GLOBAL KNOWLEDGE NETWORKING FOR THE MULTINATIONAL ENTERPRISE

by

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ABSTRACT

This thesis proposes a technology strategy that is formulated to serve as the foundation for a holistic, global knowledge networking strategy for multinational enterprises (MNEs). This thesis is framed in the context of the increasing salience of knowledge for all enterprises, everywhere, today. The uncertainties of the marketplace, global e-business opportunities born of the Internet revolution, and the paradigmatic shifts in thought on organizational design have amplified the demand for the right knowledge of the right kind at the right time. The multi-dimensional nature of knowledge and the complexities of enterprise activities are compounded by the fact that enterprises today are increasingly globalized and seeking to globally expand its activities. The capabilities to acquire quality-controlled knowledge within the necessary time-horizons, and the capabilities to leverage and diffuse acquired knowledge throughout the organization have become critical. However, the mechanisms by which to perform and enable these functions are not strategically integrated across the organization, and on a global basis.

This thesis focuses on the knowledge network as a mechanism and as a process by which to coordinate innovation and learning for enterprises and enterprise-value-networks on a global basis. While knowledge networks have been formed in both non-profit and for-profit sectors, this thesis will be concerned solely with knowledge networks for businesses. Knowledge networks can be analyzed into technology and human elements, but often there is no coordinating strategy that synthesizes both elements into integrative solutions that can capture the value of knowledge for the enterprise. The hypothesis guiding this thesis is that existing models of knowledge networking are not sufficiently holistic, and proposes an integrated knowledge networking strategy that leverages both technology infrastructure and human competencies in meeting organizational knowledge requirements.

The emergent nature of strategically initiated knowledge networks in business can adapt knowledge networking solutions that have been developed in the non-profit sector. One such framework for knowledge networking from the non-profit sector is the GSSD (Global System for Sustainable Development) initiative, developed in MIT with partners in academic institutions around the world, is one such methodology that aims to facilitate knowledge flows and knowledge sharing on a global scale. This thesis (a) develops a technology strategy that adapts the GSSD framework for enterprises that operate on a global scale, (b) illustrates its conceptual feasibility by proposing several designs for GSSD-E, or GSSD for the enterprise, and (c) applies the designs to a test case. The test case is a conceptual implementation of the GSSD-E design for Sony Environmental Management Systems. The thesis concludes by suggesting further possible directions in researching GSSD-E possibilities.

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CONTENTS

List of Figures and Tables

Figures

Tables

1. INTRODUCTION

1.1 The Problem

Like the wave of the future, the 'knowledge movement' in commercial enterprises has been inexorably gaining in momentum and pervasiveness. The knowledge-based economy, knowledge management, knowledge networks, knowledge workers, knowledge markets, knowledge commodities, knowledge assets, knowledge stocks and flows, and knowledge infrastructures are recent semantic inventions that all carry the 'knowledge' tag. Indeed, the knowledge factor is very much at the heart of how organizations are run in the twenty-first century. Even so, the means of acquiring knowledge, leveraging knowledge and diffusing knowledge throughout an organization are processes that are by no means systematically or strategically ensured and facilitated, despite the sheer criticality of knowledge in the decision-making process. The absence of sophisticated mechanisms hitherto developed that capture the value of knowledge does not suggest that the current interest in knowledge is a fad – indeed, knowledge is and will always be a crucial determinant of success or failure in decision-making. It, instead, points to the urgency of knowledge requirements today, made ever more intensive by rapid advancements in information and communications technology. In businesses, the real-time economy has arrived, in which the correct decisions must be made, and made now. Simply put, the tolerance for error and slowness in decision-making carry potentially tremendous penalties in an environment where the fickleness of consumer preferences and fluctuations in national economies make for increasingly volatile market environments.

For enterprises that operate on a global scale, the multi-dimensional complexities that must be managed within ever-decreasing time horizons, mean that the knowledge requirements by managers are ever-more demanding. Alliances of enterprises – value networks of independent enterprises that seek alliances to mutually leverage synergies and core competencies – are increasingly common and multifarious, further increasing that level of complexity, and further raising the bar that must be overcome in order that the right knowledge can be leveraged in the right time. Indeed, these are the two salient trends of our time – namely, the increasing global expansion of business enterprises as a result of advances in information and communications technology, and the formation of multinational value networks of multinational enterprises and domestic enterprises.

1.2 The Strategy

One mechanism to solve these problems of knowledge under-supply that has been developed and implemented, largely in the non-profit and academic sectors, is knowledge networking, a set of techniques born of multifarious disciplines – network analysis, sociology, political science, economics, business studies, information systems and organizational design. This thesis proposes the use of knowledge networking strategies to meet these challenges of knowledge acquisition, creation and leverage on a global basis, in the context of multinational business enterprises and multinational business enterprise networks. The thesis is made up of two central components – in the first half, the thesis will argue for the need of a holistic global knowledge networking strategy for the multinational enterprise, while in the second, it will adapt a global

knowledge networking system developed in the academic sector for use in the context of the multinational enterprise.

Knowledge networking, while relatively semantically young, is conceptually mature – there have been knowledge networks throughout the history of human civilization – and refers at its simplest and most ancient form the coming together of different people as a result of a common purpose to collaborate and leverage the knowledge of each other in pursuit of that common purpose. This thesis identifies the two main components of the knowledge network in its people and its technological infrastructure – the former is the raison d'etre for the knowledge network, while the latter is utterly indispensable for the coordination of a global knowledge network. It will argue that knowledge networks that rely on one element and neglect the other are inadequate in competing in the market environments of today. This thesis is concerned with global knowledge networking, and hence two enterprise forms that operate on a global scale will be examined in greater detail. These two enterprise forms refer to the multinational enterprise and the value-network, a multi-enterprise alliance that has the function of a unified enterprise. Arguments will also be presented that suggest the convergence of MNEs and value networks into globally active value networks as enterprise activities become increasingly globalized as a result of information technologies, boundaries blur, IT systems integrate, coordination-and-control mechanisms evolve, and decision-making powers become increasingly decentralized to knowledge workers operating in dynamic and volatile market environments.

It will contend that a successful global knowledge networking strategy is one that strategically and holistically synthesizes elements of both, and that can surmount the barriers, tangible or otherwise, that impede the knowledge sharing and knowledge creation processes that are at the heart of the knowledge networking process. The thesis then proceeds to propose the adaptation of an extant global knowledge networking system – the Global System for Sustainable Development (GSSD) – for use as the knowledge networking technology strategy in the context of the enterprise. It will show, via proposed designs and a brief case study of conceptual implementation in a real MNE, that the GSSD is a framework that is generic enough for adaptation and one whose structure and operation in the academic context can equally contribute value-add in global business.

This thesis begins in chapter two by providing the context – what is knowledge? How can we analyze knowledge into components that can be useful in the context of enterprises? What is the value of knowledge? What are an enterprise's knowledge assets? It will proceed in chapter three to define the knowledge network and the knowledge networking process, and how these concepts relate to the enterprise and its variants – the multinational enterprise, the value network and the multinational value network. It will declare the parameters that will be used to evaluate existing and emergent knowledge networks, and analyze the organizational structures of multinational enterprises, value networks and emergent multinational value networks to provide the context of the subject of interest in proposing a holistic knowledge networking strategy. With the context, one proceeds in chapter four to put forth the hypotheses that knowledge networking must be strategy-driven in leveraging both technology and people within the organization. In chapters five to seven, the GSSD system is mooted as a knowledge networking technological infrastructure and conceptual foundation for knowledge networking in the multinational enterprise, and four forms of the adapted GSSD system are proposed to show the conceptual

feasibility of such an undertaking, along with a case-study and conceptual implementation of a GSSD-enterprise design for Sony Environment Management Systems.

The thesis concludes with a summary of the key points that have been made, and further pathways from which research can proceed in studying and measuring the role of global knowledge networking for enterprises.

2. KNOWLEDGE

2.1 Introduction

Knowledge has always been an indispensable and critical component in effective management and business leadership. Philosophers and thinkers, from Aristotle to Foucault, have mused about the nature of knowledge, and indeed, few are unfamiliar with Francis Bacon's assertion that "knowledge is power". Peter Drucker's "knowledge workers" and Nonaka's "knowledge-creating companies" represented the vanguard of intellectual input in the creation of knowledge management – a relatively young discipline of management practices thematically linked by their key emphasis on knowledge as a the key driver of value creation. Interest in knowledge and its management was founded on several factors: (1) the experiences of networked knowledge-intensive enterprises that leveraged the synergy between, and connectedness of, its employees (most of whom are adepts in their fields) to drive innovation, (2) the development of business transformation strategies (as manifested in Total Quality Management and Business Process Re-engineering initiatives in large corporations), (3) the evolution of management information systems in enterprise modeling, expert systems, enterprise resource planning initiatives and relationship software, and (4) the emergence of the learning organization which emphasizes the links between learning, knowledge and value-creation[1].

Knowledge in a for-profit organization is vital for two functions[2] – that of being a fundamental, if intangible, resource for effective execution of its mission, and that of being valuable assets for sale or exchange. Knowledge is hence critical for the sustenance and strengthening of a business enterprise's viability.

2.2 Knowledge and Markets

The vision of a "knowledge-based economy" inhabited by "knowledge-intensive firms" and "knowledge workers" that describes a postindustrial economic structure fundamentally different from those of the past, as harbored by an exponent of knowledge management, may have been somewhat highfalutin and 'woolly' (as a wag from the Financial Times describes it)[3], but it reflects the tremendous differences that separate the world economy today from that of a century ago. The revolution and resultant criticality of information and communications technology, the globalization of business, and the absence, hitherto, of management tools and practice that offers a framework for capturing the value of knowledge in pursuing organizational objectives, have spurred a great deal of knowledge-based thinking and conceptualizations in the past decade that have impacted existing schools of thought for strategy, innovation, organizational design, and information systems.

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[1] D. Garvin notes that the learning organization is an organization that is skilled at creating, acquiring and transferring knowledge while modifying its behavior as a result of assimilating new knowledge and insights. A. de Geus asserts that learning is the only sustainable competitive advantage, continually developed from lessons learnt from successes and failures.

[2] Stewart, T., "Intellectual Capital", 1997

[3] Grant, R., "Shifts in the World Economy", 1999

'Knowledge-centric' thinking in business management has led to the theory that knowledge is the primary factor of production in the New Economy, displacing capital in the industrial economy and land in the agricultural economy,[4] in which non-tangible intellectual assets continue to displace physical and financial capital in relative importance. In this context, developed nations have in the past decades been shifting from a heavy reliance on traditional industries like textiles and steel to an economy built on knowledge intensive industries like services and high tech. The latter industries are concentrations of knowledge capital both in terms of the workers (deemed 'knowledge workers' for their skills, knowledge, and expertise) and the complex processes that require the former. As a result, these industries are responsible for producing most of the value in the final product, and this value is hence attributed to the knowledge capital that had been invested in creating the product or in delivering the service. [5]

Digitalization[6], the adoption of digital technology resulting in the enhancement of the capacity for transferring, storing and processing information, has driven innovations in networking[7] practice and technology. Together, digitalization and networking have made the virtualization[8] of work possible by eliminating the physical barriers of distance and time in organizing global business. The increasing 'inter-connectedness' of the globe is one factor that has resulted in market environments that are principally characterized by rapid change. The rapid pace of innovation and the efficiency of communications have compressed product life cycles at all stages while ramping up the urgency in time-to-market and R&D. The explosion in the number of channels for information acquisition as a result of the Internet and advancements in affordable means of high-speed of communication, and the rapidity of innovation in processes, product design, and IT technologies, have outstripped innovation in the methods and techniques of managing knowledge in the enterprise. The popular emphasis on meeting short-term targets, benchmarking and speed has obscured the need to innovate intellectually and to put new management concepts, systems and structures into practice. This thesis will put forward the argument that knowledge networking is one such concept that has been deployed, in some sense, in the non-profit sector, and would deliver significant value-add if deployed in the context enterprise.

2.3 The Value of Knowledge

It is starkly apparent that knowledge has value in every function of the business enterprise that can be deemed core to the enterprise's operation. Knowledge is a key input to the identification and creation of new business opportunities, and the quality of decision-making is almost entirely premised on the presence of the required knowledge. The knowledge within the enterprise, at the level of the collective, and the employee, at the level of the individual, impacts productivity, efficiency and effectiveness as reflected in revenues and costs at every level, from decision-making to problem solving to innovation in processes, products and services. This unchallenged salience of knowledge in the conduct of business is one reason why critics have expressed doubt about anything tagged with the word 'knowledge' – from knowledge-management to

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[4] Quinn, 1992, Drucker, P., 1993, Burton-Jones, 2000
[5] Reich, R., "Work of Nations", 1990, and Stewart, T., "Intellectual Capital", 1995
[6] Tapscott, D., "The Digital Economy: Promise and Peril in the Age of Networked Intelligence", 1997
[7] Castells, M., "The Information Age: Economy, Society, & Culture. Vol III: End of Millennium", 1999
[8] Hagel III, J. and Singer, M., "Unbundling the Corporation," *Harvard Business Review*, 1999

knowledge-workers to knowledge-based-economies – simply because it has been too all encompassing in their scope. More correctly, perhaps, this new focus on 'knowledge' for businesses should be viewed as the 'knowledge-centric' perspective of the business organization. Despite the significance of knowledge to business enterprises, little attention has been paid explicitly to its management and creation.

Just as flexibility and adaptability have been identified as strategic capabilities that modern enterprises cannot do without in order to beat the competition, so knowledge – when, where and how it is being created, shared and leveraged – is the necessary ingredient to achieve these and other strategic capabilities for enterprises that increasingly operate in 'real-time'[9] that demand enterprises to operate, innovate, and meet the customers' demands better and faster than competitors. As such, knowledge has been dubbed as a key competitive advantage[10] for all enterprises in the knowledge-based economy. This is most apt for multinational, transnational, global corporations that face competition in multifarious countries in differing markets characterized by disparate cultures, politics and economics.

Knowledge management, as this new discipline in managing the knowledge creation, diffusion and storage processes in an enterprise has been called, has registered some benefits for enterprises that translates to improved bottom-lines via enhanced revenues and/or reduced costs[11]. Besides improving enterprise profitability, the viability and market image of the enterprise, together with its relationship with employees, partner enterprises and customers are enhanced. The value of knowledge for the enterprise is shown in table 1 below in key areas in which a generic enterprise operates. Ultimately, knowledge is valuable to the enterprise only if it is relevant and helpful in enhancing or expediting a business process that ultimately delivers real economic value to the enterprise – i.e. only knowledge linked by practicable pathways to the creation of economic value is valuable to the enterprise.

For global enterprises, the diversity encountered in extending operations mean that the role of knowledge will be even greater as a result of the complexity of forming coherent aligned global and local strategies for managing activities in different environments in which different conditions prevail. These complexities arise from the presence of diversity in terms of the enterprise's operations and operating environments. This diversity represents both a strategic challenge as well as a strategic opportunity. The challenge arises from the need to manage the additional dimensions of complexity associated with maintaining semantic equivalence across cultures, varying time zones, differing regulatory regimes and political environments, and cultural distinctions. The strategic opportunity that diversity offers arises from local differences that demand at least some local innovation to adapt products designed in the headquarters of the enterprise to the preferences of the local market. The knowledge that is created in the design and production of a product for local markets can be indirectly transplanted to other markets. For example, Unilever's Indian branch developed a new laundry detergent targeted at the working class, and created a new business system that could create, market and distribute the product, resulting in an economic success as a result of the large market size and high asset turnover.

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[9] The Economist, 'Special Report: The Real-time Economy', February 2001

[10] G. Mentzas & Apostolou, D., 2nd International Conference on the Practical Aspects of Knowledge Management – Basle, Switzerland, 1998

[11] M. Santosus, J. Surmacz, Knowledge-Bridge Consulting, D. Skyrme et al

Unilever has since replicated this business model for other markets in other developing countries.[12]

Table 1 below shows the value of knowledge for various domains of enterprise knowledge – the benefits that arise from say, having greater know-how in controlling some industrial process, or for analysts to have access to time-valid and accurate data and information when drafting forecasting reports.

Enterprise Knowledge Domains and the Value of Knowledge[13]

Enterprise Knowledge Domain	Value of Knowledge
General Operations	Learning from mistakes of own and other companies, avoiding the costs incurred in 'reinventing the wheel' by knowing where the right information and/or knowledge can be obtained, faster problem-solving via ICTs that allow sharing of expertise and seeking of advice from other sections of the enterprise to minimize downtime, experience gained from operations is codified and stored to provide a repository of organizational memory that can advise and guide future operations, process innovations reduce administrative costs.
Products and Services, Research and Development	Shortened development times, increased rate of innovation, avoiding 'reinventing the wheel' reduces the costs incurred due to redundancies while refining product quality, mechanisms that permit free flow of ideas via discussion forums etc. allow refinement of ideas that can improve process efficiency and end-product quality.
Customers	Intimate knowledge of customers allow development of products that are more oriented to the needs of customers, improved customer services and hence increased customer satisfaction in the near-term and loyalty in the long-term.
New Business Opportunities	Acquisition and synthesis of new and existing knowledge in databases and people aid in a more timely and accurate analysis of new business ventures that can reduce potential losses and identify the most profitable opportunities, while allowing a better understanding of the risks involved.
Human Resource	Recruiting, assigning and motivating the right people to the right tasks results in higher quality work, lower costs due to errors, and greater efficiency in completing the task. Retaining talent within the organization ensures that the keepers of the un-codifiable component of organizational memory remains with the organization and can hence be tapped at a later stage.

Table 1: Enterprise Knowledge Domain and the Value of Knowledge

[12] Ripley, J., "Strategies from the Bottom of the Pyramid", 1999

[13] Includes material from Skyrme, D., 1998, Stewart, T., 1997, Davenport, T., 1998

2.3.1 Value of Knowledge – Key Drivers for the Enterprise and the MNE

The value of knowledge to enterprises and MNEs in the New Economy is increasing, and this is resulting from the convergence of several factors:

1. *Globalization*: International competition has increased as a result of an increasing number of substitutes in most product markets, and production and service capabilities that were hitherto available only in First World nations are no frequently located in developing countries due to lower operating costs but often no less effective. Knowing how to be effective in operations, marketing, and product/service innovation is therefore critical.

2. *Response to changes in supply and demand in the market*: Knowledge about customers will be crucial – enterprises need to be both better and faster than competition in delivering products and services that can meet and exceed customers' expectations. To harness the value of innovations (product, operational or otherwise) by suppliers, enterprises themselves must know how to integrate suppliers into their own business model.

3. *Intensified competition*:
    a. Innovation by competitors – Competing organizations are constantly innovating in terms of products, services, and business processes. As new technologies emerge, enterprises face competition both from existing rivals and from entrants who are unburdened by legacy systems and can hence leverage new technology and practices for competitive advantage. Knowing how to innovate and implement change at all levels is therefore necessary.
    b. Operational effectiveness – The enterprise must perform both efficiently and effectively, to remove bottlenecks in operations. Hence, knowing where to look for the bottlenecks must be coupled with how to solve it. Since speed is the key with the emergence of the 'real-time' economy[14], there is also a need to know how to resolve bottlenecks quickly.
    c. Competition for Talent – Talent embodied in 'knowledge workers' is highly mobile and has been manifested on an international level in the 'brain drain' movement of experts and professionals from the rest of the world to the United States. Between corporations and enterprises, there are analogous movements of expertise driven by the attraction of better opportunities and incentives.

2.4 Defining Knowledge

Knowledge as a term defies any one single specific definition and indeed there are differences in the definitions of knowledge as offered by philosophy, sociology and organizational-behavioral studies. It is possible however to identify broad themes that are common in most existing definitions, that knowledge is related to describing, analyzing, understanding, and hence upon application, changing the environment surrounding the entity possessing that knowledge. While the attempt to define the nature of knowledge, to varying degrees of satisfaction depending on

[14] The Economist, 2002, February (?)

the individual inclinations of the reader, one can also view knowledge from the lens of practicality – how can knowledge be defined in its applications to business? One categorization[15], by Charles Savage, analyzes knowledge into a sextet of fundamental components that have synergistic value when present and applied in concert:

1. Know-who: The right people for a task
2. Know-what: An understanding of the knowledge needed, and where to look for it, for a task
3. Know-how: Skills, processes and procedures
4. Know-why: Understanding of the underpinnings and context for the task and its relevance for the enterprise as a whole
5. Know-when: A sense of timeliness – when to act
6. Know-where: A sense of place – where to act

2.5 Perspectives in Viewing Knowledge

There are three key perspectives of knowledge that encapsulates these six components of knowledge and that will be central to the discussions in the thesis, and these are 'knowledge and information', 'knowledge-as-a-process vs. knowledge-as-a-commodity', and 'explicit knowledge vs. tacit knowledge'. All three perspectives encompass the treatment of the nature of knowledge as well as its practical applications.

2.5.1 Knowledge and Information

Information is called the medium through which knowledge can be transmitted, but the two have fundamental differences[16] that there have been frequently overlooked by enterprises engaged in knowledge management initiatives. A typical distinction between the two is such that information has been defined to be data with context while knowledge is information from which meaning can be derived[17]. More precisely, the operational definition of information is that it consists of facts and other data organized to characterize a particular situation, condition, challenge or opportunity. Knowledge is instead found in humans or inanimate agents as truths and beliefs, perspectives, perspectives and concepts, judgments and expectations, methodologies and know-how. Reality dictates that knowledge is not comprised, however, of clearly specified guides to deal with routine situations, since few situations are repeated and details and contexts are often, and critically, different. Practically speaking, a person who possesses knowledge in a certain field therefore must therefore have the understanding that permits him or her to envisage possible different ways of handling different situations and to anticipate their implications and effects. In essence, knowledge, in the form of mental models, scripts, and schemata – must provide the capability to work with novel situations by synthesizing disparate concepts and predefined methods. Hence Savage's analysis of knowledge into six fundamentals describes the practical applications of knowledge with not so much concern for what knowledge is, as opposed to what it does for the enterprise.

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[15] Savage, C., "Fifth Generation Management", 1996
[16] Wiig, K., "Knowledge Management: An Emerging Discipline Rooted in a Long History", 2000
[17] Amidon, D. M., "Innovation Strategy for the Knowledge Economy: The Ken Awakening", Butterworth-Heinneman, 1997

The conversion of information into knowledge is a complex process that reflects the fundamental differences between the two concepts – new information and insights are internalized by the establishment of links with prior knowledge and these links vary from firmly characterized relationships to vague associations, hence resulting in the creation of new knowledge. The latter is hence a synthesis of prior knowledge and new information resulting in updated and modified mental models that permit reasoning, decision-making and action. Karl Wiig further contends that while information and rudimentary knowledge can be codifiable in a form external to the human, *understanding*, based on knowledge in determining what a specific situation means and how to handle it, is more difficult to codify and hence primarily people-based.

Enterprises in the past largely equated information with knowledge, simply because without the former, the latter was ineffective and sub-optimal in effect – the example here is that a bridge engineer may have the knowledge of designing bridges of robust structures, but in the absence of precise information with regards to the span and height of the bridge, the intended type of bridge, the soil conditions on both ends, and the appropriate composition of materials to construct the bridge, the bridge-engineer's bridge design would be incomplete at best, and completely useless at worst. Enterprise managers have hence made the assumption that given a repository of enterprise information, employees would be able to find the right information, and hence gain the right knowledge to make the right decisions. This follows a linear line of thought that assumes information can directly map into knowledge by providing more detail, and ignores the complex cognitive processes in the human mind that bridge the discontinuity between information and knowledge. Information is therefore a necessary requisite of, but not sufficient for, the formation of 'knowledge' or certainly, 'understanding'.

The failure of information systems – the vehicle of information processing and storage – to meet the enterprise's knowledge requirements as manifested in costly deployment with in-apparent returns, flawed decision-making and process sub-optimizations, is not an indictment of the uselessness of an enterprise-architecture. The backlash against information systems is not so much against the effectiveness of information systems in doing what they are truly supposed to do, but against the hype and inflated expectations that surrounded their deployment. Management information systems process information, and provide decision-support via the provision of information and processed data.

