etc.);
— percentage of streets safe for children to play;
— GDP per capital;
— unemployment rate;
— number of business starts/failures in the central business district.

B2.4 Josias Zietsman and Laurence Rilett

In the insightful report *Sustainable Transportation: Conceptualization and Performance Measures*, Zietsman and Rilett (2002) developed a comprehensive set of objectives and performance measures for sustainable transportation (shown below).

Objectives and Performance Measures for Sustainable Transportation (Zietsman and Rilett 2002, pp. 26-27)

Objective	Performance Measures
1. Maximize accessibility	Number of travel objectives that can be reached within an acceptable travel time, ability of non-drivers to reach employment centers and services, land use mix, % employees within *x* miles of major services, highway system supply, transit supply, and time devoted to non-recreational travel.
2. Maximize comfort and convenience	Walking distance to transit services, trip distance, comfort and convenience, and frequency of service.
3. Maximize economic benefit	Jobs added, value added to goods produced, wages added to job payrolls, tax revenues, net present worth, and change in gross domestic product (GDP).
4. Maximize equity	Point-to-point travel cost, point-to-point travel time, population within walking distance to transit, percentage of disadvantaged travelers with alternatives, affordability of public transit, percentage of income devoted to transportation, percentage of day devoted to commuting, and percentage of residents participating in land use and transportation decision-making.
5. Maximize livability	Average vehicle speed, mode split, per capita land area paved for roads and parking, and number of major services within walking distance of residents.
6. Maximize mobility	Mobility index, total delay, delays per person, person throughput, volume/capacity ratio, travel time, travel rate, link capacity, and link usage.
7. Maximize pedestrian and bicycle usage	Mode split, bicycle counts, pedestrian counts, and quality of pedestrian and bicycle environment.
8. Maximize productivity	Passengers per vehicle revenue, vehicle hours, and operating cost per passenger trip.
9. Maximize reliability	Variance of point-to-point travel time, reliability of service, schedule adherence, and freeway incident delay.
10. Maximize safety	Accident rate, accident fatality rate, freeway incident rates, total value of damages as a result of accidents, traffic violations, average response time for emergency services, tons of hazardous materials spilled due to accidents, percent of vehicles exceeding speed limit, percent of motorists driving under the influence, and percent of motorists using seat belts.
11. Maximize security	Incidents of crime, transportation security-related losses, and crime rate.
12. Maximize transit usage	Mode split, passenger-miles of travel, number of transit passengers, quality of service, and portion of residents within walking distance of service.
13. Minimize air pollution	Concentration of HC, NOx, and CO emissions, percentage of population exposed to threshold levels, tons of HC, NOx, and CO vehicular emissions, and emission rates.
14. Minimize auto usage	Vehicle-miles of travel, vehicle occupancy, mode split, traffic volume, annual miles of automobile travel per capita, person miles of travel, vehicle miles of travel, and telecommuting.
15. Minimize capital costs	Capital cost, right of way cost, and mitigation cost.
16. Minimize congestion	Travel rate, delay rate, total delay, average speed, mobility index, hours of congestion, LOS, volume/capacity ratio, duration of heavy congestion, vehicles per lane mile, and percentage of corridor congested.

Objective	Performance Measures
17. Minimize displacement	Acres of land acquired, and structures displaced.
18. Minimize ecosystem impacts	Area of wetlands taken, area of agricultural land taken, area of forest land taken, area of habitat taken, ecological footprint, and pollutant run-off.
19. Minimize energy consumption	Per capita transportation energy consumption, energy consumption per time period, technological innovations, gasoline and diesel sales, vehicle miles traveled per gallon of fuel, and vehicle occupancy.
20. Minimize noise impacts	Noise levels, percentage of population exposed to threshold levels, and noise standards for new vehicles.
21. Minimize operating costs	Operating cost, maintenance cost, cost of accidents, costs associated with pollution, operating deficits, and operating revenue.
22. Minimize travel cost	Point-to-point out of pocket travel cost, point-to-point transit fares, and parking cost.
23. Minimize travel time	Point-to-point travel time, person-hours of travel, vehicle hours of travel, delay, per capita automobile use, and number of stops.