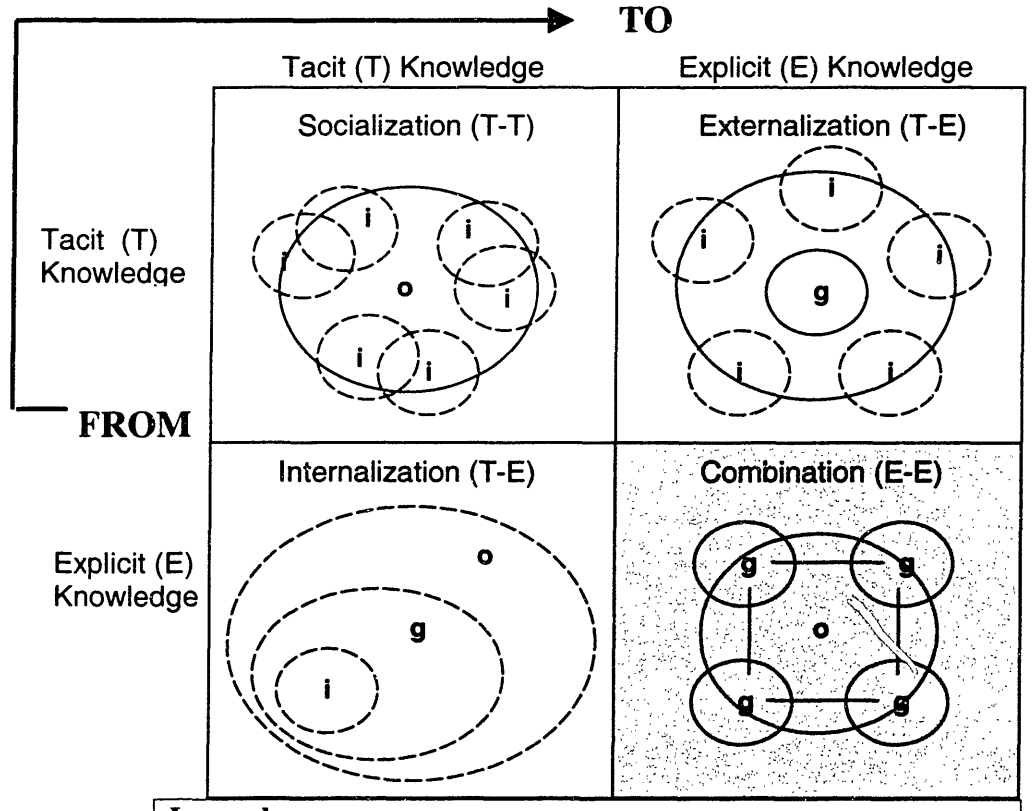
The codification of knowledge, naturally, has been of great concern to managers who intended to make knowledge 'mobile'. The codifiability of knowledge spans the continuum from information to 'codified knowledge' – a more sophisticated and elaborate physical codification of knowledge that attempts to directly communicate insights and know-how – to 'uncodifiable' knowledge – knowledge that defies easy codification.

2.5.2 Knowledge – Explicit and Tacit

Delving deeper into the nature of knowledge, one can distinguish between two types of knowledge – explicit and tacit. In an organization, knowledge is found in the form of corporate policies, market analyses, products, organizational processes, technologies, and the skills, know-how and expertise of employees. A model for knowledge creation and acquisition, called SECI (Socialization, Externalization, Combination, and Internalization), was mooted by Nonaka and

Takeuchi (1995) to describe the ways in which knowledge is generated, transferred and re-created in organizations at three levels of abstraction or social aggregation. This model distinguishes between two types of knowledge – explicit and tacit – where: (1) *explicit knowledge* is formal and systematic – it can be codified in the form of documents and reports, and has been referred to as 'migratory' knowledge because it can be easily shared and transferred, and (2) *tacit knowledge* is personal knowledge that is difficult to transmit or capture in codified form – it encompasses skills, ways of working, rules-of-thumbs, mindsets, values, and beliefs that is difficult to change or communicate.

Tacit knowledge, however, must be made explicit, more so for the enterprise so that it can be easily transferred and leveraged. A SECI knowledge cycle thus comprises: identification of tacit knowledge, making explicit the tact knowledge so that it can be formalized, captured and leveraged, and allowing the explicit knowledge to be individually processed, absorbed and contextually applied by employees in a process that makes it tacit again. The SECI model is illustrated in Figure 1 below.



Legend	
i: individual g: group o: organization Dark Grey for explicit component White for tacit component	Full lines refer to formal links, Dashed lines refer to informal links (T-E) represents conversion from tacit to explicit knowledge

Figure 1: Knowledge Conversion SECI Processes, by Nonaka and Takeuchi, 1995 (With adaptation)

The SECI model in Figure 1 examines the interaction dynamics and interplay between these knowledge types at three levels of social aggregation – individual, group and organization. The model describes generic processes of inter-mode conversion between the dichotomous forms of knowledge that were proposed and its relevance extends to any context in which organizational learning and knowledge creation are occurring. The model neither identifies nor defines in greater detail the mechanisms by which the stock of knowledge within the organization is increased, but focuses instead on these inter-conversion processes that are embedded in all activities that involve the application, sharing, learning and creation of knowledge. Figure 1 describes a sequence of four core processes of knowledge creation as[18]:

1. Socialization: The direct transfer of tacit knowledge from one person to another, in speech and other forms of presentation, for example by demonstration or by context-specific advice. Sharing of tacit knowledge between individuals through joint activities like brainstorming, discussions and debate.

2. Externalization: The conversion of tacit knowledge into more explicit forms, it involves the expression of tacit knowledge in publicly comprehensible forms, i.e. when knowledge is applied or when goals and frameworks are set. An example here will be the selection and publication of best practices within the enterprise for internal circulation.

3. Combination: The conversion of diverse sets of explicit knowledge into more complex, better integrated sets of explicit knowledge to support problem-solving and decision-making: communication, dissemination, and systematization of explicit knowledge

4. Internalization: Conversion of externalized knowledge into tacit knowledge on an individual or organizational scale; the embodiment of explicit knowledge into actions, practices, processes, and strategic initiatives

The overlap of units between the inside and outside of the organization reflects the key influence of factors from the external environment that affect the knowledge process within the organization. The SECI processes hence illustrate processes foundationally embedded in enterprise knowledge life cycle dynamics– a more precise model taken from a more 'macro' perspective of knowledge processes in the enterprise – that will be discussed further in this chapter.

2.5.3 "Knowledge-as-a-process" vs. "Knowledge-as-a-commodity"

The tacit-explicit nature and SECI processes provide a lens to scrutinize the nature of knowledge and the processes by which explicit forms are converted into tacit forms. Here, two enterprise perspectives of knowledge are identified that are conceptual offshoots of tacit and explicit knowledge, and these are respectively: (1) Knowledge-as-a-process and (2) Knowledge-as-a-commodity[19]. The process- and commodity- centric views of knowledge begin by analyzing the nature of knowledge and hence fore deriving its applications. The modern enterprise usually

[18] Nonaka, Takeuchi, "The Knowledge Creating Company", 1995
[19] G. Mentzas, 2000, Hansen et al, 1999

encompasses both types in managing knowledge, though the process approach lends itself more easily to tacit knowledge while the commodity approach would do so more easily for explicit knowledge.

Knowledge as a "*process*" – This approach, also known as the 'collaboration' or 'personalization' approach emphasizes ways to promote, motivate, nurture or guide the process of knowledge creation by individuals working alone or in groups, in order that knowledge in the community can be leveraged. A process-oriented view of knowledge recognizes that knowledge is often unique to individuals and irreplaceable and as such, mechanisms such as incentive systems and greater flexibility in the allocation of responsibilities are used to ensure that creativity is not stifled and that talent is retained and used in the most optimal way. This focus of such a perspective is therefore on collaboration support technologies that can assist the social communication processes between individuals that is necessary for knowledge creation to take place. Hence, knowledge is deemed to be closely tied to the user or the creator and knowledge is shared effectively only via person-to-person contact (physical or virtual). IT-based tools are then developed not to store knowledge, but to facilitate communications, and examples of these include e-mail, video conferencing, workflow management systems, and group-decision support systems.

Knowledge as a "*commodity*" – This approach, also known as the 'content-centered' or codification approach, treats knowledge as an object that is separated from its creators and users – a thing that can be located, manipulated and hence, captured, measured and managed as one would with tangible artifact. Indeed, the focus of such a perspective is on products that contain or represent knowledge, and such products are typically concerned with managing documents and databases in the processes of their creation, storage and re-use in computer-based corporate memories. Further examples are best-practice databases and lessons-learned archives, case-bases that record in detail older business-case experiences, and knowledge taxonomies. The goal therefore is to store documents with explicit knowledge in them – memos, reports, articles etc. – in a repository where mechanisms are put in place to allow users to access them and hence reuse existing knowledge in creating new knowledge that is specific to the user's context. Companies that have extensively engaged in building knowledge bases comprising best practices, work products, case reports and process methodologies include General Motors, Glaxo Wellcome and Daimler Chrysler.

2.6 Knowledge in the Enterprise

An enterprise needs to leverage knowledge that is found within itself – as embedded in people, processes, and organizational memory – as well as knowledge about the external environment – market fluctuations, regulatory changes and technological innovation. This is the third perspective in viewing enterprise knowledge, having presented the information-knowledge divide and the tacit-explicit divide. Two categorizations of knowledge are introduced here under the 'enterprise knowledge' umbrella, that of intellectual capital and competitive intelligence. 'Intellectual capital' is the sum of knowledge – embedded in explicit codified form and in tacit human-competency form – about entities that create value for the enterprise. These include entities within the enterprise like functional units (e.g. R&D, marketing etc.), as well as entities beyond the enterprise like partner enterprises – suppliers and buyers – as well as customers.

Intellectual capital is comprised of three components – human capital, structural capital and relationships capital. The first two refer to the human talent and the technological infrastructure of the firm, while the last is concerned with knowledge about the customer, and knowledge about other enterprises that are allied to the firm – for example, suppliers, buyers, and service providers. 'Competitive intelligence' refers to knowledge about entities that are external to the enterprise – competitors, stakeholders in the community, and political institutions. The following section will describe in greater detail the features of intellectual capital and competitive intelligence. The distinction here is that intellectual capital is the prerequisite for competitive intelligence to be leveraged. The necessary human, structural and relationship capital must be present in order for competitive intelligence to be acquired and used to optimal effect. The mechanisms of acquiring and leveraging competitive intelligence will be discussed here, with reference to intellectual capital.

Figure 2 diagrammatically illustrates the components of enterprise knowledge. The dynamics of knowledge growth and loss within the enterprise are partially illustrated below, with examples given of how each form of intellectual capital can be enhanced or diluted.

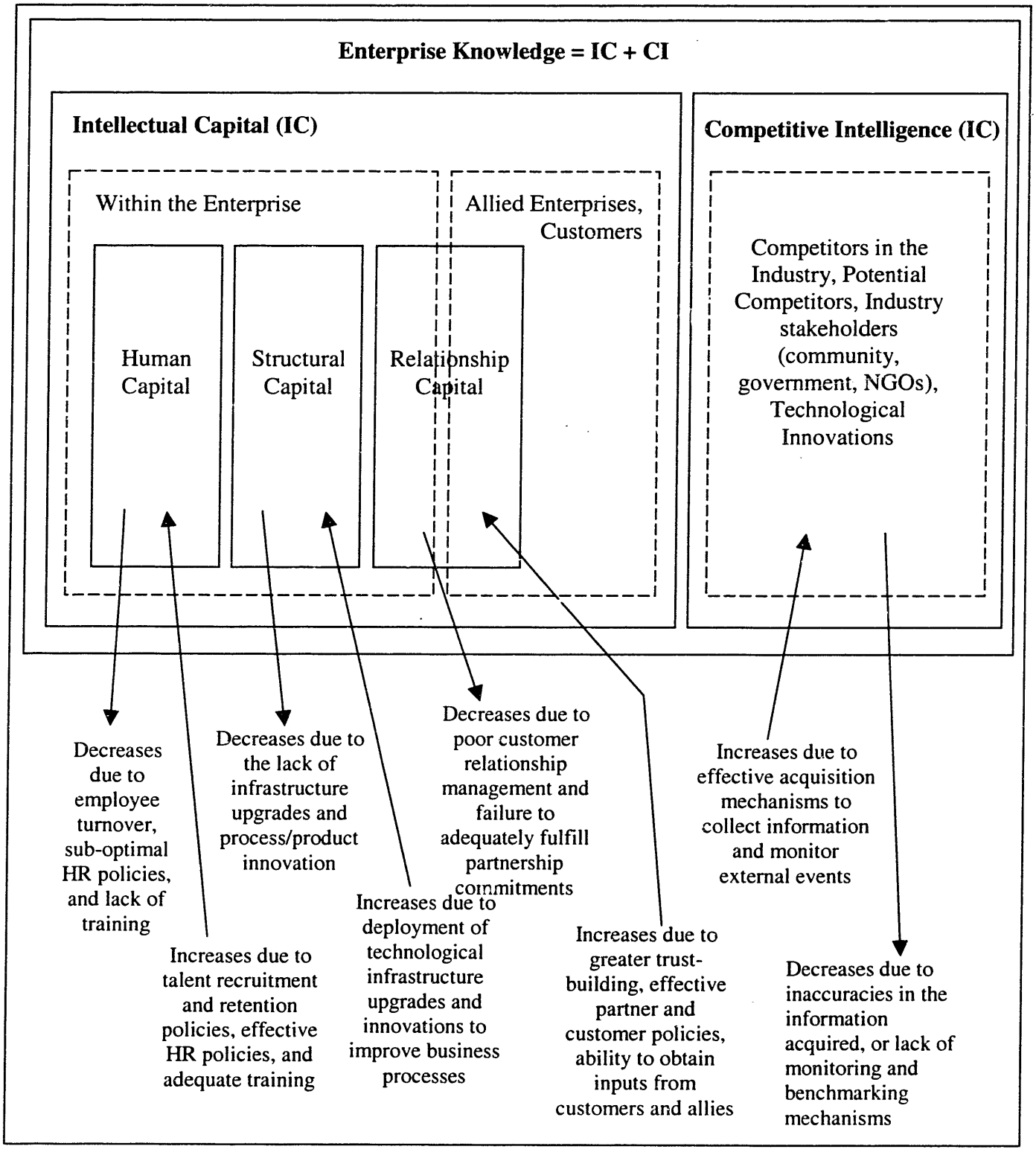


Figure 2: Representing Enterprise Knowledge: Intellectual Component and Competitive Intelligence

2.6.1 Intellectual Capital (IC)[20]

Definition

Also known as the knowledge assets of the enterprise and to some extent the value network to which the enterprise belongs, intellectual capital is found in the organization's patents, process methodologies, employees' skills and experience, technologies, and information about customers and suppliers. Intellectual capital can be seen through the lens of explicit and tacit knowledge – i.e. the former, which can be codified or captured, and the latter, which is contained in the heads of employees and which defy easy documentation. Klein and Prusak defines the explicit form of intellectual capital as "intellectual material that has been formalized, captured and leveraged to produce a higher-valued asset" – in other words, intellectual capital is created only when intelligence is given coherent form, whether in a database, report or process methodology document, and encapsulated in a form that can de described, shared and exploited. The more tacit form of intellectual capital comprises 'soft' knowledge that encompasses the expertise (a semi-permanent body of knowledge) of personnel with respect to execution of specified tasks, and the tools that can augment this expertise by acquiring and delivering facts, data and information, as well as connecting human expertise, to employees who need it in a timely and accessible fashion. Intellectual capital is therefore defined to be the knowledge assets of the enterprise and its allies, and is hence introspective in its approach. It is in a sense a measure of the enterprise's capabilities to capture the value of knowledge by leveraging knowledge in its various forms – in codified form or in the minds of its employees.

Constituents

Intellectual capital in an enterprise is the synthesis of three components – human capital, structural capital and relationship capital[21]. Human capital refers to the skills, talents and capabilities of employees who are required to negotiate business dealings with partner enterprises and suppliers, and those who are required to provide solutions for customers and service-subscribers. Human capital is also the source of innovation, in terms of organizational design, product design, technologies and culture. Structural capital refers to the key enabling infrastructure like information systems, intelligence-gathering units and R&D laboratories that allow sharing and leveraging of knowledge, hence crucially converting individual know-how (often in tacit form) into an organizational asset (of explicit form) that the entire enterprise can re-use as adapted to other similar situations. Techniques and technologies that can be identified as easily transplantable, customizable and reusable, and the ICT infrastructure that facilitate knowledge transfers, are therefore the twin pillars of structural capital. Relationship capital, initially dubbed 'customer capital', is the value of the knowledge embedded in managing the relationships between the enterprise and other entities with whom it conducts business, and recognizes the emerging salience of strategic partnerships between suppliers, buyers, customers and service providers in the value chain of a product or service. At the interface between the enterprise and the customer is where intellectual capital is ultimately converted into monetary form, and the effectiveness of this conversion mechanism is determined by the enterprise's

[20] T. Stewart, "Intellectual Capital", 1997

[21] Saint-Onge, H., "Strategic Capabilities: Shaping Human Resource Management within the Knowledge Driven Enterprise", 1996

knowledge of the customer – preferences, habits and spending patterns as manifest in complaint letters, renewal rates, cross-selling, and referrals– and how it leverages this in terms of branding, marketing and advertising. Intellectual capital is, at a higher level of abstraction, can be seen in terms of a dichotomy of human capabilities, skill-sets and competencies in the organization of business and the management of relationships, and technology-based infrastructure (both of code and of hardware and software) that supports and enables management and coordination to be efficiently conducted on a large scale.

2.6.2 Competitive Intelligence (CI)

Definition
Competitive intelligence comprises knowledge of competitors and rivals that critically determines successful decision-making in enterprise. Competitive intelligence is therefore externally focused and concerns the enterprise's competitors, some of which may be allied to the enterprise in other related markets. Competitive intelligence – knowledge of external environments, entities and events – has an analog within intellectual capital that pertains to knowledge about enterprise environments, entities and events, and both require the organizational, cultural and technological architecture described by intellectual capital in order to be effectively and efficiently leveraged.

Constituents
Competitive intelligence is defined as knowledge about competitors that is formally derived from analyzing and understanding information on competitors, market trends and other industry-related materials collected from sources that include media like radio/television interviews/analyses, published journals, newspapers and annual reports, and employee contributions from the routine conduct of their jobs and customer inputs. This glut of information is scrutinized from the disparate sources and meaningful material is extracted (via increasingly sophisticated technologies that assist the human reviewer) for further analysis. The output analyses that reviewers put together will give insights into the intentions of competitors, governments and other organizations that can impact the enterprise's bottom-line and operations. Competitive intelligence is therefore less sophisticated in form than intellectual capital that it consists largely of codified material in codified or audio-visual form.

Using CI
Competitive intelligence allows management to anticipate (as opposed to merely reacting to): (1) changes in the market and industry for the enterprise's products and services, (2) initiatives and actions taken by competitors, and (3) changes in political power and government regulations that will affect an enterprise's strategy and activities.

Challenges
Enterprises face challenges in two aspects: in (1) acquiring competitive intelligence and in (2) leveraging it.

(1a) Acquiring CI: In terms of acquisition, the challenge is akin to locating the proverbial needle in the haystack, where vital and relevant information is found only amidst oceanic quantities of information that is mostly noise to the enterprise. The sources of 'raw material'

(unprocessed data and information) required for the analysis and/or synthesis of competitive intelligence include:

1. Annual reports, which are meant to communicate the enterprise's intentions to shareholders and potential investors. MNEs that are publicly traded usually express accomplishments as well as future plans and current enterprise information in their annual reports for financial institutions as well as current and future shareholders.

2. Depending on the industry or nature of business, reports of varying authenticity-of-fact and disclosure may also be filed by the company with other government agencies that are in the public domain, for example with agencies like stockbrokerage houses and the Securities and Exchange Commission in the US. Also, enterprises increasingly have a well-maintained presence on the Internet that publishes corporate information. Computer data-bases specific to certain trades and businesses, and maintained by trade associations, cyber-library enterprises and other agencies are mines of information, while firms like Reuters and Bloomberg increasingly use the Internet to broadcast information real-time to subscribers.

3. Radio and television shows often provide varying perspectives of an enterprise.

4. Advertisements by an enterprise in the different media can offer insights into its recruiting or marketing strategy, while conversations and collecting information packages at trade-shows and career fairs can yield deeper understanding of the competitor, especially since employees at exhibition booths are more inclined to disseminate information rather than keeping secrets.

5. Patents filed by competitors will be interest enterprises that are involved in R&D and can point to the intensity of product innovation by the particular enterprise.

6. Benchmarking, done in-house or outsourced to an external consultancy, compares an enterprise's products and business processes, and is a technique for learning that has been adopted by many MNEs seeking competitive intelligence about rivals. Formal exchanges of information is possible, but informal approaches like using and examining a competitor's product or service is very common – for example, software games companies routinely purchase a competitor's software to perform comparative analyses.

7. The sales division is an excellent source of information about the outside world and competitive intelligence can be gleaned from what customers think, especially since these customers would have done their own comparative analysis of the enterprise's products/services vis-à-vis competitors'. What influences the customer's decision comes both from actual utility derived from the product as well as their perceptions as molded by marketing, hence marketing and sales can potentially tremendous input with regards to customer preferences with regards to product price, characteristics, quality, service and other factors.

(1b) Acquisition of CI for the MNE: The acquisition of competitive intelligence for the MNE is considerably more difficult than for the domestic enterprise. The domestic enterprise need gather competitive intelligence on both the political, economic, regulatory and social

developments of a single nation as well as on local competitors, but the MNE must do so for the myriad countries in which it is active. Gathering competitive intelligence therefore becomes a task for intelligence units within the enterprise that is dedicated to manage the information overload and from which to extract pertinent intelligence that can inform decision-making.

(2) Leveraging CI: An enterprise leverages competitive intelligence in the three sectors previously identified – the market/industry, competitors, and environmental factors (political, economic, regulatory and social) – to:

a. Discover potential newcomers into the market

b. Learn from the successes and failures of competitors and their strategic intentions

c. Learn about the state of technological advancements in the industry and how they can be applied to its own context

d. Identify potential strategic partners and acquisition targets

e. Learn and understand the implications of innovations in product design and manufacturing processes, and

f. Recognize and adapt to changes in the political or regulatory climate of the nations in which they operate.

2.7 Leveraging Knowledge for the Enterprise – IC+CI

While knowledge can be seen as a combination of IC that is internal to the enterprise or to the value web of allied enterprises, and CI that pertains to its competitors, an enterprise leverages this knowledge to generate tangible value via the knowledge life-cycle that consists of two main processes: (1) creation of new knowledge via innovation in management practices, product development and process improvements, and (2) organization-wide sharing of current enterprise knowledge in its six fundamental components (know-how, know-why, know-who etc.). Both processes encompass the SECI processes proposed by Nonaka and Takeuchi, and which was introduced in **2.5.2 ('Knowledge – Explicit and Tacit')**. Indeed, the SECI knowledge cycle addresses processes that do take place within the enterprise but it requires clarity with regards to processes that can tie the creation and management of enterprise knowledge to the fulfillment of the enterprise's strategic goals – this clarity is provided by the formulation of an enterprise knowledge life cycle dynamic that involves SECI processes in its every step that are detailed in tables 2 and 3.

As an enterprise evolves in its capabilities of managing and leveraging data, information and knowledge, so too the value increases in the way that an enterprise with good data-processing capabilities cannot be as competitive as an enterprise that can leverage the tacit knowledge in its employees and the explicit knowledge in its own internal reports and information/data analyses. The value add that comes from being able to capture the value of knowledge is depicted as the zenith of development in figure 3, which shows the enterprise's ability to migrate upwards on the

knowledge content vs. capacity pathway – with each iteration of the cycle, the existing stock of knowledge within the enterprise increases (if knowledge loss is not greater than knowledge created or acquired) such that the enterprise can ultimately develop the capabilities to harness the value of knowledge. Knowledge content refers to explicit and tacit knowledge, the sum total of the learning, experience and expertise that is either embedded in the competencies of people, or in codified representative forms, while knowledge capacity refers to the infrastructure of the enterprise, be it technological, organizational, administrative, cultural or political, that facilitates or impedes organizational learning and innovation. This is a macro perspective of the role of knowledge in the enterprise, but the creation and sharing of knowledge within the enterprise – the core mechanisms by which an enterprise can leverage knowledge – at the micro-level, is contingent on component sub-processes of knowledge creation and knowledge sharing. These are dynamic processes – enterprise knowledge life-cycle dynamics – that are illustrated in figure 4.

For the areas described in the section on the value of knowledge, table 4: Leveraging Enterprise Knowledge Domains shows the methods and processes that are used to capture the value of intellectual capital and competitive intelligence. Table 4 hence identifies the linkage between knowledge creation, knowledge sharing, and the actual operational processes of leveraging (itself a process of knowledge creation) new and existing knowledge (learning by doing and experience).

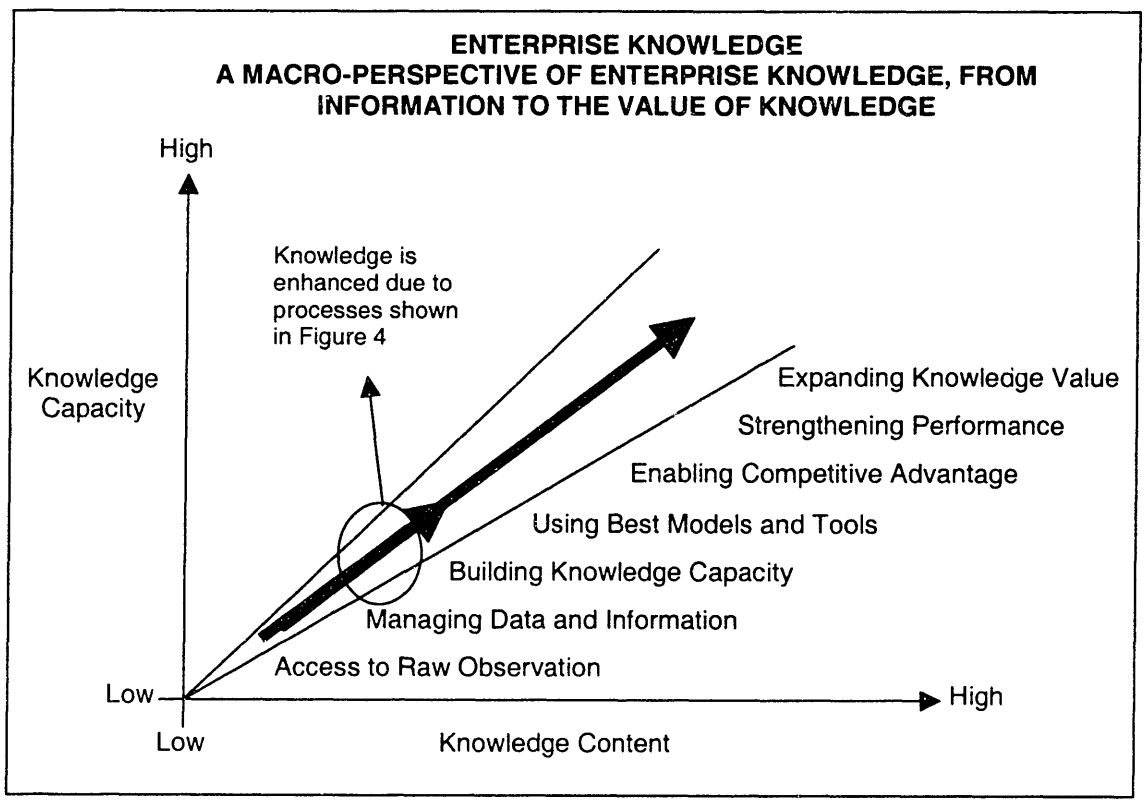


Figure 3: From Information to Value of Knowledge, Choucri, GSSD, 2000 (With Adaptation)

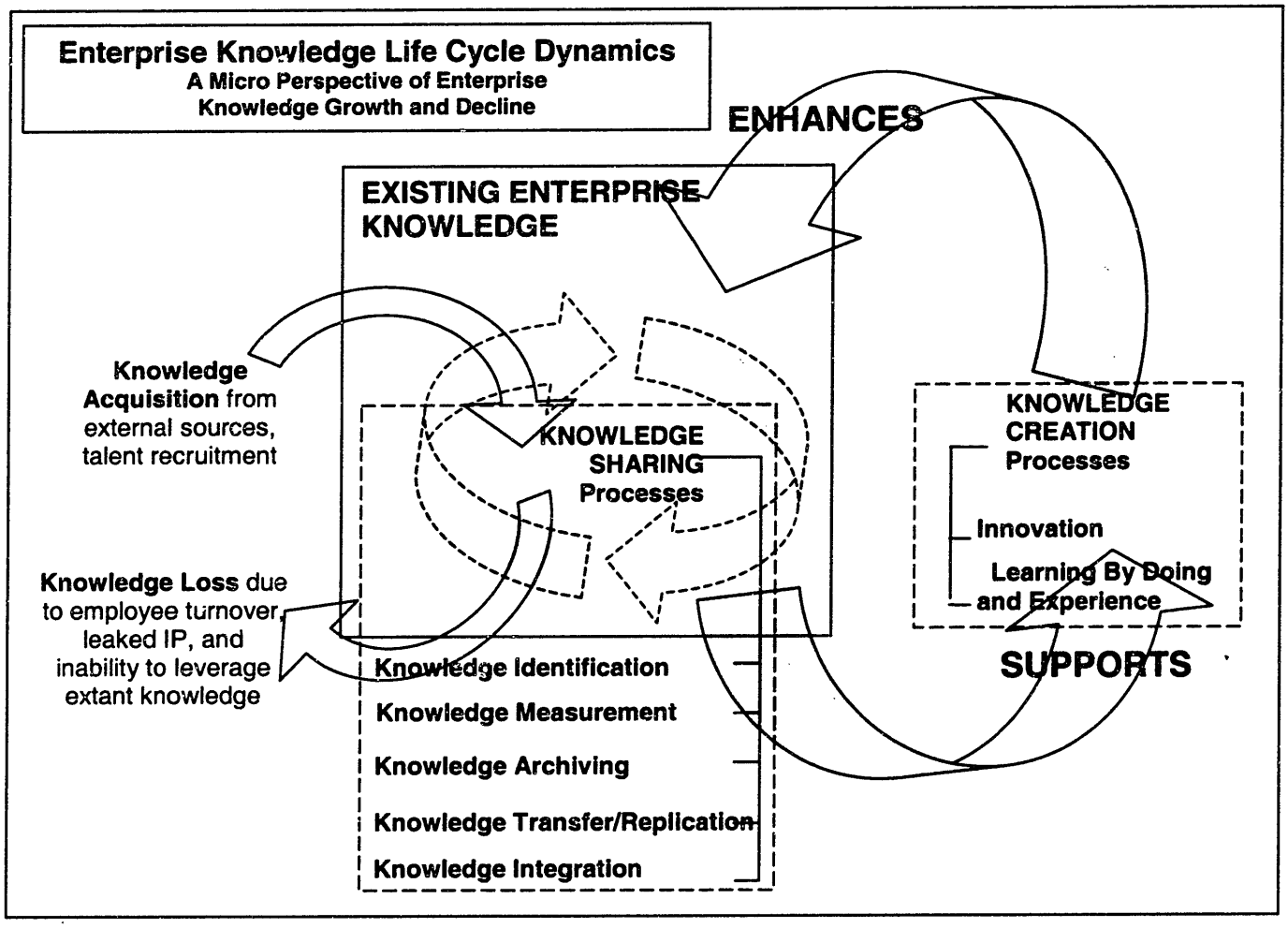


Figure 4: Enterprise Knowledge Life-Cycle Dynamics

Enterprise Knowledge Life-Cycle Dynamics Process Descriptions							
Knowledge Creation		**Knowledge Sharing**					
Innovation	**Learning By Doing & Experience**	**Knowledge-Identification**	**Knowledge-Measurement**	**Knowledge-Archiving**	**Knowledge-Transfer**	**Knowledge-Integration**	**Knowledge- Acquisition**
New knowledge manifested in reports, insights, understanding and skills. (Explicit and Tacit Knowledge)	New knowledge as well as strengthened understanding, manifested in skills and understanding (Tacit Knowledge)	Involves identifying or taking stock of knowledge as embedded in tacit form (people) or in explicit form (codified)	Assessment of knowledge – its type, volume, and location in the firm – and its value, as expressed in explicit form	Archiving of knowledge in a digitized & explicit form, involving its categorization and storage	Diffusion and re-use of acquired and existing knowledge, involves assimilation and understanding	Involves assimilation of concepts, synthesis, and analysis of knowledge, and hence involves manipulation of knowledge in its explicit and tacit forms	Involves the acquisition of knowledge from external sources, involves understanding of what is not known and hence what to find. End product may be tacit or explicit. Involves knowledge identification and transfer

Table 2: Enterprise Knowledge Life-Cycle Dynamics Process Description

SECI and the Knowledge Life-Cycle								
K Life-Cycle Processes:	Knowledge Creation		Knowledge Sharing					
	Innovation	Learning By Doing	Knowledge-Identification	Knowledge-Measurement	Knowledge-Archiving	Knowledge -Transfer	Knowledge -Integration	Knowledge-Acquisition
SECI Processes:	S, E, C, I	S, I	E, C	E, C	E, C	S, I	E, C, I	S, E, C, I
Notes: 1. (1) Socialization: Tacit-Tacit; (2) Externalization: Tacit-Explicit; (3) Combination: Explicit-Explicit; (4) Internalization: Explicit-Tacit								

Table 3: SECI Processes and the Knowledge Life-Cycle

Leveraging Enterprise Knowledge Domains	
Enterprise Knowledge Domain	**Methods to Leverage Knowledge**

Operations Planning and Strategic planning[22]	• Enterprise Resource Planning software use information and data to optimize production processes, investments, and resource planning.
	• Strategic planning models are knowledge intensive, and are largely predicated on existing information. Some approaches include:
	  • SWOT (Strengths, weaknesses, opportunities, and threats) – a SWOT analysis builds upon competitive intelligence: Strengths and weaknesses are internal to the enterprise and pertain to the characteristics of the products and services in term of price, costs and quality, technology pertaining to patent protection and rate of innovation, market share and customer loyalty, worker skills and manufacturing techniques, and financial status and marketing activities. Opportunities and threats are external in nature, and will benefit most from the input from competitive intelligence and encompass competitors' products and their characteristic plus their decisions and actions, alliances and partnerships, supplier relations, patents and trademarks, raw material sources, and their financial arrangements. Government policies and regulations towards the company and its competitors are also important aspects of SWOT.
	  • Porter's Five Forces model – this models the enterprise's current position as influenced by the risk of new entry by potential competitors, the degree of rivalry between incumbent competitors and itself, the respective bargaining power of buyers and suppliers, and the threat of substitutes.

Products and Services, Research and Development	• Knowledge bases and virtual help-desks powered by search engines and spidering algorithms that are accessible to engineers and designers to reduce the time taken to seek information and to enhance the quality of this information. • Collaborative software that permits virtual discussion boards, virtual teamwork meeting-places, and instant messaging to permit real-time communication between two physically separate places.

[22] Strategic planning involves the construction of a unified and comprehensive plan that integrates the organization's major goals, policies, and action sequences into a cohesive whole (Quinn, 1980, Glueck, 1980), and is predicated on the theory that proper planning will allow the enterprise to prosper.

	• Communications and computing infrastructure that permit real time communications between departments to reduce the costs of delay and to facilitate just-in-time production schedules, while augmenting responses to changes in scheduling production. • Enterprise resource planning software also permit performance assessment indicators and benchmarking, hence providing data that can be used to identify weaker-performing areas and inadequacies in the enterprise, and the necessary corrections needed.
Customers	• Databases of customer information – preferences and demographic – can be analyzed by mining tools to identify patterns that can provide insights for marketing and product design strategy. • Repository of customer feedbacks can be compiled and fed to virtual helpdesks that can be deployed online to provide better customer service, or used by customer service line employees to answer customer queries.
New Business Opportunities	• Market analysis can be used to produce insights and market knowledge for identifying the 'white spaces'[23] in mature industries, and unmet needs that can be addressed, usually technologically, in new and emergent industries. • Spotting the opportunity in the first place requires an underlying knowledge of the nature of the customer base, and of the market environment. • Identification of new business opportunities also considers the economic, political and social dimensions of exploiting an opportunity – can the opportunity be efficiently exploited? Will exploiting the opportunity encounter resistance from the government or from society?
Human Resource	• Incentive systems encourage retention of the right people and better communication channels permit faster learning and more effective knowledge diffusion and transfer. • A culture that champions meritocracy and performance-based rewards will likely be more attractive as a recruitment and talent retention tool. • Human resource management programs can optimize the process of identifying the right people for the right tasks can engender optimal outcomes in terms of increased productivity, higher quality work, and increased motivation.

Table 4: Enterprise Knowledge Domain and Methods to Leverage Knowledge

[23] 'White spaces', a term coined by C. K. Prahalad and G. Hammel, refers to gaps in the provision of a certain product or service for a specific market segment in a mature industry that become possible and/or economic to address, over time, as a result of innovation in technologies and management practices that result in greater scale and scope efficiencies.

2.8 A Strategy to Leverage Knowledge

To leverage knowledge in creating value for the enterprise, the key objective is to ensure that the people in the enterprise – the decision-maker, the designer, the customer-services personnel, etc. – can access the right knowledge in the fastest possible time. This means that linkages must be formed to connect employees to colleagues with expertise, information in a database, and tools and software that can support decision-making with analysis of data and information. The bi-dimensionality of these linkages, in the form of tangible technological constructs and infrastructure and intangible human knowledge, indeed characterizes the organizational forms that have appeared and evolved, over time in response to changing environments and technological innovations, to harness the value of knowledge.

Today, the convergence of technological capabilities in computing and communications, sophisticated network organizational forms, and the demand for rapid and cogent responsiveness to market changes has created the viability and necessity of a coherent strategy for global organization-wide learning and innovation. Knowledge networking is one such strategy that has been conceived to optimize knowledge life-cycle dynamics in order that the organization can best harness the value of knowledge – the intellectual capital possessed by the organization as well as its competitive intelligence on markets and rivals. The configuration, characteristics and categorizations of the knowledge network, itself an organizational form that supports knowledge networking strategy, will be discussed in the following chapter, and will form the basis of a proposed holistic knowledge network that seeks to translate human competencies into economic value for the organization on a robust technological infrastructure.

3. KNOWLEDGE NETWORKS

3.1 Introduction

The emerging salience of the 'knowledge network' has its roots in the 'innovation networks', 'information networks' and other associated networked organizational variants that encompassed networking processes in which knowledge was acquired, shared and created by members. As its title suggests, the knowledge network consists of 'knowledge' and 'network'. Chapter 2 has introduced knowledge – what it is and more importantly, why it is relevant to business today in the context of this thesis. 'Network', on the other hand, refers to an organizational form, one that is associated with the characteristics of flexibility and adaptability, both of which are increasingly recognized as features that are very appropriate for the volatile market environment of today, where dynamic market conditions demand high-speed responsiveness. The knowledge network hence possesses the fundamental features of the network organization in terms of its structural and cultural configurations, and is shaped by its purposes of leveraging knowledge to achieve competitive advantage. As an example of knowledge networks, the clusters of interdependent high-tech industries in regions like Silicon Valley and Route 128 in the USA and Hsin-chu in Taiwan, with links to universities and research institutions have led by example in terms of what collaboration and synergy between 'knowledge workers' (the innovators, academia, and professionals) and business (the entrepreneurs and MNEs) can produce. Fittingly, 'knowledge network' has been a name that has been ascribed to a multiplicity of technology-based organizational forms that connect knowledge-creating entities in to leverage the value of synergistic knowledge sharing.

In this chapter, the concept of the knowledge network will be defined, and in particular, there will be a focus of global knowledge networking – knowledge networks that cross the boundaries of language, culture, distance, and regulatory regimes. Furthermore, the knowledge network will be defined in terms of its characteristics, its role in enterprises, and two models of knowledge networks in the past and present. In analyzing the knowledge network, one can identify a triad of elements that define the knowledge network – in terms of strategy, people and technology. While strategy defines a direction and a framework for action to achieve organizational objectives, the people and technology factors, and the interfacing between them, are determinants of the efficiency and effectiveness of the knowledge network. From a related perspective earlier mooted, people-centric networks fit nicely into management cultures that belong to the "knowledge-as-a-process", competence-driven school of thought, while technology-centric networks fit nicely into management cultures that adhere to the "knowledge-as-a-commodity", infrastructure-driven school of thought. This thesis will contend that an enterprise adopting only one of these models of knowledge network will be not able to both successfully compete globally while leveraging global opportunities. Instead, this thesis proposes that for a knowledge networking strategy to be successful globally, both elements – people and technology – must be holistically synthesized under a coherent strategy in order to facilitate enterprise-wide innovation and learning processes.

3.2 Defining the Knowledge Network

As technology evolves and the dynamics of market conditions change, the need for enterprises to sustain their competitive advantages often require transformational strategies that impact the very structural set-up, and the attendant cultural heritage and political status quo, of the organization.

As discussed, the quality of decision-making and 'knowledge work' – un-repetitive and novel tasks that require know-how and knowledge – depends on the quality of knowledge in the decision-maker, and more generally, it depends on the extent to which decision-making is co-located with the requisite knowledge. This sort of co-location can be achieved either by devolving decision-making authority to the source of knowledge, or by concentrating knowledge at the source of decision-making. The latter crucially depends on the mobility of knowledge and the degree of error in decision-making that is tolerated. Mobility of knowledge refers to the codifiability of knowledge – can it be made explicit and transferrable? In this, the time-element has now become an additional element of criticality – can knowledge be made explicit and transferrable within the time required? Indeed, with ICT advances, knowledge that is fully codifiable can be quickly transferred at low cost and aggregated at a single location. Conversely, knowledge that is highly tacit (knowledge that arises from experience, flair or conceptual-density) is also highly immobile and decision-making and decision-making must be distributed to these sources. Market tolerance of flawed decision-making is shrinking with increased competition from rivals both global and local, the lowering of barriers-to-entry to many markets, and the increasing adoption of free-market policies in most countries of the world that had hitherto maintained close markets. Market volatility and pressures for the enterprise to be flexible and adaptable point to the increasing salience of distributed decision-making. In relatively stable market environments like those of the industrial era, centralized decision-making traded off speed, responsiveness and creativity for efficiency, quick response, unvaried products, and an unambiguous command-and-control mechanism.

Today's markets demand both efficiency as well as creativity in products and services, on top of responsiveness to a market in which customer preferences – market demand is rapidly changing and market leadership is hinged on providing better and better products/services in the absence of high barriers-to-entry. A mechanism is hence needed to coordinate distributed decision-making as a result of the need to devolve decision-making to the sources of knowledge, while centralizing codifiable knowledge since it is not always possible or practicable to completely devolve decision-making powers throughout a large organization due to coordination problems or to concentrate responsibilities on the 'best qualified'. In order to provide a structure that facilitates decision-making, an organizational structure that facilitates the free-flow of knowledge in its forms – tacit and explicit – needs to be built. This mechanism needs to: (1) connect people with other knowledgeable people, (2) connect people to information, (3) enable the SECI processes as well as the conversion of information into knowledge, and (4) provide a vehicle to mobilize knowledge so that knowledge sharing and organizational learning can enhanced. The mechanism that this thesis proposes for these functions is the knowledge network.

The knowledge network is a structure born of an environment marked by increasing market volatility and its demands on the enterprise – demands for rapid responsiveness, increasing costs of innovation, flexibility in shifting the scope and scale of production, and adaptability to implementing new technologies. It is the result of increasing recognition that knowledge, embedded in humans, processes and products are critical determinants of an enterprise's abilities to compete in market conditions that punish inefficiency and flawed decisions. In the past, a network of inter-dependent agents as an enterprise organizational structure was rendered unfeasible by high coordination costs and the efficiencies associated with hierarchy and control amidst market conditions that changed slowly in the near-term. Indeed, the necessary mechanisms for coordinating multiple tasks and projects, and that could permit high-speed and cost-feasible communications in a network of inter-dependent agents were absent, hence precluding the formation of large-scale networks. With the IT revolution of the past three decades, the tables have turned: tight centralized control has been rendered impractical and too costly as a result of the myriad temporally-varying complexities engendered by a rapidly changing market environment, while the emergence of affordable information infrastructure has rendered communications, computers and enterprise information infrastructures de rigueur enterprise coordination mechanisms. Cisco, which largely adopts a network organizational structure, has proven the feasibility of a network organization on a global scale[24].

In a structural sense, the network structure consists of nodes that are interconnected by links[25], where nodes can consist of individuals, groups, or organizations, which serve as hubs of activity or organizational processes, while links refer to the various connecting and coordinating mechanisms that provide paths for communications, team-working and knowledge flows (tangible or otherwise). Choucri and Millman defines the knowledge network by synthesizing elements of people, technology and structure,

"The knowledge network is a computer-assisted organized system of discrete actors, with (a) knowledge producing capacity, (b) combined via common operating principles, (c) retaining their individual autonomy, such that (d) networking enhances the value of knowledge to the actors, and (e) knowledge is further expanded[26]*"*

Organizationally defined, the knowledge network is characterized by specialized knowledge assets under the joint control of its members – in the network, knowledge assets in the form of intellectual capital and competitive intelligence are shared in the form of collaboration (possibly cross-departmental) between network agents, information from knowledge bases and personal interactions is made readily accessible to authorized agents, and informal virtual communities of practice can form within the enterprise from these networks. Also, the network is governed by flexible coordination mechanisms – the boundaries within the enterprise are flexibly defined with the formation of temporary teams to handle specific projects, and this means that associative ties between agents are often dynamic. Decision-making is largely decentralized and locally defined, such that executive management will provide the goals and a broad strategic framework while empowering network agents with decision-making capabilities within clearly defined bounds.

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[24] Castells, M., "Information Age, End of Millennium", 1999, and Govindarajan & Gupta, "Quest for Global Dominance", 2002

[25] David Skyrme, "Knowledge Networking", 1999

[26] Choucri, Millman, 1999

Through the social lens, linkages within the knowledge network have a social component in addition to commercial contract – relations that bind together a group of individuals, teams or organizations in collaboration to achieve some collective purpose. Trust, commitment and loyalty have been touted as key elements of an enterprise human resource policy, and act as the glue that will retain talent within the organization. Indeed, the nature of team formation-and-dissolution in a network whose linkage configurations are intentionally dynamic mean that individual loyalty to the enterprise must be cultivated by the right people policies and incentive systems. The case of the multi-enterprise knowledge network introduces additional complexity and will be discussed later, since it represents a case in which loyalty to the node – which, in this case, is the enterprise – supercedes loyalty to the network as a whole, and as such, introduces a host of challenges that must be met with policy responses.

Technologically, the knowledge network refers to an organization in which individuals or teams are connected together by a network of computers that acts both as a coordination mechanism of enterprise activities, or as gateways of shared access to a common database of virtual resources on a corporate intranet and/or on the Internet. Communications backbones like broadband access and management information systems are front-runners of today's knowledge management systems that offer virtual collaborative capabilities to eliminate physical barriers to collaboration. With chapter two's definition of information as the medium for knowledge, one can appreciate the importance of management information systems (MIS) to effective and efficient knowledge networking. Touted as, and having failed at living up to the fog of hype that proclaimed MIS as a silver bullet to solve the enterprise's needs, the true value-add of MIS has too often been missed – MIS applications, today best known as enterprise integration (EI) systems, automate repetitive financial reporting and accounting processes, while organizing information and data into data-warehouses from which they can be extracted for analysis in strategic planning. Today, EI applications assist in decision-support in a wide range of areas from supply chain management to customer relationships management. While EI provides a computationally effective toolbox for optimizing routine enterprise processes, knowledge management systems (KMS) provide virtual environments that permit real-time multi-party, multi-directional communications and virtual collaboration via instant messaging, chat forums and message boards that are also enhanced by modeling and analytic software packages that can mine data and information for un-obvious patterns that could be of potential value to the enterprise.