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Appendix C: MPO Questionnaire

1. How would you describe your position in the MPO?

- Board Member
- Director
- Deputy Director
- Program Manager
- Transportation Planner/Engineer
- Other (please specify)

2. What is the population served by your MPO?

- 50,000 - 200,000
- 200,001 - 1,000,000
- 1,000,001 - 2,000,000
- 2,000,001 +

3. What is the geographic area served by your MPO (in square miles)?

- less than 500
- 501 - 1,000
- 1,001 - 1,500
- 1,501 - 2,000
- 2,001 - 2,500
- 2,501 - 3,000
- 3,001 - 4,000
- 4,001 - 5,000
- 5,001 +

4. What is the approximate annual operating budget of your MPO?

5. What is the voting structure of your MPO?

- Each representative from a political jurisdiction and/or MPO member entity receives one vote.
- The voting structure is based upon the population in each jurisdiction (i.e., the structure is weighted/adjusted).
- Other (please specify)

6. Is your MPO part of a COG or regional planning agency?

- Yes
- No

7. What is the worst (current) Ozone designation in your MPO region?

- No data
- Attainment
- Marginal
- Moderate
- Serious
- Severe
- Extreme

8. What is the worst (current) Carbon Monoxide (CO) designation in your MPO region?

- No data
- Attainment
- Moderate <12.7 ppm
- Moderate >12.7 ppm
- Serious

9. How would you rate your MPO's attention to the following transportation policy goals?

	Excellent	Very good	Fair	Poor	Very poor
Economic growth	◡	◡	◡	◡	◡
Equity and public participation (e.g., Title VI and environmental justice)	◡	◡	◡	◡	◡
Environmental protection/stewardship	◡	◡	◡	◡	◡
Mobility	◡	◡	◡	◡	◡
Safety	◡	◡	◡	◡	◡
Security	◡	◡	◡	◡	◡
System efficiency/intermodality	◡	◡	◡	◡	◡

10. How important do you think the following concerns are in relation to transportation planning and decision-making?

	Very important	Important	Moderately important	Of little importance	Unimportant
The concern that greenhouse gas emissions from the transportation system are leading to a disruption of the global climate.	◡	◡	◡	◡	◡
The concern that pollution from the transportation system is negatively affecting human health.	◡	◡	◡	◡	◡
The concern that the transportation system is reliant upon finite resources and energy supplies.	◡	◡	◡	◡	◡
The concern that negative impacts from the transportation system are adversely affecting ecosystem health and biological diversity.	◡	◡	◡	◡	◡

11. How does your MPO or its member entities assess the potential impacts of a transportation policy/project?

- A benefit-cost analysis is used — i.e., environmental and social impacts are translated into a monetary value for comparison.
- Environmental, social, and economic factors are left in their natural units (e.g., environmental effects are expressed in terms of damage to ecosystems, health and safety effects are expressed in terms of morbidity, and economic effects are expressed in monetary terms) and compared/traded-off against one another.
- An analysis of impacts is rarely undertaken.
- Other (please specify)

12. When selecting new transportation projects to be included in your TIP — with the exception of transit projects funded by 'New Starts' — how often is more than one alternative project or solution considered?

Always	Very often	Sometimes	Rarely	Never

13. The role of the MPO in the decision-making process is to endorse the consensus reached by its members/participating stakeholders.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree

14. The role of the MPO in the decision-making process is to act as trustee on behalf of affected stakeholders (such as disadvantaged groups) without necessarily following majority views on important issues.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree

15. The primary role of the MPO in the decision-making process is to:

- Reach consensus amongst its members/participating stakeholders.
- Implement programs with the greatest net benefit, regardless of their distributional impacts.
- Balance the needs of under-represented or disadvantaged groups with the wishes of the majority.
- Give special emphasis to under-represented or disadvantaged groups.