The knowledge networking process that occurs within the knowledge network builds on the collaboration between people and the connections between computers, and reflects the joint control and shared ownership of knowledge assets through collaboration and dynamic partnerships within the network. As David Skyrme describes,

"Connect several people together and you have multiple pathways for the creation and flow of knowledge. Combine knowledge from different perspectives and you can create new opportunities and respond to challenges in innovative ways. Networking give organizations flexibility and responsiveness"

Knowledge networking involves all the processes in the enterprise knowledge life cycle dynamics introduced in Chapter 2, from knowledge acquisition and creation, to its sharing and re-use.

The essence of the knowledge network is built around a triad of elements – strategy, people and technology.

3.2.1 Strategy

The strategy of a knowledge network describes the organization's vision, mission, and plan to leverage knowledge from the synergies of collaboration between network agents in the pursuit of organizational goals. This framework for action considers people policy and technology management in seeking to drive innovation and learning in the enterprise and must ensure that both elements are harmoniously aligned. Promoting a culture of IT-supported knowledge-sharing between physically distant agents while installing incompatible software systems that prevent electronic data-sharing is one example of non-aligned strategy, or in many cases, a non-existent strategy for optimizing the interactions between technology and people. One instrument that senior management has in enforcing strategy is organizational design and this will be discussed in the following section. The barriers that prevent the formulation of coherent strategy are largely people-based – the fear of change, the fear of losing organizational control, an inability to communicate the underlying value proposition supporting knowledge networking processes in the enterprise, mismatches and disconnects between the perceptions of executive managers and line managers, the lack of buy-in from managers tasked to coordinate knowledge networking initiatives, the misunderstanding of the scale of change required, the misconception and subsequent sub-optimization of the collaboration process, and the resultant demoralization of employees are all factors that cause knowledge networking to fail from the planning stage to the execution stage.

3.2.2 People

People – the knowledge workers in the organization – are the raison-d'etre of the knowledge network and form the basis of organizational competence. C. K. Prahalad calls managing knowledge the "art of managing the heart (emotional commitment) and the head (the intellect)" and indeed, knowledge networking can only produce optimal outcomes by providing a socio-cultural infrastructure that engenders organizational commitment and trust between network agents, as well as policies that reward knowledge-sharing and constructive collaboration.
The barriers that prevent the formulation of coherent strategy are largely people-based – the fear of change, the fear of losing organizational control, an inability to communicate the underlying value proposition supporting knowledge networking processes in the enterprise, mismatches and disconnects between the perceptions of executive managers and line managers, the lack of buy-in from managers tasked to coordinate knowledge networking initiatives, the misunderstanding of the scale of change required, the misconception and subsequent sub-optimization of the collaboration process, and the resultant demoralization of employees are all factors that cause knowledge networking to fail from the planning stage to the execution stage.

3.2.3 Technology

Technology – in the form of IT infrastructure and the information systems within the enterprise – provides the infrastructure for knowledge networking. While the adage goes that, 'power without control is nothing', the global enterprise requires technology for knowledge networking to take place on a global scale. Technological issues like harmonization of protocols and standards, systems scalability and upgradability, and enterprise-wide compatibility are considerations that must be resolved at the planning stage to avoid the immense costs suffered by firms that stumbled in implementing large-scale enterprise resource planning projects in the late nineties.

3.3 Enterprise Knowledge Networks

Conceptually and operationally, knowledge networks are subsets of the enterprise. Where the enterprise is small, as in the case of the start-up, the enterprise can itself be the knowledge network, in which enterprise employees form teams to handle different projects. As the enterprise grows in size, enterprise functions are increasingiy specialized into business units that handle areas like finance, human resource, product development, research and development, and manufacturing. Knowledge-intensive functions of the enterprise – strategic planning, research and development, or human-resource, for example – are commonly the sources of the enterprise's competitive advantages, and it is in these areas that knowledge networking will be most effective. Knowledge networks within each of these business units can be coordinated by an organizational meta-network structure that loosely coordinates the activities of the business units as a whole. In terms of the enterprises that knowledge networking can describe, scale is a possible axis of variance – knowledge networks can describe the organization of entities within an organization, the organizational design of the whole enterprise itself, or the organizational structure of an alliance of enterprises. Single enterprises may be an entire knowledge network unto itself – as are many small and medium enterprises – with dynamic network associations of assets and human resource (knowledge-workers) that form in order to perform certain knowledge-intensive projects that require different areas of expertise. The meta-network model, where the entire organization is a network of networks of knowledge workers working on disparate projects, has a central governance node that performs administrative duties and financial accounting activities, and which acts as a coordinating, 'leader' node.

There are several ways of characterizing the knowledge network – by function, node-size, linkage strength, centralization of authority, and boundary-crossing complexity.

Characteristic parameters include:

Knowledge Function: knowledge sharing and access, knowledge creation

The enterprise knowledge life-cycle dynamics that was alluded to in Chapter 2 comprises two principle elements of 'knowledge management' – in this context, referring to knowledge sharing and access – and 'knowledge creation' – the creation of new knowledge via collaborative research and development between agents seeking to leverage the synergies of cooperation. The former gives rise to 'knowledge sharing' networks and involves shared access to archived

information that is separately supplied by network members, and open channels through which advice may be sought from other members of the network. The latter gives rise to 'knowledge creation' networks that are more active in the use of knowledge resources – it is concerned with innovation and the application of knowledge arising from synergistic collaboration between members – and new knowledge that is created in this innovation process is fed back into the knowledge creation process. Some knowledge networks, naturally, are involved in both the provision of access to shared knowledge as well as providing the organizational mechanisms for collaborative innovation initiatives.
'Knowledge creation' networks result in the creation of new knowledge though the main objective for such organizations is to apply the knowledge of network members in pursuing goals that are coincident with the organization's mission, and knowledge creation is a by-product of this process. The talent of the members of the network, and the policies that encourage and constrain creativity affects the quality of knowledge created and hence applied by these networks.

Examples of 'knowledge creation' networks are found in the cross-company, non-business-affiliated communities of practice founded by professionals working in the similar trade, non-profit organizations like IISD (International Institute of Sustainable Development) and TiE (the Indus Entrepreneurs – a club of Indian entrepreneurs that hosts networking events to facilitate joint-ventures and collaboration).
'Knowledge sharing' networks are operated around the technologies of databases and policies of knowledge sharing. Network member entities pool their stock of codifiable and explicit knowledge into an archive that is accessible by other members and that is updated frequently. Examples of knowledge sharing networks include the sustainable development gateway built and maintained by Indian organizations engaged in sustainable development and online reference sites on specific interests (for example, china.eastview.com as 'the knowledge infrastructure' of China).
Hybrid networks that execute both functions naturally exist, though with varying degrees of efficiency and success. Examples of such hybrid networks that combine both core knowledge processes are Skandia and Cisco.

Node-size: networking between individuals, teams, departments/divisions, and enterprises

The size of nodes in the knowledge network depends on several parameters, the most important of which is the size of the enterprise in which the knowledge network is contained. Hence when the enterprise is viewed as a knowledge network – a startup conceivably will have the smallest node size where each node consist of individuals, while the largest MNEs have nodes the size of whole divisions and within each node, sub-networks with sub-nodes the sizes of teams or sub-divisions. MNEs therefore can be considered to be knowledge meta-networks operating on a global network consisting of knowledge networks of varying node sizes, with each node consisting of smaller networks and smaller nodes, where node size decreases with network size to the point where a node consists of an individual. Hence there is a continuum in node size and network complexity (number of links and nodes) from the smallest node size of the individual (in the start-up) to medium node sizes of teams and departments in small-and-medium enterprises to very large node sizes of divisions and departments in MNEs and large corporations.

Linkage-strength

The pattern and constitution of linkages and nodes are dynamic and evolve to adapt to events and projects, hence links strengthen and weaken while density of connections change. Linkages tend to be strong when they are established over time and augmented by tradition and history. Such that ties gradually obtain a greater social component – with factors like reputation, trust, and loyalty that reinforce the bond.
Linkages that are weak change dynamically when the ties that bind network actors together are purely commercial and too short-term for trust and loyalty to develop. Within the network organization, because of the project-driven nature of work, team compositions are in constant flux – these are very apparent in consultancies, in which teams form and dissolve as dictated by the projects' need for specific expertise and experience. Hence while link dynamicity provides organizational flexibility and efficiency – permitting the deployment of the most suitable person for the task – the trade-off could count against the establishment of trust in the relationship.

Centralization of Authority

Centralization minimizes coordination costs and delays, while permitting greater coherence in execution of activities that concern network sustenance and expansion. Global optimization, across the entire network, is more easily accomplished when authority is more centralized, than in a decentralized network where there exists the danger that local optimization may not be coincident with policies that allow for a more beneficial global optimization.
Decentralization, however, reduces the bottlenecks in decision-making processes – since the central, 'leader' node need not be consulted for every operation or decision – and hence decentralization reduces delays and associated costs, allowing enhanced responsiveness and flexibility of the network. Decentralization, in permitting greater freedom to individual nodes, encourages creativity and innovation, and allows opportunistic responses to environmental changes by individual nodes. The downside would be that as a result of less coordination from the center, decentralized decisions might be inconsistent with the overall strategy of the network, hence the danger of local optimization taking precedence over global optimization.

Boundary-Crossing Complexity

This factor refers to global enterprises and the additional dimensions of complexity that must be considered when activities are spread across multiple disparate environments. A knowledge network can also be analyzed in terms of the boundaries that it crosses, i.e. the spread of its network agents and/or activities across geographic units that are governed by different cultures, levels of development (human and infrastructural), and regulations and political considerations. The larger the spread of the knowledge network, the greater the complexity of governing the network and ensuring network effectiveness and coherence as a result of the differences between each node.
Spread across politically defined regions: Intra-state (national), inter-state (national), regional (international), and trans-regional (international)
Political and regulatory changes are most apparent when one considers the boundaries across which the knowledge network operates. Local knowledge networks operate intra-state, with activities and network membership confined to a single homogeneous set of regulations and

political considerations. Inter-state or regional knowledge networks deal with a more complex mix of regulatory and political considerations while trans-regional or international networks have to deal with a large set of differing political and regulatory considerations.
Spread across culturally defined regions: Intra-region, inter-regional, global (trans-cultural)
As the geographic spread of the knowledge network increases across states and regions, there will invariably also be differences, of varying intensity, in culture (for example, China vs. the US, Southern US vs. NE US).
Factors like exchange rate differences and language differences must also be considered in managing virtual collaborative ventures to ensure semantic equivalence under different contexts.

3.4 Types of Knowledge Networks – Three Archetypes

From each of the divergent characteristics of knowledge networks, commonalities can be identified, and of these, two common elements can be discerned in all knowledge networks in the roles of human agents, technology, and the interplay between these. Two different models of knowledge networks have been observed in organizations of the past, and two emergent models will be presented. Each of these models has different structural configurations within the 'network' pattern, and is characterized by different processes and mentalities. These archetypes of knowledge networks are:

Type I: Human-centric
Type II: IT-centric
Type III: Emergent Integrated IT and Human

3.4.1 Type I: Human-centric – Knowledge Creation and Innovation

Type I knowledge networks, or human-centric networks, arise from the 'knowledge-as-a-process' school of thought that believes in the intrinsic uncodifiability of knowledge, since knowledge is embedded in the dynamic of application as opposed to being embedded in static constructs. They have been one of the earliest forms of networks in existence and in its most basic form, are built on personal relationships and informal contacts. This gave rise to so-called 'informal knowledge networks'[27] that operated on the basis of social control-and-coordination processes that were born of trust and mutual understanding between network members. More sophisticated type I knowledge networks have simple formalized control systems and governance mechanisms, and exist in both the business and non-profit context. In the past, knowledge networks were mainly centered on the knowledge networking process between individuals in close physical proximity (within the same physical location – e.g. branch office, department or division), especially since the strength of communication linkages between units depended on the quality of information infrastructure available. As such, early type I knowledge networks were usually small in terms of geographic spread due to the high costs of coordination and control, and physical barriers that impeded effective knowledge sharing – for example, documents could at best be faxed from one location to another and repositories of information and/or knowledge were in physical form and centralized at one node, and hence not easily/quickly accessible by other nodes. The development and improvement of transport linkages between regions and countries of the world has resulted in a continuous expansion of

[27] IISD, "Strategic Intentions", 1997

the geographical spread, such that today, with high-speed and real-time communications a reality, knowledge networks are truly global. Present day type I human-centric knowledge networks are associated with enterprises having a networked organizational structure, with flat hierarchies and project-driven work. Such enterprises are likely small and medium sized enterprises with fairly basic IT infrastructure, and are highly specialized in a certain product segment of the market.

Characteristic Features:

Type I knowledge networks are hence concerned with knowledge creation via collaborative team working, and knowledge sharing via formal or informal one-to-one communications and document exchanges. This model of knowledge networking adopts the "knowledge-as-process" perspective where knowledge is chiefly tacit in nature and embedded in humans, and manifested in processes or "by doing". The knowledge shared and created are mainly tacit or uncodified in physical form. The type I knowledge network consists of a group of people – who qualify not from interest but from aptitude or experience in their individual disciplines – working together to address a common concern. The value-add is that by these interactions, and by collaborative work, new knowledge is generated, and existing knowledge (especially tacit) among network members is shared.

The defining characteristic of the type I knowledge network is the centrality of people – the knowledge-workers – within the enterprise, as manifested in the relative autonomy and independence of network members, and the salience of trust and personal relationships as decisive components of the 'glue' that allows the network to function effectively and efficiently. The diversity and subjectivity among people is key in the interpretation of data, information and explicit knowledge and subsequent action, such that creative solutions, and solutions that are unique and adapted to that particular context.

The guilds and trading federations of pre-Enlightenment Europe, the trading companies of England and Holland in the nineteenth century, the start-up companies and university-industry collaboration networks of today all shared some of the characteristics.

There are trade-offs in strategic capabilities and challenges that are inherent in such a model.

Strategic Capabilities:

The organizational and governance structures of the type I knowledge network are relatively more decentralized (in terms of authority) and hence with less constraints from bureaucracy, there is a certain degree of individual or group autonomy and independence. This provides an environment that is more receptive of creativity and hence innovation. The spirit of collaboration in the mutual pursuit of common goals is exemplified in the collaborations between the entrepreneurs of start-ups and the academics of research institutions in Silicon Valley, which resulted in innovations, world-class both in quality and quantity, in the fields of electronics, software design, and biotechnology. When the decision-making is distributed among qualified expertise, the type I model functions excellently under conditions that either prevent the

centralization of decision-making (as a result of barriers) or that demand rapid application of expertise for a given task.

The emphasis on trust and personal relationships mean that company loyalty is stronger, while the commonality in aims of network members – in the case of the start-ups, the entrepreneur and his team – result in stronger motivation and team spirit that translates into higher levels of productivity and innovation. The de-humanized syndrome arising from under-appreciation that is felt by some employees in large, hierarchically organized organizations is hence not so apparent, if at all.

Challenges:

As an enterprise grows, the knowledge network will expand in size, and ultimately as more projects and tasks are undertaken, the original knowledge network becomes a meta-network – a 'network of networks'. It is the coordination problems associated with network size (number of members in the network) and complexity (number of networks governed by central node) that will ultimately threaten the viability and competitiveness of a type I network: Decentralization of authority and fragmentation of activities results in efficiency penalties as manifest in the costs arising from weak control-and-coordination as divisions and teams are not so responsive to directions and strategy from the center.

In the type I structure, while learning and innovation may be impressive on the level of the individual team or division, organizational learning and innovation may be difficult to be diffused, when knowledge is not consolidated and intra-enterprise inter-network knowledge flows are impeded as a result of political reasons. For example, an unsophisticated governance structure may result in the formation of 'silos' around separate work groups or teams that will seek to protect its own autonomy and hence hoard its own information and knowledge, resulting in reinventions of the wheel and an inefficient innovation process for the company. There is also a lack of organizational learning mechanism in this type of knowledge network, like a centralized knowledge repository, that can facilitate knowledge transfers between different parts of the enterprise.

Strong/stable linkages may very effective and efficient when all agents are working within a certain set of market conditions, but in a volatile market environment, inefficiencies are introduced when the strength of these bonds resist change, such that network becomes increasingly rigidified as a result of stasis brought about by linkages that are maintained even when economic conditions dictate otherwise. With trust and personal relationships as the sole drivers of network efficiency and effectiveness, there is a tendency for overall enterprise performance to suffer if there are disruptions to these relationships, so much so that breakaways may occur.

3.4.2 Type II: Technology-centric – Knowledge Sharing and Organizational Learning

Type II knowledge networks belong to the school of thought that subscribes to the philosophy of "knowledge-as-a-commodity" that argued that knowledge, with the aid of technological innovations in computing and brain-and-cognitive-sciences, can be encapsulated in the form of

physical objects and hence made mobile. The technology-centric knowledge network came into being at the dawn of the IT revolution when databases were first introduced. Their predecessors to IT-centric enterprises could be called 'information-centric' as they archived and stored information, in physical form in the era before digitization became sufficiently cheap or convenient, in a central library or archive where employees could search for records or documents. Naturally these would be enterprises that could afford to do so and that found sufficient economic reasons to do so, and as it were, usually governments and the public sector performed this role. With the revolution in electronics and computing, business enterprises increasingly found useful, if not immediately then potentially, a digitalized archive of information that formed the core of 'organizational memory'. Unlike the type I human-centric networks whose practitioners were start-ups and small-to-medium sized enterprises in the present day, type II technology-centric networks usually operated in the large, multi-divisional and hierarchical organizations with strong governance structures. The use of technology to create data-warehouses of information with corporate online portals that could foremost be used as coordination mechanism for a large organization was attractive, and certainly it was often a top-down decision made by senior management and managed by an IT department. Motivated by an emphasis on optimization and efficiency, the technology-centric network is largely a mechanistic model of information processing and control that is constrained both by computational machinery, but also by the specification of goals, tasks and procedures to achieve outcomes that are pre-specified. The brief bubble of high expectations in technology as the key to unlocking the value within knowledge was captured in the following, from a popular text on information systems in the late nineties,

> *"Information systems will maintain the corporate history, experience, and expertise that long-term employees now hold. The information systems themselves – not the people – can become the stable structure of the organization. People will be free to come and go, but the value of their experience will be incorporated in the systems that help them and their successors run the business."*[28]

The premise of the type II knowledge network is that given access to the right information (statistics or facts) and codified knowledge (reports, analyses), the network of human users will then know how to proceed about achieving his or her objectives. In another words, by providing a technological foundation of networked computers, data-warehouses and management information systems, it is expected that the users will adapt to the IT systems and that a human knowledge network would form out of the own accord of employees without changes (or with minor changes) to existing organizational structures. The activities of such a human knowledge network at the top layer of the type II network were not expected to be as intensive or as central to enterprise operations as in the type I network – the level of network activities would be low, with the management of extant information and knowledge being its key.

Type II networking provided management with a tool to control and coordinate the knowledge flows and stock of codified knowledge, but human resource policies and other type I knowledge networking practices are still required to create tacit knowledge, convert the tacit knowledge into its explicit form and vice versa, and for effective leverage of the codified knowledge in the knowledge base in value-creating activities.

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[28] Applegate, L., Cash, J., Mills, D.Q., "Information Technology and Tomorrow's Manager", 1988

Characteristic Features:

This model of knowledge networking hence adopts a "knowledge-as-a-commodity" perspective that treats knowledge as codifiable objects. These knowledge 'objects' can then be linked together by an IT-based network of codified knowledge and information with a front-end portal that interfaces with a higher layer of networked users. Information and knowledge are therefore treated as synonymous constructs that can be adequately expressed in the rules-based logic and data inputs/outputs that drive pre-determined actions in pre-programmed modes. Hence the technology-centric type II model assumes that[29]: (1) the same knowledge can be re-used by any human mind or computer to re-process the same logic to produce the same outcomes, (2) the same outcomes will be needed and repeatedly delivered through the optimal use of the same input resources, (3) the system's primary objective is to achieve the most efficient means for transforming pre-specified inputs into pre-determined outcomes, and (4) the role of subjectivity in interpreting information is to be minimized to achieve conformance above creativity.

The defining characteristic of the type II knowledge network is the use of IT in managing knowledge and in promoting organizational learning, and the management of knowledge in the organization as opposed to the objective of the type I knowledge network that is about the creation of knowledge. This is manifested in the deployment of management information systems, on the premise that information in the intranet, data-warehouses and cyber-libraries is the carrier or media in which knowledge is embedded. Where type I knowledge networking consisted of networks of people, type II knowledge networking focused on navigable networks of information, embedded in which was knowledge. By providing employees with access to these archives of 'knowledge objects', management assumes that new and acquired knowledge can be diffused through the organization quickly and efficiently, and that the software is optimal – i.e. that the database will return exactly the documents or information that is sought after by an employee. Large corporations, like IBM, were quick to adopt the use of such management information systems as they sought technological answers to enhancing enterprise innovation and learning. Along with a central database that attempted to integrate information across the organization, the firm also implements enterprise resource planning (ERP) – a software-driven initiative to integrate operations and data across enterprise functions and plan enterprise activities and resource allocations.

The knowledge networking process is then one where users can upload new information and/or codified knowledge onto the network, or search for and retrieve information that other users had uploaded into a database or repository, via the online portal that would act like the search engine over the intranet and possibly other extranets. Type II knowledge networks are largely automated, IT-based mechanisms of knowledge access and sharing, and is a control-and-coordination device for organizing the enterprise's explicit knowledge resources. Management information systems like data-warehouses, networking software and enterprise resource planning software packages form the backbone technologies for the stage II knowledge network. Type II knowledge networks are centered on the organization's IT backbone infrastructure, equipping members with access to the knowledge that can be crucial to performing tasks, and acts as a

[29] Malhotra, Y., 2002

mechanism to augment and interconnect knowledge resources so that information-access and knowledge-transfer can be effected.

The strategic capabilities and challenges for the technology-centric network is further discussed:

Strategic Capabilities:

Type II knowledge networking provides an IT infrastructure that serves both as a repository of organizational memory that is accessible and searchable by all authorized employees, as well as enterprise resource planning tools. By making known and searchable enterprise information on the enterprise knowledge network, employees could in principle easily access from their own workstations the information that they sought. In this way, the computerized knowledge network was a cornerstone in the enterprise's attempts to facilitate organizational learning. Also, by providing access to information, the enterprise provides a mechanism to diffuse the fruits of innovation initiatives as well as lessons from organizational memory across the organization and so prevent costly reinventions of the wheel.
An IT infrastructure, when fully operational, can reduce the coordination costs of the network, since in reality, the network here describes not so much organizational design, but a hierarchically controlled organization, in which the locus of decision-making was highly centralized, overlain with a MIS-powered network of information that connected knowledge assets with knowledge workers. With this comes organizational efficiency – commands from the governing center are efficiently executed.

Challenges:

The key strategic challenge for the type II is the tremendous reliance of the knowledge network on the right information since outcomes are entirely determined by the content of the knowledge base. The model for the type II is based on the assumption that all relevant knowledge – whether tacit or explicit – can be codified and stored in computerized databases, software programs, and institutionalized rules and practices, but factors like intuition, experience and flair are qualities that easily defy codification. An electronic knowledge base cannot by itself capture the multi-dimensional richness of the knowledge of the people in the organization, indeed, mechanisms for collaboration, for seeking out advice and for virtual communities to form, are required. This is in line with an earlier proposal that decision-making powers need to be distributed to the sources of knowledge, while knowledge that could be codified should be mobilized since it is not always possible or practicable to completely devolve decision-making powers throughout a large organization due to coordination problems or to concentrate responsibilities on the 'best qualified'.

The downside of the network is its under-emphasis on the role of the human in the knowledge network, and the misconception that providing information is enough without providing other enterprise elements like commitment and loyalty between employees, and creativity in problem-solving. As a result, the right cultural ingredient that is intrinsic to successful knowledge networking is not developed.