16. The stakeholder groups/MPO member entities engaged in the planning/decision-making process are only interested in realizing their own objectives.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
◡	◡	◡	◡	◡

17. The stakeholder groups/MPO member entities engaged in the planning/decision-making process are willing to consider the issues of others, beyond their own interests.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
◡	◡	◡	◡	◡

18. How often does your MPO and its member entities consider the following groups in the transportation planning process?

	Always	Very often	Sometimes	Rarely	Never
Children/youth K-12	◡	◡	◡	◡	◡
Commercial beneficiaries of transportation (e.g., shopping centers)	◡	◡	◡	◡	◡
Ethnic or minority groups	◡	◡	◡	◡	◡
Freight companies	◡	◡	◡	◡	◡
Low-income groups	◡	◡	◡	◡	◡
Physically disabled	◡	◡	◡	◡	◡
The elderly	◡	◡	◡	◡	◡

19. On average, to what extent do the customers in the following groups benefit from your MPO's transportation policies and programs?

	Greater than the average customer	Same as the average customer	Less than the average customer	Cannot be determined
Children/youth K-12	◡	◡	◡	◡
Ethnic or minority groups	◡	◡	◡	◡
High-income groups	◡	◡	◡	◡
Low-income groups	◡	◡	◡	◡
Middle-income groups	◡	◡	◡	◡
Physically disabled	◡	◡	◡	◡
The elderly	◡	◡	◡	◡

20. What is the total number of projects in your most recent TIP?

21. How many projects in your most recent TIP were designed or selected with the following target groups in mind?

Children/youth K-12	
Commercial beneficiaries of transportation (e.g., shopping centers)	
Ethnic or minority groups	
Freight companies	
Low-income groups	
Physically disabled	
The elderly	

22. When developing new transportation policies/projects, to what extent are efforts made to improve the following areas?

	A great extent	Much	Somewhat	A little	Not at all
Unmet transportation needs and demands	◡	◡	◡	◡	◡
The adequacy of incentives designed to encourage a desired travel behavior	◡	◡	◡	◡	◡
The adequacy of existing public/private institutions at managing/operating the transportation system	◡	◡	◡	◡	◡
The adequacy of existing (federal/state/regional) legislation	◡	◡	◡	◡	◡
The extent to which existing (federal/state/regional) legislation is implemented	◡	◡	◡	◡	◡
The adequacy of existing transportation technologies	◡	◡	◡	◡	◡

23. It is feasible for my MPO to apply and adhere to a principle which states that the environment must be protected and continually improved in areas negatively affected by transportation-related pollution.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
◡	◡	◡	◡	◡

24. Does your MPO use a visioning process to develop its long-range transportation plan in which decision-makers and stakeholders first identify a desirable future and then work backwards to identify pathways to that future?

[Note: This 'backcasting' approach is different to scenario analysis, in which several future scenarios are developed and used to evaluate transportation policies.]

- Yes
- No

25. In your experience, to what extent have the air quality standards established by the Clean Air Act led to any innovative (or non-traditional) planning activities?

A great extent	Much	Somewhat	A little	Not at all

26. To what extent do you think more stringent air quality standards would lead to improvements in:

	A great extent	Much	Somewhat	A little	Not at all
The environment?					
Economic growth?					
Transportation technology?					

27. To what extent are your transportation plans integrated/ coordinated with:

	Highly integrated	Integrated	Coordinated	Minimal overlap	Not connected
Urban/regional development plans?					
Health and human services?					
Environmental regulation?					
Employment policy?					
Economic policy?					
Energy policy?					
Trade policy?					

28. Thank you for taking the time to complete this survey.

If you have any comments on the questions asked in this survey, please enter them below along with the question number.