The costly failure of many management information systems to generate the desired returns was the result of many people-based problems, and not to technological problems. Technological difficulties largely arose from system incompatibilities between new systems and existing legacy systems. The larger issues were factors like resistance to change at all levels, inadequate definition of changes and functional requirements by the enterprise to the IT contractor, and inadequate resources in manpower training and development.

3.5 Towards Emergent Knowledge Networks

The types of knowledge network models presented here are near polar opposites, with one having the strategic capabilities that the other lacks, and vice versa. The next chapter will propose a model of an emergent, integrated knowledge network that integrates the human and technological components of networking via strategic organizational design. Organizational efficiency, responsiveness and innovativeness as well as learning capabilities were shown, though not all at once, in both types of knowledge networks of the past, but both had fundamental inadequacies that were inimical for competitiveness in today's business environment. Knowledge networking requires all three capabilities, with the strategic deployment of knowledge management human-resource policies and management information systems. The framework for such a holistic knowledge networking strategy that can encapsulate these qualities will be discussed in the next chapter.

4. DESIGNING THE INTEGRATED KNOWLEDGE NETWORK

4.1 Introduction

In the previous chapter, type I people-centric and type II technology-centric knowledge networks have been introduced as knowledge networking strategies that are inadequate to meet the challenges of today's market environment. Chapter 3 discussed the capabilities specific to two knowledge network models and identified fundamental operating deficiencies that must be corrected. This chapter proposes a *type III integrated knowledge network* model that can capture the strategic capabilities of the first two types of knowledge networking, and dynamically manage the trade-offs within networking. A knowledge networking strategy for a generic, domestic enterprise will be proposed, but different enterprise-variants – the value network and the multinational enterprise – will be explored. The type III knowledge network will be strategy-driven – one that has vision, mission and a framework for execution – that can synthesize both elements of technological and human networking into a synergistic, value-enhancing knowledge-creating commercial entity. It will manage these elements both within and between knowledge networks.

4.2 Type III: A Strategically Integrated Solution

An emergent model that has been taking shape in the late nineties, the type III knowledge network model integrates elements of both types I and II, and synthesizes thought on networked organizational design, knowledge management and management information systems deployment. Type III reconciles the "knowledge as a commodity" perspective of technologists with the "knowledge as a process" perspective of management theorists and combines ideas of knowledge network as IT-intensive information-management with that which also incorporates inter-personal human-centric knowledge-management practices. Where the people-centric network concentrated on the innovation/knowledge-creation arm of the knowledge life cycle, and the technology-centric network concentrated on the learning/knowledge-sharing arm, the integrated network encompasses both.

Such synthesis is designed with a clear knowledge networking strategy that can serve as an over-arching strategy to coordinate knowledge networking initiatives within the enterprise and that acts as a guide to transforming the existing organizational structure, administrative processes and culture within the enterprise to one that can effectively incorporate knowledge networking practices of open knowledge sharing and collaboration. The flexibility and innovative fecundity of an environment that are characteristic merits of the network organization are well aligned with the need for enterprises to develop the capacity to redefine and adapt organizational goals and business models while reinventing processes, products and services to ensure competitive survival and accommodate conceptual as well as technological obsolescence. To meet the challenges of coordinating and managing the activities of a network, the knowledge network must balance flexibility and stability of linkages, centralization and decentralization of authority, and be directed by a clearly defined collective purpose that can unify disparate actors in a common cause.

Type III knowledge networks therefore harness the twin forces of technology and human-management policies in executing enterprise strategies. Technology is a fundamental driving force in boosting computation and information processing powers, technology, in the form of ICTs, is needed to provide critical enabling infrastructure to support knowledge networking in a firm. One can then expect to see that the successful "knowledge-based economy" firm will be one where human knowledge networking is strategically oriented to take place over a foundation technological knowledge networking to engender optimal performance levels. While technology cannot correct poor management practices, technology can enhance the productivity and performance gains from good management practices. The management of the personal, political and cultural dynamics that arise between members in the network is the second keystone of the type III knowledge network.

Type III knowledge networks may be physical or virtual, but all demand active participation from human members. Type III combines the functions of types I and II by having its technological component comprise a system that supports and enhances the functions of human users in planning, implementation and project implementation. The geographic bounded-ness and lack of institutionalized learning mechanisms of type I are shed with the world-spanning connectivity in the technologies that have origins in those of stage II, and have resulted in the creation of virtual knowledge networks of individual experts who work to achieve common aims possibly without convening physically. Integrated knowledge networks

4.3 Formulating Strategy

One of the pioneers of the type III knowledge network model, small and medium enterprises (SMEs) that evolved in the technology parks of Silicon Valley and Route 128 subjected the IT-enabled network organizational model to the litmus test of reality, and provided a working demonstration of the virtues of the network organizational model – flexibility, innovativeness, synergy, and responsiveness to the dynamics of a volatile market – as well as challenges that the network organization had to meet – in organizational design like coordination and control, political factors like trust and loyalty, and issues of culture like knowledge sharing. The knowledge network is a paradigm of an enterprise network of IT-enabled interdependent units of knowledge workers collaborating to achieve a collective purpose, and a holistic knowledge networking strategy is needed – one that provides a direction and framework for action in the dimensions of technology, and people, and the interactions between these.

An overview of a knowledge network strategy will be provided below at three levels of enterprise-size in terms of number of departments or divisions within the organization. At the lowest level, the domestic small-or-medium enterprise (from a single-department start-up to an enterprise with a few divisions) will be examined; at the middle level, the MNE – a large, multi-divisional corporation encompassing business units in different countries – is considered; at the highest level of aggregation, the value network – an alliance of enterprises that include both SMEs and MNEs – is examined.

The knowledge networking process must be strategically crafted such that it directly helps the enterprise in fulfilling the goals of the enterprise and in fulfilling its mission. To this end, an enterprise knowledge networking strategy must assess the company's vision and mission

statement, and map out the role of knowledge within business processes of the enterprise. The present state of knowledge assets within enterprise activities must first be ascertained before a coherent and holistic knowledge networking strategy can be formed to map out transitory paths that must be taken to enhance knowledge life cycle processes. In order to assess the present state of knowledge assets within the enterprise, it must carry out an organizational *knowledge audit* that identifies extant conditions within the enterprise in the dimensions of strategy, people and technology with regards to innovation and knowledge management. Strategic issues refer to assessing the key knowledge drivers behind the business and its relation to the core competencies of the enterprise. effectiveness and efficiency of knowledge flows within the enterprise and barriers that are limiting these, the use and collection of management information like key performance indicators and benchmarking data, and the knowledge assets of the enterprise vis-à-vis competitors. The *technology* component of the knowledge audit assesses the state of the information infrastructure in the enterprise and how it supports knowledge life cycle processes, the effectiveness and efficiency of technology in managing organizational memory and intellectual property, in facilitating the SECI processes of synthesizing explicit knowledge and tacit knowledge, and in facilitating the process of 'getting the right information to the right people at the right time'. The *people* component of the knowledge audit is as much concerned with environmentally engendered organizational behavior as embedded in social values and work culture as work patterns (team-working versus individual work), incentive systems like performance based compensation schemes, willingness to share knowledge among knowledge workers, and receptivity of superiors to suggestions and proposals, as with talent attraction and retention issues like the composition of the labor-force (number and quality of knowledge workers) currently in the enterprise, and existing initiatives to track and retain the best and brightest of the enterprise.

Knowledge in the enterprise has been introduced in Chapter 2 to encompass intellectual capital – knowledge within the firm or its partners – and competitive intelligence – knowledge about the firm's competitors. A knowledge audit will map out the areas where knowledge can create competitive advantage for the enterprise and the existing state (policies and status quo) of these areas. This will permit planners and management strategists to envision a desired future state, and then construct practicable policy pathways to correct existing deficiencies and improve on existing policies, hence steering the enterprise from the existing state to the desired future state. In the enterprise, there are areas in which leveraging knowledge yields the largest gains. Indeed, the type-I-type-II dichotomy is quite apparent in high-tech enterprises that often comprise both knowledge-based operations as well as industrial bulk-processing operations[30], in which the principal enterprise knowledge areas include not only an innovation-intensive areas like strategic planning and research and development (encompassing product design, prototyping, testing etc.), but also logistics, marketing (includes branding, advertising, identification of market segments and emerging opportunities), and distribution.

4.4 Executing Strategy

Where the principal enterprise knowledge areas constitute the targets of a knowledge networking strategy, execution pathways must be formulated in order that the knowledge goals of each domain can be fulfilled. In each of these knowledge domains, both human and technology

[30] Arthur, B., "Increasing Returns and the New World of Business", Harvard Business Review, 74, 4, 1996

dimensions are required in the formulation and execution of policies that can acquire and create the relevant knowledge. The latter must then be incorporated into improving existing business performance in order to achieve sustainable economic gains both in the short and long term. Analysis will proceed in two directions – human policy and technology policy – that will attempt to holistically achieve knowledge goals of each knowledge domain. The human and technology policies for the domestic enterprise will be first presented, while the case of the MNE will be presented in the following section, and that of the value network thereafter.

4.5 Human Policy[31]

Human policy in the organization has always been a key determinant of organizational performance for any knowledge-intensive trade or industry. For the knowledge network, an effective human policy is one that optimally creates and leverages synergy among knowledge workers in the network in innovating and responding to meet market demands in accordance with the mission of the network. Human policies affect the interactions between both agents within the network as well as those beyond – at knowledge workers within the enterprise, the value network (i.e. enterprises that are upstream or downstream in the value chain(s)), and the end-customers themselves. Indeed, from the perspective of the enterprise, for the network effect – where 'the whole is greater than the sum of its parts' – to be achieved, policies are needed that can provide a cultural and social environment – whether physical or virtual – that encourages collaboration, that permits experimentation, that inspires commitment to a common cause, and that can the interests and goals of knowledge-workers with those of the enterprise. Adaptiveness, responsiveness, and flexibility are three qualities that are predicated on an enterprise's ability to innovate in terms of products, processes and technologies, and these are in turn contingent on cultural and organizational innovation – involving the re-organization of work, reward and penalty systems, re-structuring of chains of command and decision-making locii.

The formulation of a coherent and comprehensive human policy element of an enterprise knowledge networking strategy hence draws from the disciplines of organizational behavior, knowledge management, and human resource strategy. In the traditional industrial era organization where the imperative has been to follow a certain pre-defined recipe of actions to ensure pre-specified outcomes amidst a market environment that was assumed to be static within the near-term, mechanisms of organizational control and coordination like hierarchy and centralized decision-making authority had the consequence of suppressing innovation and creativity. In a market environment defined by volatility, the organization will have to continually assess the foundational logic of business activities – its value propositions to customers and its competitiveness vis-à-vis rivals – and hence ensure that its business performance is aligned with these market changes.

While traditional business logic is based on control, the dynamics of the new business environment require a business model that is governed by less rules, some guidelines and more freedom in acquiring and assessing information, and leveraging this information to create knowledge that will ultimately underpin the solutions, products or services that the client desires. By explicitly encouraging experimentation within bounds and the challenging of existing

[31] Creech, Davenport, Mentzas, Skyrme, Stewart, Wiig et al

assumptions, the human-resource policy must hence be able to promote innovation and the management of knowledge.

There are two salient elements in the management of knowledge workers within the knowledge network, and these pertain to network governance – command-and-control mechanisms – that define what should or should not be done, and the culture of the organization – the behavioral norms and values that influence the interactions, motivation and loyalty among knowledge workers.

4.5.1 Governance[32]

Governance via organizational controls usually seek the compliance of employees with pre-defined goals that need to be achieved using pre-set 'best practices' and standard operating procedures. Such industrial age organizational controls ensure conformity by enforcing task definition, measurement and control, yet they can also inhibit creativity and initiative – indeed, the prerogative here is error-avoidance as opposed to innovation. While such controls work well in a stable market environment, the rapidity of change today will require something different, which recognizes the need to innovate, not just in technology, but also in business models, value propositions, organizational design, and organizational culture. The challenge will be for management to instill commitment among knowledge workers towards a common cause. Pressures for real-time response to market dynamics mean that knowledge workers will have to be autonomous in order to effectively react to these changes. Knowledge workers must hence also be confident enough to act on the basis of incomplete information while trusting their own judgments and taking decisive action in order to exploiting increasingly narrowing windows of opportunity. More and more, for knowledge workers to be empowered with decision-making capabilities, control will be self-exerted, as opposed to being exerted by hierarchical superiors. As explicit control via formal rules and regulations become inimical to competitiveness, implicit controls, via organizational culture, will become increasingly necessary. Where formal rules and hierarchy have governed organizations in the past, the knowledge network will rely more on controls via norms and behavior.

4.5.2 The Cultural Imperative – Commitment, Trust and Openness[33]

Developing an information-sharing infrastructure is an exercise in engineering design, but enabling the effective utilization of that infrastructure for information acquisition, knowledge sharing and creating new knowledge is an exercise in organizational design that encompasses the establishment of a culture that enables these processes. Symbols and rituals, attitudes and behaviors, values and norms, all are components of 'culture' – 'the way we do things around here'[34] – and it is argued that culture will be a more effective means of aligning the aims of network members with that of the collective. Culture can be an effective glue in retaining for the enterprise its best talents, and it is culture – some call this the social ecology of the enterprise – that creates trust and commitment. C. K. Prahalad calls managing knowledge a battle for the heart and mind. Many knowledge management methodologies focus on the latter, but the former

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[32] Creech, H., 2001
[33] Govindarajan, V., & Gupta, A. K., 2001, Davenport, T., 2000, Malhotra, Y., 2001
[34] Kroeber, A.L. and Kluckhon, C., 1952; Bower, M., 1982

is perhaps equally significant – an enterprise needs to know how to optimally leverage its human capital, but at the same time, it must be able to retain talent and expertise.

Often, individuals may not willingly share information with departmental peers or with other departments within the same enterprise, never mind those in allied enterprises, due to the belief that exclusive knowledge delivers unto them a positional superiority in bargaining and negotiations. Here, the employee would perceive that because information is the basis of knowledge, whose leverage is a source of power, sharing information would dilute that advantage, and hence resulting in a perceived conflict between individual self-interest and the collective interest. Indeed, despite the increasing sophistication of IT in aiding knowledge sharing and innovation, the human propensity to hoard knowledge as a source of political leverage within the enterprise, may result in the sharing of partial or inaccurate information. Sharing of inaccurate information would impact decision-making processes that will critically jeopardize the enterprise's competitiveness, and at best, result in a termination of employment and at worst, threaten the very survival of the partner, if not the very enterprise itself. As such, the effectiveness of knowledge sharing initiatives and the integrity of information flows are crucially dependent upon the motivation of people to share accurate information on a timely basis across intra-enterprise boundaries. And this motivation – at all levels of aggregation within the enterprise – is itself born of trust, that all agents within the value network will act in the best interests of the collective, and that the knowledge arising from information sharing will not be used in ways that would harm the individual's interests. The culture of information and knowledge sharing is hence of great criticality in influencing the performance of a knowledge network. An organizational climate of openness, with willingness among knowledge workers to share knowledge and information, and to learn from each other, should therefore be the aim of managers.

4.5.3 Learning and Innovation[35]

A culture of open knowledge sharing must also be complemented by a culture of learning and innovation in order for knowledge networking to succeed in delivering optimal returns. To motivate employees with the drive to innovate, in terms of improving the status quo, and the willingness to express their creativity while remaining in the bounds of accountability, the enterprise must adopt initiatives that clearly define the so-called 'out-of-bound' markers – the limits to experimentation, the toleration of failure of experiments, and an incentive system that rewards initiative and performance.

For the knowledge network, while creativity drives the innovation process, the learning process is equally critical. Continuous, enterprise-wide learning is needed for the knowledge network to be efficient in innovation – the costs of reinventing the wheel can be a severe impediment to enterprise competitiveness – and drives a positive feedback loop akin to the knowledge life-cycle: the more one learns, the more knowledge that is gained, which in turn can be applied such that more learning results. In creating knowledge, the loop also permits learns by doing such that errors committed once can be 'learnt' and stored in organizational memory, such that they would not be incurred again. An organization's capability to learn, again, is supported by twin pillars of technology and people, where the former becomes increasingly crucial as the organization

[35] Argyris, C., 1999, Raelin, J. A., 1999

becomes larger. In order for the people element to support organizational learning, however, the right policies must be in place. There must be an adequate budget and time that is allocated to learning initiatives, examples of which are:

- Learning on the job during regular hours
- Sessions for retrospection and review by employees and management, and detailed feedback on subsequent action vis-à-vis suggestions, proposals and recommendations.
- Mentorship of less-experienced employees by the more experienced employees
- Learning to be stored and recorded as part of a physical or software-based organizational memory that can advise and guide future action.

4.5.4 Learning from Customers[36]

External to the enterprise, knowledge about the customer is an integral component of relationship-capital – a component of intellectual capital. Derived from sales team and customer services personnel via raw data and analysis from surveys, recorded conversations, experience in interactions with customers, complaints, help/service inquiries, transaction characteristics, and comparative product popularity vis-à-vis other similar products in the market, customer knowledge thus collated in codified form (reports, surveys, analysis papers etc.) will be digitized and stored in virtual knowledge repositories that are powered by intelligent search systems. While technology manages, the processes of acquisition, re-use, analysis and hence decision-making are also critically dependent on people – those who design and devise marketing and sales strategies and value propositions for the customer, and those who in ensuring that supply is aligned with demand. Beyond traditional market research methods like those listed, enterprises are increasingly realizing that a closer relationship with customers may be more effective and yield insights that may not be encapsulated or articulated in customer surveys. These require knowledge workers to be able to actively learn from the customer, to understand their preferences, both expressed, or subconscious.

For example[37], firms like 3M and Honda encourage researchers and engineers to spend time with users of their products. For example, the plastic cup-holder affixed below the radio and above the gear-stick in many cars was invented by Honda who paid workers who drove Honda to allow designers and engineers to accompany them to work in their Honda cars every morning in order to discern the habits of drivers. The insight that was obtained was that many drivers wanted to bring drinks like coffee into the car for consumption on the way to work, but had to create makeshift holding mechanisms to hold their cups. The resultant invention by Honda engineers – the incorporation of the cup-holder into the car – was a low-cost and simple innovation that instantly gave Honda the extra edge over many of their competitors when car-buyers immediately attracted to the Honda over other cars, which were otherwise on par with Honda cars in any other way. This extra edge, obtained from the leverage of an understanding of the needs of the customer that were unarticulated in any survey, brought in significant earnings for Honda.

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[36] Skyrme, D., 1997, Tiwana, A., 1999, Davenport, T., 2000

4.6 Technology Policy

The rapid digitalization of the world has provided knowledge networking with the foundations on which to build a global-scale network. The role of technology has been called an 'enabling' element that 'supports' knowledge management, but the criticality of enterprise responsiveness in a dynamic real-time economy makes IT – an enterprise's soft- and hardware computing infrastructure – the required foundation for effective and efficient knowledge networking. Technology hence acts as critical infrastructure that enhances and amplifies the value of knowledge by providing the infrastructural foundations for the knowledge life cycle processes – knowledge acquisition, knowledge creation, knowledge sharing and access. Indeed, an IT infrastructure is responsible for the transmission, management, diffusion and integration of information and data, for creating virtual meeting-places and tools that can support collaboration. The dynamic volatility of the market environment – the 'real-time economy' – will also demand that enterprise knowledge infrastructure technologies must be sensitive to the pressures of technological obsolescence and enterprise expansion (or contraction), and hence permit both scalability as well as upgrades.

Hence, a knowledge networking technology policy is made up of three major and disparate components –

- Transmission of data and information – communications backbone infrastructure for connecting every unit of the enterprise,
- Management of data and Information– enterprise integration initiatives for managing and leveraging information and explicit information,
- Enabling knowledge creation and sharing – knowledge management systems for facilitating virtual teamwork/collaboration activities, and leveraging both explicit and tacit knowledge.

All three components will impact the key knowledge domains identified above, though there are specific functionalities and applications within each that will address individual knowledge domains.

4.6.1 Communications Backbone Infrastructure[38]

A basic backbone infrastructure that forms the communication channels between nodes in a knowledge network, consists of fixed-line communications links like broadband fiber-optic, copper or co-axial cables, wireless communications links like VSAT (very small aperture terminal) satellite links, radio or microwave links, or other electromagnetic media through which data is transmitted from one point to other points (in engineering parlance, the first six 'layers' of the OSI reference model for communications between systems[39]). As the velocity of market

[38] Alstyne, M.V., and Brynjolfsson, E., 1995; Applegate, L.M., Cash, J.I. and Mills, D.Q., 1988; Clemons, S.K., Reddi, S.P., and Row, M.C., 1993; Jarvenpaa, S.L. and Ives, B., 1994; Lucas, H.C. and Baroudi, J., 1994; Peters, T., 1992; Rockart, J. and Short, J., 1991

[39] The OSI, or 'open systems interface', reference model consists of seven layers that describe the processes and levels of operation that take place in communications between any two points. These layers are the physical layer (provides the electrical, functional, and procedural characteristics to activate, maintain, and deactivate physical links that transparently send the bit stream; only recognises individual bits, not characters or multicharacter frames); data link layer (Provides functional and procedural means to transfer data between network entities and possibly correct

dynamics increases, physical communications hardware and software are critical elements in the management of an MNE network in which business units and assets are dispersed across time zones and regions. Indeed, ubiquitous connectivity, and increasingly, the adoption of universal standards in software protocols by firms across the globe, has contributed to the formation of value networks by facilitating rapid partnering between enterprises in alliance-formations across the globe. The rise of the network organization – the principal structural component of the knowledge network – and the practicality of managing knowledge assets – the core subject of knowledge networking – have been the result of two key events in IT in the past decade pertaining to: (1) telecommunications – the deregulation and privatization of the telecommunications industry in many Western countries has dramatically lowered costs of both domestic and long-distance telephony, and (2) the Internet – the world-spanning information and communications network that has affordably connected people from almost all strata of society and from almost all regions of the world. IT has hence established more rapid inter-nodal communications within the knowledge network, due to the increase in the number as well as bandwidth of communications channels and hence significant reductions in information delay, resulting in greater inflows, outflows, and exchanges of data and information – the primary elements of knowledge – and significant reductions in information delays. The latter factor – also associated with the development of corporate Intranets and extranets, are also core essentials for efficient and effective knowledge networking, and form the most basic components of knowledge management software, the nature of which will be explained shortly. The coordination costs of managing a network organization has hence substantially reduced as a result of the IT revolution.

4.6.2 Enterprise Integration Infrastructure[40]

The enterprise integration (EI) infrastructure of the firm builds on the communications backbone infrastructure of the firm – while the latter provides the means and media via which the firm transmitted content to internal as well as external sources, the EI infrastructure processes and manages that data and information. By interconnecting hitherto distinct information systems, streamlining the firm's business processes, integrating information and data from these processes, and ultimately enhancing internal efficiency by permitting a seamless flow of information, an EI infrastructure informs and enables enterprise-wide planning, execution and

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transmission errors; provides for activation, maintenance, and deactivation of data link connections, grouping of bits into characters and message frames, character and frame synchronization, error control, media access control, and flow control); network layer (Provides independence from data transfer technology and relaying and routing considerations; masks peculiarities of data transfer medium from higher layers and provides switching and routing functions to establish, maintain, and terminate network layer connections and transfer data between users);transport layer (Provides transparent transfer of data between systems, relieving upper layers from concern with providing reliable and cost effective data transfer; provides end-to-end control and information interchange with quality of service needed by the application program; first true end-to-end layer); Session layer (Provides mechanisms for organizing and structuring dialogues between application processes; mechanisms allow for two-way simultaneous or two-way alternate operation, establishment of major and minor synchronization points, and techniques for structuring data exchanges); presentation layer (Provides independence to application processes from differences in data representation, that is, in syntax; syntax selection and conversion provided by allowing the user to select a "presentation context" with conversion between alternative contexts). The seventh layer, on top of the first six, is the application layer and refers to the software-driven services that are provided by the media.

[40] http://mysap.com/solutions/, Malhotra, Skyrme, Cortada, Davenport et al

reporting, and hence serves as a critical support system for knowledge networking. Indeed, the EI infrastructure and the communications backbone infrastructure of the enterprise are essential determinants of the effectiveness and efficiency of the knowledge network, where knowledge networking effectiveness refers to whether or not a person can obtain required knowledge from information in codified form or from another person within the enterprise, and networking efficiency refers to the cost and speed of obtaining the required information. EI initiatives comprise two key components: (1) Enterprise Resource Planning (ERP), and (2) Harmonization of standards.

ERP refers to an enterprise systems technology that at the most basic level integrates enterprise-wide data and information into a single computer system that has a, shared data/information repository (for example, a data-warehouse) for all commercial and operations data/information, as well as a whole range of functionalities that can: (1) automate repetitive and standard processes the way machines automated manufacturing plants in the industrial revolution, and (2) provide decision support capabilities. ERP today, indeed, integrates the information and data along with an entire suite of application software:

1. Transaction processing – automates financial accounting and reporting processes – invoice, payment, and orders processing;

2. Workflow management software – for example, computing optimal production plans, and re-engineering processes. Impacts product knowledge;

3. Supply Chain Management software – in supply chain planning and execution – the former uses math algorithms to help you improve the flow and efficiency of the supply chain and reduce inventory while the latter automates the different stages of the supply chain. Functionalities provided by supply chain management software include optimization of value network, supply and demand planning, and supply chain event (life-cycle stages) and performance (measurement indicators) management;

4. Human Resource Management software – Functionalities include the maintenance of profiles of employee training and skills, managing training programs, identifying career paths and progression of employees, and the analysis of enterprise vs. industry compensation packages;

5. Customer Relationship Management software – Functionalities include supporting and synchronizing customer information, extracting and mining customer preferences, history and profitability data into a database, and analyzing, driving and predicting customer demand;

6. Strategic Planning Support Systems – Software that track and report on business performance measures such as key performance indicators, aggregates, mines and analyzes data, and data-warehousing management;

The enterprise needs to harmonize standards in software formats, and reporting protocols and terminology across the organization to achieve systems interoperability via universalized data formats, software protocols and a glossary of terminology.

The value-add to overall enterprise performance if correctly implemented is well documented:

1. EI allows companies to leverage best-of-breed software and develop E-Commerce solutions like eMarketplaces, portals and application service providers, while prolonging the effective life of legacy systems and existing information technology investments.

2. Cross-functional integration results in enhanced efficiencies organization-wide, with meta-data management that govern data formatting.

3. Reductions in time spent by people looking for data/information and managing format inconsistencies and incompatibilities, resulting in reduction in the costs of information management.

4. Accuracy and timeliness of information and data increases as more data/information is gathered faster and computation expedites processing, resulting in more rapid and confident decision-making. The responsiveness of the organization to market volatility as a result increases, hence leading to a better understanding by senior management involved in strategic planning of enterprise activities and development. Also, IT-augmented operational efficiencies will enable the deployment of just-in-time systems and lower inventory buffers, and time to market can be expedited as a result of better information management.

The challenges to enterprise integration are[41]:

1. Technical complexity: Inexperience with the use of EI applications will sure lead to a drop in productivity in the near-term, and depends on the complexity of implementing and managing the system. Security challenges must be technically met, now that information and data are integrated into a single source that can be accessed by a greater number of users. Costs must also include the extensive conversion of existing formats and interfaces of legacy systems in line with a new universalized standard.

2. Control-and-coordination complexity: While EI systems can be an excellent tool for coordination and enterprise activities planning, control and coordination is largely dependent on the usability of the system by managers, and how well other knowledge workers can leverage the functionalities of EI software to manage resources in their projects. Because EI involves bringing together multiple different systems in different business functional units onto a common platform, there is a potential that in attempting to accommodate the complexity of each function, the resultant system becomes too complicated to use and bogged down in speed by the computational complexity of managing multiple processes. Security is naturally a control issue, and as mentioned, the increased access to previously information will carry a certain measure of risk to the

[41] http://isaca-la.org/doc/erprisks.pdf

enterprise. Penalties and other governance mechanisms must be built to deter theft of information. Internal audits of performance and productivity post-EI-systems-installation will require greater IT expertise, such that auditors can audit both financial and operations in which IT is a primary component of activities.

3. Business process complexity: EI initiatives integrate organizational data into a single point that will require back-up redundant systems to safe-guard against errors. The possible complexity of the EI system once built, may obfuscate managers who have had little experience with computers and who may hence, find managing and decision-making enterprise activities more challenging than before. Because user receptivity is key to the success of the EI initiative, training and cultural change will be needed to engender productivity gains from using these systems. Also, there will be the challenge of motivating and convincing employees of disparate departments of embracing a business environment where hitherto different and discontinuous business processes become integrated.

4.6.3 Knowledge Management Systems

IT can significantly enhance network organizational structure and learning, via knowledge management systems. The knowledge management systems of an enterprise are built on the foundations of a communications backbone infrastructure and an enterprise integration infrastructure. The enterprise integration infrastructure performed the tasks of automating many processes that were otherwise repetitive and of integrating information from business processes in order that many knowledge management processes can be facilitated – knowledge acquisition, knowledge sharing, and knowledge re-use. Enterprise knowledge management systems are hence critical enablers of knowledge life cycle processes, both in creating, sharing and re-using knowledge in the pursuit of enterprise objectives. EI infrastructure can facilitate a broad distribution of information and hence promote organizational learning by rapid diffusion of ideas. Distribution is, naturally, but one element of organizational learning supported by IT that can simplify the process of knowledge acquisition by tapping sources of competitive intelligence and by simplifying the process of network member grafting. Collaborative systems that involve group decision support systems further enhance network coherence while individual decision support and relational databases reduce managerial reliance on subordinates. Increased knowledge sharing might form the basis of better decisions and learning curve effects, while also amplifying knowledge generation by focusing on additional sources of expertise on important issues within the network. Because the resultant downside is information overload, technology can facilitate a filtering of information to ensure that only relevant information is returned to those who need it most. It has been argued that since the potential loss of network partners leads to a potential loss of learning, a technology based organizational memory may often lessen the effect and greatly improve the management of intellectual capital.

Knowledge management systems comprise four components: (1) enterprise intranet with portal, (2) an organizational knowledge repository, (3) collaboration-enabling technologies, and (4) knowledge acquisition tools. A typical list of knowledge management systems applications include:

1. Electronic on-line document sharing in searchable repositories that encompass file-sharing of documents like process maps, workflow diagrams, procedural guidelines, manuals, best practices, and lessons learned

2. Enterprise web-accessible intranet and extranets that hosts knowledge repository and databases

3. Virtual workspaces and environments[42]:
    a. Virtual Transaction Space: transaction processing areas
    b. Virtual Distribution Space: channels for distribution of digitalized virtual products
    c. Virtual Communications Space: interactive spaces online
    d. Virtual Information Space: areas where enterprise presence can be advertised on the Internet
    e. Virtual Information Markets: integrated spaces for purchases of information resources (articles, white papers, data etc.)
    f. Virtual Knowledge Markets: on-line advice or services for knowledge-sharing communities

4. Discussion groups, online surveys, mailing lists and listservs

5. Correspondence Handling And Tracking Systems that management correspondence and exchanges between network members

6. Data mining, information extraction with context mediation, information aggregation, network-spidering programs, and decision support modeling and analytical software

4.6.4 Summary

The three types of knowledge networks that have thus far been discussed are summarized in the following table in terms of their salient strategic capabilities and challenges.

[42] Skyrme, D., "Knowledge Networking", 1999

Summary Table of Knowledge Networks		
	Strategic Capabilities	Challenges
People-Centric (Type I)	Decentralized authority, hence creating a certain degree of individual or group autonomy Culture of cooperation and collaboration encourages creativity and hence innovation Emphasis on trust and personal relationships mean that company loyalty is stronger Commonality in aims of network members result in stronger motivation and team spirit that translates into higher levels of productivity and innovation	Decentralization of authority and fragmentation of activities results in efficiency penalties due to weak control-and-coordination Organizational learning and innovation may be difficult to be diffused, when knowledge is not consolidated and intra-enterprise inter-network knowledge flows are impeded as a result of political reasons. Inadequate organizational learning mechanisms in this type of knowledge network, like an IT-enabled centralized knowledge repository, that can facilitate knowledge transfers between different parts of the enterprise Strong/stable linkages may very effective and efficient when all agents are working within a certain set of market conditions, but in a volatile market environment, inefficiencies are introduced when the strength of these bonds resist change even when economic conditions dictate otherwise With trust and personal relationships as the sole drivers of network efficiency and effectiveness, there is a tendency for overall enterprise performance to suffer if there are disruptions to these relationships
Technology-Centric (Type II)	Provides an IT infrastructure that serves both as a repository of organizational memory that is accessible and searchable by all authorized employees, as well as enterprise resource planning tools. By providing access to information, the enterprise provides a mechanism to diffuse the fruits of innovation initiatives as well as lessons from organizational memory across the organization and so prevent costly reinventions of the wheel An IT infrastructure, when fully operational, can reduce the coordination costs of the network, and creates organizational efficiency – commands from the governing center are efficiently executed	An electronic knowledge base cannot by itself capture the multi-dimensional richness of the knowledge of the people in the organization, indeed, mechanisms for collaboration, for seeking out advice and for virtual communities to form, are required Under-emphasis on the role of the human in the knowledge network, and the misconception that providing information is enough without providing other enterprise elements like commitment and loyalty between employees, and creativity in problem-solving Technological difficulties largely arose from system incompatibilities between new systems and existing legacy systems Lack of training will result in inefficiencies in operating the systems, and because the value-add as a result of deploying technological infrastructure as the 'knowledge backbone' of the enterprise is largely predicated on the inputs to the system, quality control mechanisms must also be in place to ensure that information/data inputs are of certain integrity.

Integrated (Type III)	Communications backbone serves to connect employees within the organization with high-speed, real-time communications links Enterprise integration enablers provide crucial decision support and mechanize administrative processes Knowledge management systems provide the infrastructure that frees employees from constraints of time and space by permitting virtual work and real-time collaborative activities Individual- and group-based performance-tied rewards help engender commitment to organization while motivating employees to work Decentralization of authority and a certain degree of autonomy empowers expertise with decision-making authority Encouraging collaborative activities builds a culture of knowledge-sharing and aid organizational learning	Governance mechanisms must be able to coordinate activities that are decentralized from HQ. Training and human resource development is critical to ensure that employees will be able to effectively use the technological infrastructure Human-computer interface design will also be a determinant of the usability, and hence, the value-add from using the technological infrastructure Harmonization of technology standards will be required to ensure the inter-operability of organization-wide systems The freedom to be creative must also be bounded by a strict standard of accountability, which tolerates failure within certain bounds while encouraging experimentation. Adaptiveness, responsiveness, and flexibility are three qualities that are predicated on an enterprise's ability to innovate in terms of products, processes and technologies, and these are in turn contingent on cultural and organizational innovation – involving the re-organization of work, reward and penalty systems, re-structuring of chains of command and decision-making locii.

Table 5: Summary of Knowledge Networks: Capabilities and Challenges

4.7 Type III Knowledge Networking in MNEs and Multi-Enterprise Alliances

A broad framework has been proposed above for the generic enterprise to adopt type III knowledge networking, but one can be more precise in defining different areas of concern for different enterprise entities.

There were two salient trends identified in Chapter 1 that was driven by globalization and the emergence of network organizational forms:

1. The increasing global expansion of businesses as a result of innovations in ICT, and
2. The formation of multinational value networks of MNEs and local partner firms

This thesis is concerned with global knowledge networking, and hence two enterprise forms that operate on a global scale will be examined in greater detail. These two enterprise forms refer to the multinational enterprise and the value-network, a multi-enterprise alliance that has the trappings of a unified enterprise. Indeed, the strategies mooted in the previous section are immediately applicable to the domestic enterprise, but we are concerned with two scenarios: the value network – inter-enterprise knowledge networking, and the multinational enterprise – trans-regional knowledge networking. The context – a brief discussion on the nature of MNEs and value networks – will first be presented, and the components of a holistic global knowledge networking strategy will be discussed for global enterprises. Arguments will also be presented that suggest the convergence of MNEs and value networks into globally active value networks as enterprise activities become increasingly globalized as a result of information technologies, boundaries blur, IT systems integrate, coordination-and-control mechanisms evolve, and decision-making powers become increasingly decentralized to knowledge workers operating in dynamic and volatile market environments.

4.8 Multi-National Enterprises

Multi-national enterprises operate across boundaries of time, distance, language (both semantics and syntax), culture, and regulatory environments. Indeed, managers of MNEs recognize that dominating global markets is founded on the need to achieve both global efficiency and local responsiveness, which in turn are driven by the organizational capability to develop, acquire and leverage knowledge on a worldwide basis. Global expansion of business requires three knowledge-based capabilities: knowledge about foreign markets[43], skills and know-how for managing people in foreign locations, and skills and know-how at managing and coordinating the activities of foreign subsidiaries. In globalizing, an enterprise needs to make decisions in addressing six issues[44]: product choice, choice of strategic markets[45], mode of entry[46],

[43] Specifically, this refers to the extant state of the economy, political and regulatory regimes, level of development of the population, potential size of the market, the quality of governance structures, and present infrastructure of the country.

[44] Gupta, A. K., & Govindarajan, V., "Managing Global Expansion: A Conceptual Framework", 2000

[45] The strategic importance of a market is determined by the current and future market size as well as the learning opportunities offered by that market. Indicators of the former two factors are the size of the country's economy as well as the country's GDP, and indeed also, the wealth of its citizens and their predilections with respect to the product or service. Learning opportunities are determined in turn by the level of sophistication and exactitude of the customer base.

transplanting organizational culture, achieving dominance in the local market[47], and speed of global expansion. All six require knowledge inputs to inform decision-making, and all are vital in ensuring the viability and success of the global enterprise.

In a study by Bartlett and Ghoshal, multinational enterprises (MNEs) are evolving into a common organizational form that represents a shift in thinking away from hierarchical and matrix structures towards a network structure. Unable to resolve the increasing complexity of managing a global enterprise and the new volatility of market environments, managers in MNEs realized that present business models were inadequate. Hierarchical organizational structures performed well in an earlier era of bulk-processing industrial economy under conditions of market stability when a bureaucracy of enterprise planners could adequately respond to an environment marked by low complexity, a low rate of technological obsolescence and low demand uncertainty, but in the present day, when the latter conditions began rising, where operational complexity in worldwide enterprise activities increased, technologies became rapidly obsolescent and markets are characterized by volatility, hierarchically organized enterprises that were strong in corporate command-and-control were too slow in responding, as IBM[48], found to heavy cost in the 1980s, against more flexible and adaptive competitors like Digital Equipment, a pioneer of flatter hierarchies and more 'organic' organizational structures.

What was needed was a solution that balances centralized efficiency with locally sensitive responsiveness and adaptability while building and leveraging functional competencies. One solution that managers reached for was the matrix organizational design, which had front-line managers reporting simultaneously to different management groups so that multiple management perspectives could be integrated and synthesized to form a better understanding of market conditions, and therefore precipitating better enterprise responsiveness. The downside, however, was that the matrix accentuated differences and sharpened conflicts of interests and power struggles as a result of dual chains of command that provided little forum for managers to resolve overlapping responsibilities and different viewpoints. In a multinational enterprise, distance, time, language (syntax and semantics) and culture provided more barriers that further stifled conflict resolution processes.

The alternative has been the network organization, an organization with less hierarchy, greater decentralization of decision-making powers, greater empowerment of managers and experts, greater flexibility and adaptability as a result of less bureaucracy and a culture that encouraged autonomous and creative decision-making and collaboration between employees. The adoption of some features of the network organization, has led to MNEs developing hybrid network structures – mixed network-hierarchy organizational forms that attempted to reconcile command-and-control efficiency with responsiveness, flexibility and adaptability. These network forms are distinguished by the configuration and characteristics of the nodes and linkages within the network, and the strategies and policies that direct enterprise operations. Three models were

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[46] Mode of entry refers to two factors: the reliance on exports versus local production in the target market as expressed in a continuum of forms, and the extent of ownership control over activities that are performed locally in the target market.

[47] Dominating the local market requires both the winning of customers as well as beating off competition from competitors established in the host country.

[48] http://www.digitalcentury.com/encyclo/update/dec.html

identified by Bartlett and Ghoshal in a survey of twenty multinational enterprises and are described in the table below.

Multinational Enterprises – Characteristics and Parameters					
Organizational Characteristics	Node Description	Network Linkages	Learning and Innovation	Strategic Capabilities	Challenges
Type I – Local Specificity	High level of decentralization –Broad decision-making powers, where both HQ and subsidiary nodes share core assets and responsibilities. Subsidiaries therefore have a high degree of independence from HQ – often de facto independence in terms of strategy and enterprise planning.	HQ-Subsidiary linkages are of low formalization – social mechanisms like trust and personal relationships between management in HQ and subsidiaries are core determinants of linkage strength. Formal governance tools like simple financial controls and reporting mechanisms are largely supplementary.	The high degree of decentralization is such that learning and innovation is developed and retained within each unit.	High level of sensitivity and responsiveness to local differences.	High degree of decentralization and subsidiary-autonomy can have the unintended consequence of creating fiercely independent 'fiefdoms' that may not follow directives from HQ and that may threaten to break away. The formation of silos around subsidiaries will be tremendous barriers to knowledge networking, as innovation and learning within the subsidiary will be kept within that particular subsidiary. Loyalty to subsidiary before enterprise will restrict the willingness to share ideas and advice, resulting to costs of inefficiency, strategic mis-alignment, and large costs arising from missed opportunities.
Type II – Global Efficiency	Low level of decentralization – Assets, responsibilities and decision-making powers are highly centralized at HQ, and subsidiaries implemented and executed strategies and plans developed at HQ. Subsidiaries do not have the flexibility to develop locally specific strategies.	Very strong linkages due to governance policies that result in tight control of the strategies and operations of subsidiaries. Highly developed channels of communications, as well as social factors like trust and personal relationships, permit and reinforce command-and-control of subservient subsidiaries by HQ.	Innovation and learning are highly centralized in HQ, and subsidiaries are considered mechanisms to execute HQ's plans.	Highly coordinated global strategies that capture global scale efficiencies.	High degree of centralization of decision-making will subtract from sensitivity in response to local conditions, resulting in sub-optimal product or service performance when offered. Competitiveness of the MNE with respect to local competitors is thus diminished, and as industry products and services become more and more diversified according to the customer's requirements, the MNE's position in the local market will be under threat from rivals who have the mechanisms to adapt their products.

Type III – Internationalized	Medium level of decentralization – HQ delegates decision-making powers and responsibilities to subsidiaries which can adapt products and marketing approaches to local markets, but subsidiaries are dependent on HQ for overall strategy and innovation in designing new products, processes and strategies.	HQ-Subsidiary linkages comprise sophisticated enterprise planning and management mechanisms are core components of linkages and facilitate command-and-control. Highly developed channels of communications between HQ and subsidiaries allow HQ to exert strategic control of subsidiaries. The social component is not significantly emphasized in linkages for this model.	Innovation and overall strategies directed by HQ and diffused to subsidiaries .	Well-developed mechanisms and infrastructure for worldwide knowledge sharing.	High level of formalization of relationships between subsidiary units and HQ, if at the exclusion of commitment and loyalty-building initiatives, may result in sub-optimal performances from employees. Innovation is centralized at HQ in this model and diffused, but again, the lack of attention and adaptation to local conditions may mean that innovations are not globally optimized unless revised and re-adapted in the subsidiaries. The lack of innovative capabilities in subsidiaries represents a large loss of potential ideas and constituted in a wasted opportunity to mobilize the 'global talent base'.

Table 6: MNE Networks

A fourth emergent model – dubbed by Ghoshal and Bartlett as the trans-national network model – was proposed that could integrate the strategic capabilities of the three while resolving the fundamental challenges that faced each. This organizational form is characterized by inter-dependent and specialized regional subsidiary business units capable of aligning targeted local initiatives with global strategies. To do so, knowledge creation and sharing are effected via inter-subsidiary unit collaboration in knowledge-intensive work, and via worldwide technology-and-human-policy enabled knowledge sharing mechanisms. Besides these characteristics of inter-dependence, collaboration and knowledge diffusion, the transnational network organization is also recognized for its flexibility, decentralization and synergistic opportunities, and these characteristics both augment, and are augmented by, knowledge sharing and knowledge creation processes. The main challenges that the network structure had to resolve were those of coordination, communications, culture, misalignment of collective interest in favor of individual self-interest. Because the network organizational paradigm encompassed thinking that had multiple dimensions – strategic, social and enterprise processes – the shift is not exclusively confined to just formal organizational structure, the organizational changes that were occurring also impacted the core decision-making systems and management processes – the administrative systems, communications channels and inter-personal or inter-divisional relationships.

4.9 Multi-Enterprise Value Networks

Value network concepts are not new, and have evolved into different variants, but are united in their emphasis on the external economies of the firm and its interactions with other entities, as opposed to the traditional focus on the internal structure of the corporation. The value network paradigm[49] hence describes how value networks are concerned with aim to realize external economies of scale and of scope by relying on fragmented rather than on vertically integrated forms of industry organization. Practically defined[50], a value network is "a web of inter-enterprise relationships that generates value through complex dynamic exchanges between two or more individuals, groups or organizations". Though applicable to both the private and public sector, the focus of discussion here will be on value networks of private sector organizations, or group of organizations, that engage in both tangible and intangible value exchanges.

In the value network, unlike the traditional variant where boundaries between allied enterprises were clear, well defined, and cross-boundary interaction was minimized, the boundaries between the enterprise and its suppliers, service providers, and buyers are becoming increasingly blurred as companies shed non-core competencies by outsourcing them to other specialist companies and focusing intensely on their own core competencies. Functions that were formerly executed in-house within a single player in the value chain would now be performed by electronically networked multiple companies behaving as a single enterprise – the 'virtual extended corporation' (VEC), with inter-enterprise value exchanges taking place within this network of enterprises.

In this context, "value exchanges" describe the interactions and transactions between enterprises, and can be intangible or tangible. Tangible value exchanges refer to exchanges of products or services and financial transactions, and include tangible knowledge products and services like

[49] Berger, Sturgeon, Kurz et al, "Value Networks", 1999
[50] Allee, V., 2002

reports, documents and consulting. Intangible value exchanges refer to knowledge transfers that can result from tangible exchanges of knowledge products and services – as manifested in know-how, strategic planning information, joint product or process developments etc. – and benefits like informal benefits that arise from the formation of more intimate relationships between enterprises and their personnel.

The formation of VECs has resulted in increasing integration of allied enterprises to enable coordination of the necessarily precise and timely execution of business processes. Indeed, for a VEC to be viable and in fact, successful, "a seamless, end-to-end flow of information and processes across companies in the value chain[51]" that occurs in real-time according to agreed protocols and standards is required – in short, the VEC is a network of companies that are inter-dependent and engaged in the pursuit of common commercial objectives in the production and/or delivery of goods and services within a value chain. Both the technological infrastructure and human-related policies like enterprise cultures and norms must be ready for such networking. Indeed, these elements must be ready for the implementation of knowledge networking practices. More than just a flow of data in the form of customer details and inventory figures, the network is a necessary common platform on which to support the crucial innovation and knowledge management processes that must take place across enterprises in order for the VEC to be able to compete in an ever-changing market. Where e-commerce was about trading – buying and selling – over the Internet, e-business encompasses the full range of business interactions between enterprises – from supply chain management to customer relationship management, to enterprise resource planning and e-commerce – and has enhanced the effectiveness and indeed, the necessity, of the VEC network.

The evolution of such cross-enterprise networks have given way to cross-industry-segment networks – VECs have pointed to the formation of an even broader, but often no less tightly connected, network of allied VECs that operate across value chains. Such cross-value-chain networks of allied enterprises are called value networks[52], and the VEC can be considered a subset of the value network. In today's e-business context, the value network has been described[53] as "a group of trading partners across multiple value chains, focused on core competencies and connected via Web-enabled technology, collaborating to provide total solutions to customers." As in the VEC, enterprises within the value network are electronically integrated in a common system that enables real-time cross-enterprise flows of information, transactions and processes. The differences between the VEC and the value network are those of scale – value networks cover a larger industry segment encompassing more value chains than the VEC – and scope – value networks are more complex in terms of their end-products and services than VECs. The key drivers behind the formation of VECs and value networks are shown in the table below:

[51] IBM Corp. and Benchmarking Partners, 2000

[52] Richardson, 1972; Thorelli, 1986; Johanson and Matson, 1987; Powell, 1987, 1990; Cooke and Morgan, 1993; etc.

[53] IBM Corp. and Surgency, Inc.

Trans-Enterprise Knowledge Networking in Value Networks	
Key Drivers	**Network Advantages**
Market volatility requiring faster time-to-market and greater flexibility and responsiveness	Reduced costs through economies of scale from resource-sharing, broadening of product portfolio nad greater product customization, leveraging of core competencies, flexibility in resource allocations throughout network, access to specific expertise and a more diverse pool of technical resources, access to more channels into different markets, spreading out of risk for investment
Greater cost efficiencies in producing products of high complexity	
Innovation as increasingly important to competitiveness	
Expansion into different markets; Creation of new markets	

Table 7: Trans-Enterprise Knowledge Networking in Value Networks

Analysis of the value network has been the subject of academic research[54] and in addition to the knowledge network parameters earlier introduced, there are additional parameters for consideration that arise from the underlying premises that underlay the power-political structure of the value network. These are introduced in the table shown.

Multi-Enterprise Alliance-Networks[55]	
Enterprise Premises	Enterprises are profit-maximizing actors. Enterprises cooperate because the cost of using an alliance-network to pursue their goals is lower than doing it independently. Benefits from the alliance-network can be quantifiable (e.g. stock price, profits, cash flow, ROI, ROE) or intangible (e.g. strategic positioning, legitimization/reputation). Enterprises re-evaluate their participation in alliance-networks, according to whether the returns from cooperation or non-cooperation are greater. This is also influenced by environmental, inter-alliance-network, and intra-alliance-network factors.
Intra-Alliance Relationships Premises	Two levels of objectives co-exist, that of the alliance-network, and that of the individual member enterprise. The alliance's success/failure is not directly related to a member's success/failure. Alliance-network members compete against each other to maximize their share of the benefits, and to increase their influence within the group. An enterprise's value to the alliance-network is a function of its resource contribution.
Inter-Alliance Relationships Premises	The alliance competes against other alliances or firms.

Table 8: Multi-Enterprise Alliance-Network Premises

The non-coincident objectives of the enterprise and the value network of which it is a member, the internal tensions of cooperation to advance common interests and competition to secure individual advantage that does not necessarily benefit the collective, and the asymmetries in relationships between enterprise partners, add new dimensions of complexity to the formulation

[54] For example, Tufts University's Fletcher School Murrow Center – https://murrow.org
[55] Suen, W., "Strategic Alliances" 2002

of a coherent knowledge networking strategies for a value network. The parameters of power and interdependence, and the degree of their asymmetry across the network members, can be used to analyze the internal power structure of the value network. The power of a network member is derived from the importance of its size, contribution and the structure of the alliance, while the interdependency factor depends on the interdependence of members and the dependence of the members on the resources of the network. Interdependence also impacts learning, or more precisely, the risk of asymmetric learning by partners – this variable implies that if the rate of learning of one firm is better than that of its partner, then the first firm will enjoy asymmetric learning, and raises the probability that it will, over time, dissolve the partnership to directly compete against the second firm which had no such learning advantage. Power and interdependence in turn affect the risk of a network member cheating or defecting, and will impact the strength of linkages and the formation of trust and commitment in a relationship.

The following table describes the findings of a study on value networks by researchers from MIT and the Soziologisches Forschungs Institute (SOFI), in which three types of value networks/VECs were presented – the captive value network, the relational value network, and the turnkey value network.

Value Networks – Characteristics and Parameters					
Organizational Characteristics	Node Description	Network Linkages	Learning and Innovation	Strategic Capabilities	Challenges
Type I – Captive[56]	Characterized by lead firms that dominate the network and that coordinate tiers of 'captive' suppliers. Asymmetric dependencies with smaller enterprises highly dependent on lead firm because of their high degree of substitutability. Lead firms can treat smaller partner enterprises as appendages of it.	Network linkages are highly stable, and reinforced by the dependence of captive suppliers on the lead firms. Linkages are enhanced by a long history of collaboration, and loyalty, since lead firms will patronize 'captive' partner firms even when other enterprises are more competitive.	Because of the strong bonds between the lead firm and its smaller partners, the lead firm can transfer innovations in product design, processes or technology to them with low risk of defection because of the asymmetric dependence of the smaller enterprise on the lead firm.	Close buyer-supplier linkages result in high efficiency from high-speed information flows that allow close coordination of "just-in-time" deliveries. Long history of alliance enhances trust, loyalty and limits the incentive to cheat. Flexibility in varying production and investment levels under changing market conditions. Key virtue: Efficiency as manifest in its 'lean' production system[57]	Closeness between allied enterprises also makes it more difficult to end the relationship, hence reducing overall system adaptability, resulting in inefficiencies in terms of capacity use and cost-effectiveness. Rigidity reduces the ability of the network to link with entities beyond the network.
Type II – Relational[58]	Characterized by its socioeconomic hybrid nature, where social relationships with strong historical bases result in authority relationships and behavioral norms that provide an alternative governance mechanism to the hierarchy of an integrated firm or that of pure market. Moderate or high, and	Network linkages are stable, and reinforced by norms of trust, reputation, peer pressure and reciprocity. Linkages are built up over time and history, such that sociological factors of trust and commitment are built into the linkage.	The strong bonds of trust and commitment between partner enterprises are strong safeguards against cheating, hence there are two-way transfers of knowledge.	Trust and personal relationships enable firms to rapidly adapt as market conditions change. Adaptability also results from the flexibility arising from a highly fragmented organizational structure of very specialized small firms that could change to meet market demands of the lead (biggest) firms. Key virtue: Flexibility[59] in response to market	e captive value networks, the intra-network relationships have a strong heritage built over many years, and hence partnering with new entrants and de-partnering becomes difficult and less dependent on the market, resulting in inefficiencies in terms of capacity use and cost-effectiveness. The close relationships also limit the network's interaction with external entities and can

[56] Schonberger, 1982; Dore, 1986; Sayer, 1986; Aoki, 1987; Sako, 1989; Berger et al, 1999 etc.
[57] Womack et al, 1991
[58] Granovetter, 1985; Scott, 1988; Storper and Walker, 1989; Berger et al, 1999

	moderately symmetric interdependence between enterprises, depending on the disparity of sizes of partner enterprises.			conditions	be bound to a geographic region with a low capability of expanding.
Type III – Turn-Key[60]	Characterized by a base of highly qualified suppliers who specialize in either base processes, base components or base services, which are applicable to a wide range of end-markets, and tied to the lead firms by purely commercial contracts that can be short- or long-term. High degree of largely symmetric dependence between enterprises in the network, large firms need smaller if highly specialized firms because of their low substitutability.	Network linkages are fluid and comprise dynamic associations between partner enterprises. Enterprises partner for only as long as the alliance remains economically favorable to both parties and seek new partners when conditions favor doing so.	Innovations and learning are largely kept within each enterprise, because of the high propensity for either party to defect.	Fluid relationships allow rapid partnering and de-partnering as dictated by market conditions, resulting in organizational structural flexibility due to dynamic associations and dissociations between partners, and greater efficiency in terms of capacity utilization and cost. Geographic boundedness is low since enterprise network possesses organizational structural flexibility Key virtue: Organizational structural flexibility in partnering and de-partnering as dictated by need and market conditions	Purely commercial nature of the network alliance, combined with the heavy reliance of the lead firm on its partners may result in partners leaving the network to become competitors especially if partner firms take control of product definition and acquire know-how to develop end-products that can compete with those of the lead firm for the same customer pool. Because the same suppliers may belong to multiple value networks while working for different lead firms that may be in direct competition, technological leakage may occur. Danger of losing process expertise and knowledge that might have been foundational to, and hence endanger, some other core competency.

Table 9: Value Networks

[59] Piore and Sabel, 1984

[60] Sturgeon, 1997; Sturgeon & Florida, 1997; Berger et al, 1999

As in the comparison of the three general MNE networks, the three value-network models are still evolving towards a fourth model that can adequately capture the merits of the three models while managing the attendant trade-offs.

This fourth model, the multinational value network, recognizes the need to adapt to the realities of the global competition and must hence adopt a strategic organizational design that is least bounded by geography. In this, the turnkey network has the greatest advantage for going 'global' in its reach because of the relative ease with which it forms partnerships and alliances with firms in overseas markets. At the same time, the lack of trust and commitment in the relationships in the turn-key network, and the subsequent poverty of knowledge-sharing, are sever impediments to knowledge networking such that a trade-off must be achieved between efficiency in formation/de-formation of alliances and the role of trust in relationships.

Technological solutions should also be leveraged to enforce security and deter cheating even in formalized alliances. The efficiency of captive networks – perhaps the closest to the three of being an actual consolidated enterprise – is also a virtue that a value network will require. Efficiency in coordinating production, R&D and other business processes to preclude re-inventions of the wheel and multi-enterprise-wide process optimization plans can help enhance productivity, but such integration will require high levels of trust and commitment to the network, and hence is a trade-off against the freedom that dynamic linkages grant.

Multinational value networks are hence a hybrid fusion of the MNE and the value network, and its conceptualization is one mechanism that is speeding the global expansion of business enterprises as they leverage the core competencies of partner enterprises in establishing a global presence in seeking to pursue global opportunities. The multinational value network is not a new concept – MNEs have been establishing value networks by enlisting local allies in expanding foreign markets, resulting in the formation of multiple MNE-dominated unconnected value networks that are scattered across the world. In this earlier model, alliances are usually vertical – the value chain is dominated by the MNE with functions outsourced to local enterprise partners that are asymmetrically dependent on, and asymmetrically less powerful (in terms of resources at least, if not local expertise) than the MNE. The new model of the multinational value network will be more of a hybrid horizontal-and-vertical alliance of enterprises of symmetric inter-dependence and largely symmetric power, with MNEs collaborating in partnerships on a global scale, across value chains and across industries. One salient example of the multi-national value network is the alliance between Coca-Cola (Beverages) and McDonalds (Fast-food) and its rival alliance of Pepsi (Beverages) and Burger King (fast-food).

4.10 An Observed Convergence of Organizational Forms– The Transnational Network MNE & the Multinational Value Network (MVN)

Broadly, one will see a convergence in the organizational forms of the MNE and the value network as a resulting of (1) the increasing global expansion of businesses as a result of innovations in ICT, and (2) the formation of multinational value networks (MVNs) of MNEs and local partner firms. The transnational network MNE structure and multi-enterprise value network have characteristics that are rapidly converging in terms of authority structures, innovation and learning policies, and organizational design. The MNE, as demonstrated in the

emergence of the transnational network MNE structure, is decentralizing decision-making to its subsidiary units that are increasingly specialized, thereby creating a network of interdependent units within the MNE. The value network, on the other hand, is globalizing as firms form horizontal and vertical alliances across and between value chains. The MNE is shedding its non-core competent functions and entering into alliance networks with partners whose core competences are exactly those that the MNE is shedding, creating symmetric inter-dependencies between the MNE and its partner enterprises. In the value network, greater formalization of alliance rules and regulations are being effected while in the MNE, informal elements of enterprise culture like trust and commitment are being built into the system to make linkages between agents more robust in the same way that formal mechanisms like sophisticated contracts and constitutions will make linkages between agents in the network more robust.

4.11 Meta-Knowledge-Networks

4.11.1 Global Knowledge Networking: The Multinational Enterprise

Achieving global competitiveness by pursuing flexible and quickly adaptive organizational structures is one desired aim for such a paradigmatic shift in organizational thought in embrace the network structure. The transnational network MNE structure requires the simultaneous optimization of scale, scope, and factor cost economies, together with adaptability in managing uncertainty in a volatile environment where consumer preferences, technologies, political, regulatory and economic environments are dynamic. The latter adaptability implies the need for flexibility in production, product design, pricing, innovation and marketing strategies that are apt for and responsive to the environments in which the multinational enterprise has operations.

Decision-makers, managers and other such knowledge workers in MNEs need knowledge inputs in order to identify emergent trends, develop creative responses based on extant organizational intellectual capital and competitive intelligence before the competition, and diffuse innovations and lessons learnt worldwide, in order that the MNE can assume market leadership. Innovation and knowledge sharing, the two components of the knowledge life-cycle, require a global knowledge networking strategy that can fuel flexibility, responsiveness and efficiency on a global enterprise-wide scale. The type III integrated knowledge networking strategy presented before proposed many elements that can be used to achieve this purpose. For the MNE, additional technological and people elements are presented here to supplement those which have already have advanced.

At a global organizational level, knowledge about diverse cultures and markets and the capability to integrate and hence leverage the value of diverse 'knowledge centers' are required. 'Knowledge centers' refer to the subsidiaries of the MNE and is recognition of the fact that knowledge about the local area – market, politics, regulations, economics, and institutions – is concentrated in that particular branch. Knowledge about diverse cultures can be built via the following mechanisms:

1. Training and education – Language lessons and courses about diverse cultures, markets and economies can be made available by the enterprise via self-study courses, university programs or in-company workshops. If the MNE is already established in the foreign

country, it can leverage native employees in those countries in leading these classes for in-company workshops. Virtual lessons as part of e-learning initiatives, language software, audio-visual teaching aids and supplements, and virtual conferencing with employees from other locations in the world are important technological elements that can be used to complement, or in some cases, largely replace tutors, who may themselves be in a remote location and can be easily reached for specific queries.

2. Expatriate assignments and job rotations across geographic regions and business divisions – A several-year long assignment to a foreign market is a very intensive form of immersion that will acquire, at least at the level of the individual, a more intimate understanding of the location's culture and economic condition, but only if the individual is willing to do so, and will provide value add for the organization only if the individual has the opportunity to leverage this experience later in his or her career.

3. Cross-border, global team-formation and collaboration – Besides being able to leverage the extant knowledge in each member about locally specific responses to strategy-formation, it provides learning opportunities about diverse cultures and market understanding, while permitting the creation of inter-personal relationships and trust that will make teamworking more effective. Collaborative software and tele-conference technologies are critical in allowing the coming together of colleagues from across the globe in virtual meeting-places that permit document exchanges and audio-visual tools in presentations.

The capability to integrate, and leverage, the value of diverse, globally distributed knowledge bases, is generally regarded as crucially strategic for MNEs in seeking to exploit its global presence to out-muscle and out-compete competitors both local and global. This capability can be acquired and boosted via the following knowledge networking mechanisms:

1. Defining and transplanting organizational culture via core values and a local agenda that is derived from and supports the MNE's global agenda – Transplanting and maintaining a consistent set of corporate values in its branches worldwide create shared values that can bring together, in heart and mind, people of different cultures and provide a lodestone in aligning the objectives of individuals and subsidiary branches with those of the organization as a whole.

2. Organization-wide technological integration to create a global knowledge networking infrastructure – This extends the ideas of the technology component of type III knowledge strategy on a global scale. By integrating knowledge bases, and ensuring the interoperability of software systems and protocols, as well as a communications backbone infrastructure that can high speed communications between nodes, technological integration is the foundation of knowledge-creating cross-border collaboration initiatives, global knowledge sharing, and the leveraging of the MNE's global knowledge resources.

3. Meritocracy-based human resource policies – Merit should be the prime driver of career mobility so that managers in foreign markets should understand that they are not constrained by glass-ceilings and that they can rise to the very top.

4.11.2 Inter-Enterprise Knowledge Networking: Value Networks

The SME knowledge network is a single-enterprise network, but the emergence of value chain partner enterprises and 'value networks' of strategic allies are elevating the knowledge network to a higher level. The type IIIb knowledge network is a variant of the single-enterprise type III networks, in that it is a multi-enterprise knowledge network. Multi-enterprise knowledge networks refer either to knowledge networks of enterprises within one or multiple value chains. For example, in the computer hardware industry, there may be a value chain of multiple enterprises engaged in the production of computer disk-drives, and a value chain for the production of hard disks, and value chains for the production of other components of the desk-top computer. Ultimately, however, the customers for the end-products of these computer component value chains, are themselves the suppliers in a value chain for the production (assembly) of desk-top computers. Thus there are single-value-chain as well as trans-value-chain meta-knowledge-networks. The nodes in the network, previously individuals/departments whose virtual presence are projected via routers, servers and software, are now enterprises that will knowledge network with partner enterprises across boundaries that are governed formally by contracts and informally by social factors like trust and loyalty.

Indeed, the business landscape of today is increasingly characterized by three particularly salient trends, in which formerly large, vertically integrated corporations are downsizing and spinning off or selling functions and operations while focusing on core specializations. At the same time, highly specialized and often high-tech start-ups and SMEs (small-&-medium enterprises) are emerging as suppliers and service providers to these large corporations. The combination of complementary competencies through collaboration – a sharing and intermingling of expertise to fulfill certain objectives better and faster – generates newer opportunities and newer insights into the development of 'white spaces' – the areas for market growth and creation in a mature industry in which there are still gaps in the supply of a certain product or an under-provision of a service – or in the creation of new markets in newly emergent industries like biotech. In this case, teams from different enterprises within the network come together for joint projects, workshops and forums. The result of this is the increasing intensity in the formation of partnerships, alliances, and mergers between producers, suppliers and customers both nationally and internationally. This convergence has led to the formation of new business models now known as virtual extended corporations and value networks. These tra[illegible]enterprise organizations encompass "long-term purposeful arrangements among distinct bu[illegible]ated for-profit organizations that allow those firms in them to gain or sustain competitive advantage."[61]

Knowledge networking between enterprises will require knowledge in relationships – the 'relationship capital' component of intellectual capital as introduced in Chapter 2 – and impacts decision-making in picking the right partners and allies, in the management of alliance activities and operations between independent partner enterprises of varying sizes, the management of people or departments affected by mergers or acquisitions and the integration of IT systems, the

[61] Jarillo, C., Strategic Management Journal, 1988

creation and sustenance of trust between the two or more entities, and the establishment of a culture that is amicable to the creation of synergy. The effectiveness and efficiency of the knowledge networking process will largely depend on three tests of fit:

1. Strategic Fit – measures the extent to which the business strategies of the enterprises in the alliance can complement each other.

2. Capabilities Fit – measures the extent to which the competencies of the enterprises are complementary, and concerns the contribution of core competencies, optimal distribution of tasks and functions (like research, manufacturing and marketing), and the mechanisms by which shared key assets (like human capital, and intellectual property) can be used.

3. Cultural Fit – measures the extent to which the cultures of the partnering organizations are different, in terms of distribution of power and decision-making in the organization, the hierarchical structure of the enterprise and the nature of interactions within the different enterprises.

These tests of fit are needed in identifying the right partner enterprises, and will clearly require knowledge inputs that require thorough market analysis on the part of all enterprises seeking the alliance.

Once allied, the knowledge network will require, to the largest extent possible, seamless knowledge flows across boundaries – from an enterprise to a supplier, buyer, or service provider – to achieve greater coordination in managing joint initiatives and optimizing the returns from collaborating on tasks or outsourcing of functions. Integration of data and information across trans-enterprise value networks will also impose certain challenges of organizational control. On one hand, the enterprises in the inter-enterprise supply chains and extended value chains will need to share information and collaborate with upstream and downstream partners to ensure streamlined information flows. Indeed, they could perceive upstream and downstream enterprises as potential competitors vying for the dominant position in the value network. While sharing of accurate information pertaining to goods and services flowing across the supply chain will be necessary, it would increase the perils inherent in the paradoxical roles of collaboration and competition adopted by the various enterprises in the supply chain networks.

Integration of processes, technology and information across the value network must be complemented by an integration of decision-making across trans-enterprise boundaries. The effectiveness of integrated information flows will depend upon the accuracy of information that is shared by diverse stakeholders across these boundaries, and the challenge of information sharing will result from the potentially competitive nature of various enterprises across the value chains as access to privileged information – especially access to customer data – is often a determinant of network leadership or dominance. Indeed, access to customer and supplier data in databases and servers hosted by service providers will pose increasing privacy and security challenges. The significance of securing confidential information will be particularly salient when the supplier's knowledge of the enterprise's customers or specific relationships may be used against the enterprise either by the vendor itself emerging as a competitor in the same market, or when leaked to third parties. The primacy of trust in relationships within the value

network will mean that solely commercial contracted agreements may be inadequate in governing exchanges and protecting intellectual property.

Multi-party relationships management in the value network, from customer relationship management to supplier-buyer relationship management, is grounded in knowledge both about market conditions as well as about the nature of each partner and their goals, both declared and otherwise. While the perspective of the supply chain has changed from linear to non-linear – hence the supply 'web' analogy – the notion that knowledge is a key driver does not change. The salience of knowledge, after received information is comprehended, from the birth of the value network, its continued sustenance and its final dissolution, is demonstrated in its criticality to organizational efficiency and flexibility as well as to the coordination and governance of the network. There will be collaboration and knowledge sharing, and from these, knowledge-transfers and mutually driven organizational learning, that arise from the inter-dependence of enterprises in the network. This is already manifest in the biotech and pharmaceutical industries, both of which are highly knowledge-intensive industries, where intra-enterprise R&D networks have formed to allow partner enterprises to enhance the knowledge access and creation processes as well as to expedite the commercialization of new knowledge in the form of new drugs and medicines.

Fundamentally, multi-enterprise type III knowledge networks resemble large and vertically integrated enterprises in terms of goals and policies, but there is added complexity due to the existence of corporate boundaries between companies that impacts issues of business and technology strategy, the weaker extent of organizational control of enterprise operations and activities, the tensions inherent in intra- and inter-enterprise culture and managerial governance mechanisms. There is a need for management to understand that the key distinction between the value network and the traditional corporation is the lack of structure and lack of controls that characterize an alliance of independent, self-selected enterprises, as opposed to formal structural mechanisms that govern the corporation. Self-control and autonomy, already present in enterprises with a network organizational structure, will be evident to a greater extent in value network.

4.12 A System for Global Knowledge Networking

Knowledge networking on a global basis will become an increasingly critical strategic capability for enterprises competing in a global economy. The emergence of mutually enhancing multi-enterprise value networks, the pressures on enterprises to globalize, and the need for multinational enterprises to capture global efficiency while remaining locally responsive, are all knowledge-based challenges that will require, simultaneously, both technological and human solutions. The former provides necessary enabling infrastructure, and the latter is responsible for initiating and sustaining knowledge sharing and knowledge creation processes. An emergent type of enterprise for the knowledge based economy – the multinational value network – was introduced as a combination of the MNE and value network; in the preceding sections of this chapter, knowledge networking strategies for a generic enterprise, for the value network and for the MNE were discussed. For the multinational value network, a global knowledge networking strategy is hence required that can fulfill the knowledge requirements of both the MNE and the

value network. Such a global knowledge networking strategy will require a synthesis of both the human and technological solutions that have been previously proposed.

While the salience of knowledge sharing and knowledge creation have been widely acknowledged to be critical to enterprises of all stripes in a knowledge-based economy, knowledge networking is a relatively new concept, and knowledge networking on a global basis is newer yet. Indeed, while multinational enterprises have been forerunners of globalization, the formation of value networks and indeed, multinational value networks, are also relatively new developments in the business environment made possible and necessary in the age of e-business. Knowledge networking has been shown to integrate a multiplicity of disciplines both new and old, from knowledge management and enterprise integration, to organizational design and behavioral studies, but in terms of operationalization, it has not been purposefully on a grand scale in enterprises. Slowly, but surely, however, this is changing – MNEs like Cisco had pioneered network organizational structures; Siemens and Scandia have begun implementing knowledge management in their worldwide activities while value networks have begun integrating databases and information systems to enhance the efficiency of their operations. The new-ness of these developments mean that global knowledge networking is still nascent as a practice, and best practices have yet to be developed in the corporate world. In the non-profit and academic domains, the freedom to experiment has been somewhat greater, and has seen practical implementation of a global knowledge networking initiatives[62].

Here, the Global System for Sustainable Development (GSSD) is one such knowledge networking initiative. Conceived and developed in MIT, GSSD is an operational application of a technology-based networking strategy whose objective is to harness the value of knowledge in the realm of sustainable development on a global basis – across borders, cultures, and languages. It is therefore of interest to explore the viability of using the core technological elements of the GSSD framework in designing the foundations of global knowledge networking system for enterprises. The next chapter will discuss the design of GSSD-Enterprise –a conceptual framework that serves as the technological foundations of knowledge networking in a MVN or MNE. It will be shown how the technology-based GSSD strategy can be adapted in the context of enterprises in integrating onto a common platform of representation the technology element of type III knowledge networking while providing the infrastructure for facilitating and enhancing the use of type III knowledge networking human policies on a global basis.

[62] GSSD, IISD, World Bank Sustainable Development Gateway

5. INTRODUCING A NEW KNOWLEDGE NETWORKING APPLICATION: DESIGNING GSSD FOR ENTERPRISES

Chapters 2 to 3 have discussed the implications of knowledge and knowledge networking for the enterprise, and in particular, the MNE and the value network, and the role of the emergent multinational value network (MVN). Chapter 4 discussed a proposed holistic knowledge networking strategy for the MNE, the value network and VEC, and for the MVN, that strategically incorporates the elements of technology and human management. At the end of Chapter 4, the need for a global knowledge networking system was acknowledged, as was the gap in terms of the provision of such a system for commercial enterprises.

In this chapter, a global knowledge networking system is proposed in the form of the GSSD (Global System for Sustainable Development) initiative, a global technology-based knowledge networking system that was developed in MIT to leverage Internet and academic resources to explore innovative responses to sustainability challenges in all parts of the world. The GSSD strategy is a knowledge networking technology strategy that is meant to provide the physical mechanisms for global knowledge networking, a foundation upon which human policies will be needed to actually drive the knowledge networking process. These human policies have been dwelt upon at some length and at a generic level in chapter 3, and will not be further discussed.

This thesis proposes that a GSSD analog can be designed for global enterprises – MNEs and MVNs – that can enable critical innovation and learning processes. It delivers as a knowledge management system, as well as a platform via which the different technological elements of knowledge networking strategy can be integrated, GSSD-Enterprise, or GSSD-E, will provide meta-networking technology-based knowledge-networking capabilities that act as a critical support system for the implementation of human knowledge-networking policies in the nodal business units within the network. More precisely, the proposed GSSD-E initiative will be the core of the knowledge networking technology strategy of the enterprise, built upon a communications backbone infrastructure and providing an integrative architecture for the enterprise's enterprise integration systems as well as knowledge management systems.

A hypothesis from the previous chapter (chapter 4 – a holistic knowledge networking strategy for the MNE) is that an adaptive knowledge networking technology strategy is a critical element for knowledge networking in the MNE, on which human-related policies are absolutely contingent. This chapter will refer to the application of GSSD-E for an MNE, but they apply equally for the MVN. GSSD-E hence serves an information and communications infrastructure, on which knowledge networking capabilities can built, linkages between subsidiaries and the HQ is vital for control and coordination by HQ, as well as for allowing the MNE to strategically leverage knowledge within the organization.

5.1 Designing the Enterprise Global Knowledge Network

In designing a GSSD analog for business enterprises, the subject of study will be the transnational network multinational enterprise that is commercially engaged in various product/service sectors within one, or multiple, industries. Chapter 3 discussed the convergence of MNE and MVN organizational forms as MNEs increasingly outsource non-core-competency

functions to partner enterprises to form global-scale value networks. MNEs have traditionally been identified as brick-and-mortar giant enterprises with diverse business interests, but the IT revolution has enabled many small businesses, most notable service providers in knowledge-intensive industries like technical consulting, to go global. The focus here will be on the former – large mature multi-national enterprises that are in themselves meta-networks of smaller knowledge networks in subsidiary nodes. Examples of MNEs that fit this classification are Sony, 3M and Siemens. The MNE as an engine of global innovation and technological transfer is a subject that has been well explored[63], but less so the conceptual models of mechanisms that can achieve knowledge transfers to facilitate knowledge creation and re-use.

The design of a GSSD-E system will first involve the visualization of the MNE as an organization via which two principle dimensions of analysis can take place:

- Product Structure – Product A, B, C ... *n* (where n is the number of the products in whose market the enterprise is involved)
- Geographic Structure – Area A, B, C ... *n* (where n is the number of places in which the enterprise has operations)

This two-dimensional analysis of the MNE organizational structure was part of the evolution of MNEs as described in study conducted by Stopford and Wells (1972). The latter contended that MNEs typically grew along two pathways – companies that expand their sales abroad without significantly increasing foreign product diversity generally adopt a geographic structure, while companies that expand their product diversity would adopt a product structure. MNEs with worldwide geographic structures therefore implement a regional or multi-local strategy with a country-level division structure, with separate divisions for large market countries while MNEs with a worldwide product structure would implement strategies that emphasize global strategies, each product division assumes responsibility to produce and sell its products or services throughout the world. Stopford and Wells further proposed that when the MNE gains maturity in both product diversity and geographic spread, a global matrix is formed. While Chapter 3 discussed the fundamental inadequacies of matrix structures, a matrix visualization of the mature MNE is nevertheless conceptually correct and will be a useful mental model to use in mapping the GSSD structure into the enterprise context.

This thesis proposes that the GSSD-E model, like GSSD, has an interface that resembles a map of the knowledge resources of the organization, and one can also incorporate into this model thought on the knowledge flows within the enterprise. For the latter, one can visualize the flow of data, information and knowledge within the MNE, which may be considered to comprise one HQ unit and subsidiary units outside of (and possibly within) the home country. The content of these flows, between the HQ and the subsidiary, and between subsidiaries, encompass internal services/advice (from internal or outsourced planning or consulting unit), customer, supplier or service provider data, internal enterprise knowledge and information, as well as internal communications mechanisms (e.g. listservs, messaging, e-mails etc.) and instructions from the HQ to its subsidiary branches.

[63] Cantwell, 1995, Zander, 1998, Yamin, 1999, etc.

Figure 5 illustrates a general model for knowledge flows within an MNE, in which the MNE has one HQ unit in the home country with operations in three other countries, each of which having one subsidiary unit. Other scenarios of various permutations and numbers are conceivable – for example, one HQ unit and several subsidiaries within the home country with operations in several countries, each of which having several subsidiaries. Barriers and constraints to these flows that once were predominantly physical in nature – distance and time-zones – are now largely intangible in nature, comprising of differences in national or state regulations[64], technological standards, and context-sensitive socio-cultural factors:

1. Privacy – Accessibility of databases and information sources within the MNE, as well as monitoring of communications. Also pertains to security issues
2. Security – Authentication measures, encryption and security clearance levels for access to information that is classified according to different levels of confidentiality
3. Taxation/Licensing fees leveraged on internal non-material products – example of which are software licenses
4. Intellectual Property Protection – Issues related to technological innovation and stability of the property rights regime in protecting the innovator.
5. Semantic Differences in Language – Context and meaning may be inadequately captured in translating from one language to another.

These are factors that primarily affect the deployment considerations for GSSD-E – security and privacy will require the installation of additional software safe-guards, while financial regimes and semantic differences will require context mediation software, and intellectual property protection will rely both on security mechanisms for the enterprise as well as the legal protections that are offered for IP in the country in which the MNE is operating.

[64] Feese-Zolotnitski, 2000

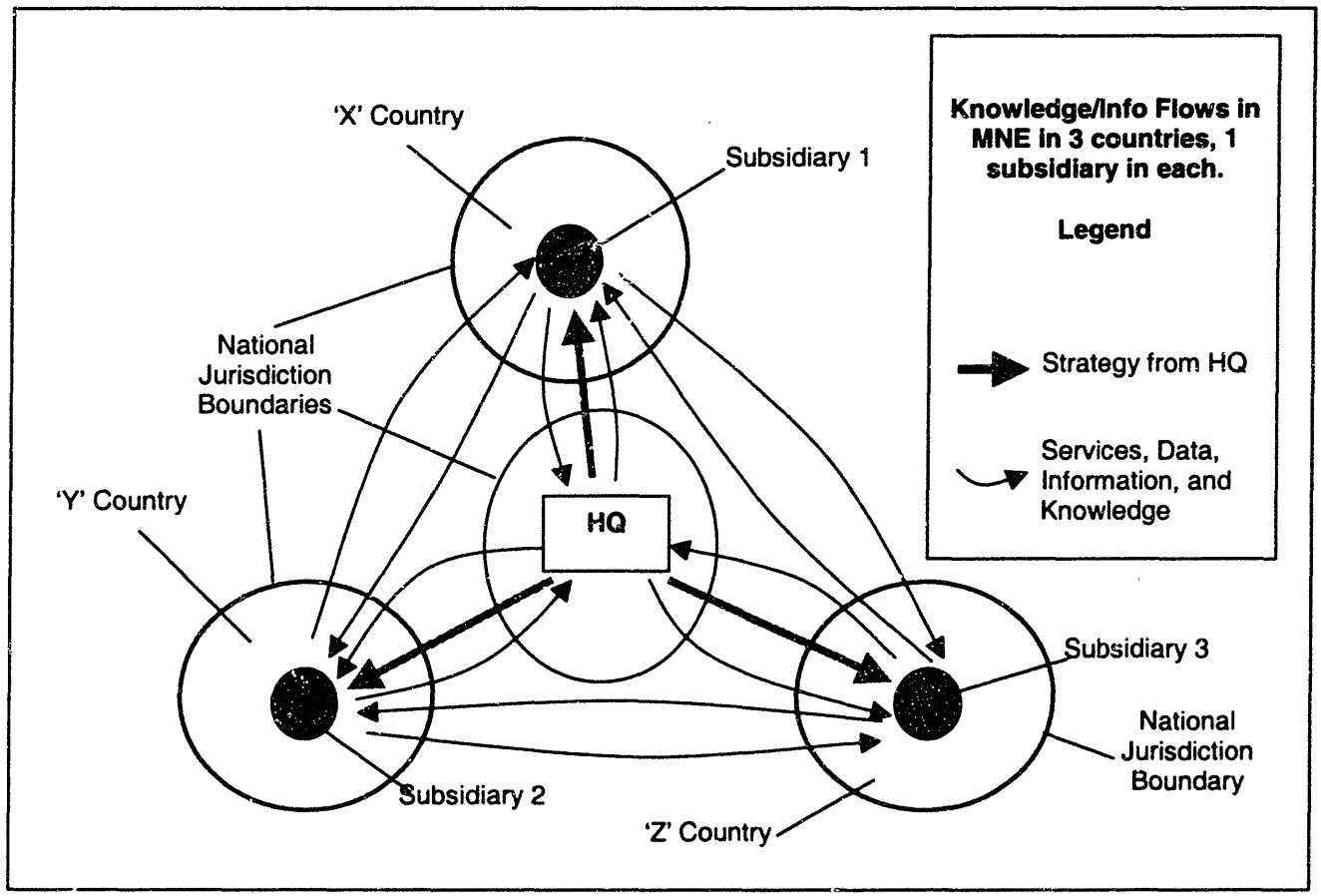


Figure 5: Representing Knowledge Flows in the MNE

5.2 GSSD for the Enterprise

The GSSD system is a linked set of knowledge produced and accessed by globally dispersed set of actors with links to information managed via a unique interface designed by MIT.[65] Motivated by the need for a global knowledge networking system for MNEs and MVNs, there is an interest in adapting the GSSD conceptual model, as successfully deployed for research and academic purposes in the non-profit sector, in the context of the enterprise as an underpinning element in the knowledge networking technology infrastructure of the MNE.

5.2.1 Conceptual Challenges in Designing GSSD-E

The conceptual challenges in designing GSSD, and their analogs in the design of GSSD-E for the MNE, are juxtaposed in the following table. The conceptual challenges that GSSD faces in sustainable development and global business are trichotomized into three types – the linkage challenge, the policy or strategy challenge, and the institutional or organizational challenge – that impact trans-regional and global knowledge diffusion and collaboration.

[65] Choucri, N., 2000

Conceptual Challenges			
	Sustainable Development[66]	Global Business	Sustainable Global Businesses
Linkage Challenge	Understanding of connections between environmental factors and social activities, between forms of knowledge and types of solutions.	Understanding of connections between strategy and the role of 'knowledge' in the MNE, between the forms of knowledge and types of solutions.	Understanding of connections between enterprise activities and their impacts on, or implications for, society and the environment, between forms of knowledge and types of solutions.
Policy Challenge/ Strategy Challenge	Definition of appropriate concepts for and approaches to decisions about management towards sustainability and managing the global environment.	Definition of appropriate strategies and frameworks for decision-making with the aim of enhancing competitiveness and core competencies in a global marketplace in line with fulfilling the enterprise's vision.	Definition of appropriate concepts for and approaches to decisions about enterprise management towards sustainability and managing the global environment in aligning enterprise objectives with environmental concerns.
Institutional Challenge/ Organizational Challenge	Identification of appropriate approaches, methods, and procedures for international responses to environmental alterations due to human activities and attendant social dislocations.	Identification of appropriate organizational design methods, culture-shaping policies and human-technology policies for global organizational responses to competition and dominating global markets.	Identification of appropriate organizational and process design methods, and human-technology policies for global and local organizational responses to the environmental impacts of enterprise activities, and the cost feasibility of environmental initiatives.

Table 10: Knowledge Challenges for Sustainable Development and for Global Business

Like GSSD in its original form, the objectives of GSSD-E are broadly similar if different in the nature of the content: (1) enhance the accessibility of knowledge about enterprise activities, competitive and market intelligence, and innovations in processes, technologies and perspectives to knowledge workers and decision-makers who are devising or executing organizational strategies; (2) enable knowledge sharing through dedicated and customized search engines and spidering algorithms, quality-controlled knowledge mining tools, multilingual capacities, and decision-support modeling software; and (3) provide virtual environments which facilitate collaboration between different nodes within the network and which can transcend boundaries of distance, culture, and language.

5.2.2 Designing Elements of GSSD-E

[66] Choucri, N., 2000

To achieve these objectives, GSSD-E will encompass: (1) a coherent strategy for integrating and organizing worldwide enterprise knowledge in multi-dimensional and multi-sectoral terms, (2) in which knowledge is represented via a plurality of interrelated concepts and interrelationships organized in taxonomic form and adhering to a glossary of shared terminology, (3) the knowledge acquisition process, at the individual user's level of abstraction, is augmented by functionalities that include navigation mechanisms and collaborative arenas, (4) in which a set of multi-lingual functions will enable non-English speaking users access with equal usability to the same functionalities as English-speaking users.

The GSSD system has the following key characteristics that will be adapted for GSSD-E:

- Gateway character – Interface to repository

- Knowledge base – An organized repository of links to sources of codified knowledge, information and data
  - Subject-specific: Sustainable development as applied in multiple sectors via multiple lenses (problems, solutions, issues). Lends itself to knowledge base design with regards to one subject domain (for example, product type)
  - Contents of the knowledge base comprise abstracts of, and links, to reports, articles and databases.

- Multi-national nature – knowledge is provided by participating network members in multiple countries
  - Information within the knowledge base resides in servers located at participating network members in various countries
    - Mirror sites are established in the locations of network members to enhance speed of access and minimize risks related to dependence on a single centralized site for the knowledge base.
  - Multi-lingual aspect is addressed by translation at the site of the network member that is providing content for the knowledge repository
    - Semantic consistency is maintained by means of a commonly-established glossary of terminology

- Logical, taxonomic structure – lends itself to analyzing the enterprise from the meta-layer down ('rings', 'slices', 'concepts', 'sub-slices')
  - Users can identify classes of content that is most relevant to their needs and either link to, peruse, or download the latter into their computers.

The interface design for GSSD is shown in figure 6, and comprises slices, rings, concepts and sub-concepts. This particular structure for GSSD has been designed as an access-point to a massive, and growing, body of content pertaining to the subject of sustainable development and the environment. The volume of content within the GSSD knowledge base increases in the following process:

- A report, article, or database is nominated for inclusion by an individual (anyone)

- MIT researchers review this nominated contribution as part of a quality assessment process via a pre-established set of criteria
- If the nominated contribution is accepted, an abstract is prepared in the languages of all participating GSSD network node country as governed by a glossary of terminology that ensures semantic equivalency between the languages
- This abstract, and the link to the actual document, is linked from multiple locations in the GSSD architecture according to the categories under which its subject(s) would be classified.

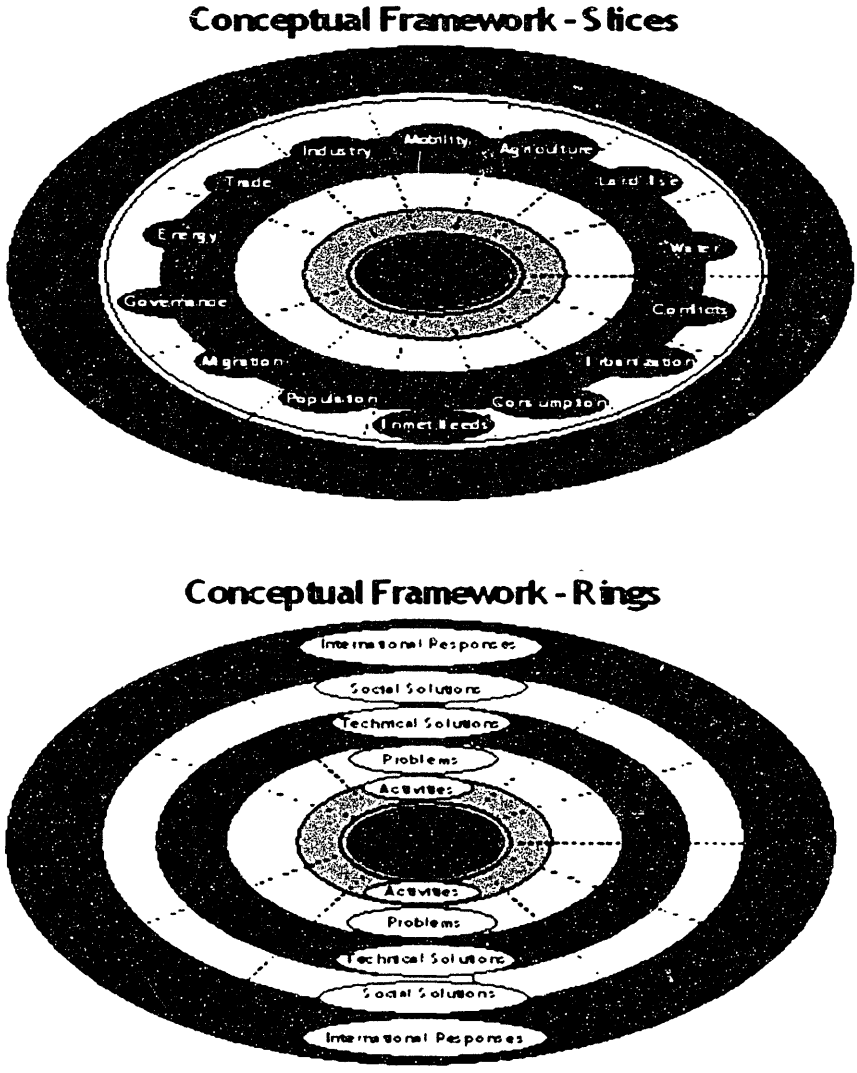


Figure 6: GSSD conceptual design[67]

[67] Choucri, N., 2000

5.2.3 Knowledge Management and GSSD-E

As discussed, the knowledge networking technology infrastructure for the enterprise encompasses three elements: the ICT backbone infrastructure, an enterprise integration framework, and a knowledge management system. Each element can be subdivided into multiple components, and GSSD is most immediately relevant to the knowledge management system component. Here, GSSD has many characteristics, as previously explained, that are relevant to, or that can be adapted for, the MNE.

The process here is two-way: users access GSSD to search and look for knowledge, while nodes on the GSSD network will acquire and add locally created knowledge into the GSSD knowledge base. For GSSD-E, collaborative software that permits virtual teaming can be a functionality added to the GSSD system to give it a real-time capabilities. These characteristics are immediately linked to the provision of access to codified knowledge, information and data via a taxonomic structure that permits a discriminatory search for relevant content as defined by the user.

Also, the GSSD system is a repository of intra- and extra-organizational knowledge content that is provided by the members of the GSSD, and can be regarded as a repository of organizational learning. GSSD hence also enables knowledge creation and application via these mechanisms. GSSD can be further adapted to cater to specific enterprise knowledge requirements in terms of interface design, content type or organization. The core subject content of GSSD relates to sustainable development, and GSSD-basic (the original form of GSSD focusing on sustainable development, as opposed to GSSD as a generic knowledge management system) encompasses content that pertains to fourteen different sectors, one of which relates to industry in general. GSSD-E will require expansion of content related to sustainable development and environmental issues within the particular industry, product sector, and sub-product-sector that is germane to the particular enterprise. Currently the GSSD interface serves as a gateway to non-interactive content. Adaptations can be made such that GSSD-E can act as the gateway to content that includes interactive components like modeling tools, collaborative software and related knowledge-management software, and interactive e-learning software in addition to non-interactive content. Further modifications may be made such that GSSD-E interfaces with enterprise integration tools, but value-added of this requires further exploration. GSSD-E may therefore be designed as an enterprise map of knowledge resources (pertaining to a single area, or to multiple areas – e.g. environment, business strategies like six-sigma for manufacturing etc.) and knowledge-related tools via various perspectives.

5.3 Presenting the GSSD-E Design

5.3.1 A GSSD Meta-layer for Knowledge Networking in the MNE

A generic framework for mapping the knowledge flows within the MNE has been illustrated by Figure 1. To facilitate these knowledge flows and other knowledge networking processes within the MNE, the GSSD architecture has been proposed as a mechanism that can operationalize knowledge networking. A 'GSSD view of the MNE' is shown in figure 2. A meta-layer interface can be designed to simplify and encapsulate the key ideas of Figure 1 and uses the two

parameters of 'geographic area' and 'product/service sector' in modeling the MNE. The product/service sector parameter relates to an industry or a sector within the industry at the highest level of abstraction. For example[68], 3M operate in multiple industry sectors including architecture and construction, automotive, aerospace and marine, electronics, healthcare and others; Sony operates in the entertainment (computer, movies, music), electronics, insurance and other industries.

The meta-layer GSSD-E view hence provides a portal for the user with a matrix to find the product-country/region intersection that contains content that is most pertinent to his or her requirements. This is shown in Figure 2. Figure 2 is consistent with the GSSD-basic design, and its components are:

- Rings: Geographic Area: Countries/regions of operations, HQ
- Slices: Major Product/Service Sector and HQ executive function e.g. Products/Services. For Sony Group: Electronics, Entertainment, Insurance and Finance

5.3.2 GSSD-E Design Alternatives

Further design of a more specific application using the GSSD architecture is possible which directly follow from the GSSD-E meta-layer of figure 2. As introduced, the meta-layer serves as a navigator via which users can narrow search preferences by increasing the level of specificity. By selecting a ring-slice intersection of geographic-area and product/service-sector, the user accesses content that are germane to that intersection via functionalities that have been harmonized and integrated worldwide by the MNE. The GSSD-E system can be a straight adaptation of the GSSD-basic design – a knowledge base used, maintained and continuously built by nodes within the MNE worldwide network – that provides knowledge sharing and organizational learning, or a common integrative gateway that provides access points to knowledge management mechanisms like collaborative software, enterprise integration suites, and knowledge base.

Figure 3 shows the development of four possible designs of GSSD-E under the GSSD-E meta-layer:

1. Type I GSSD-E: A basic knowledge base centered on a single product/service-area intersection (minimal change to GSSD-Basic)

2. Type II GSSD-E: As an interfacing gateway for the knowledge management systems (GSSD becomes a gateway to collaborative software, analytical tools and cyber-libraries)

3. Type III GSSD-E: As a common interface to enterprise integration tools (like Enterprise Resource Planning, Supply Chain Management, etc. software)

[68] Stewart, T., 1997, & Skyrme, D., 1998

4. Type IV GSSD-E: As a comprehensive system that integrates onto a common platform the knowledge base functionality, knowledge management systems and enterprise integration tools.

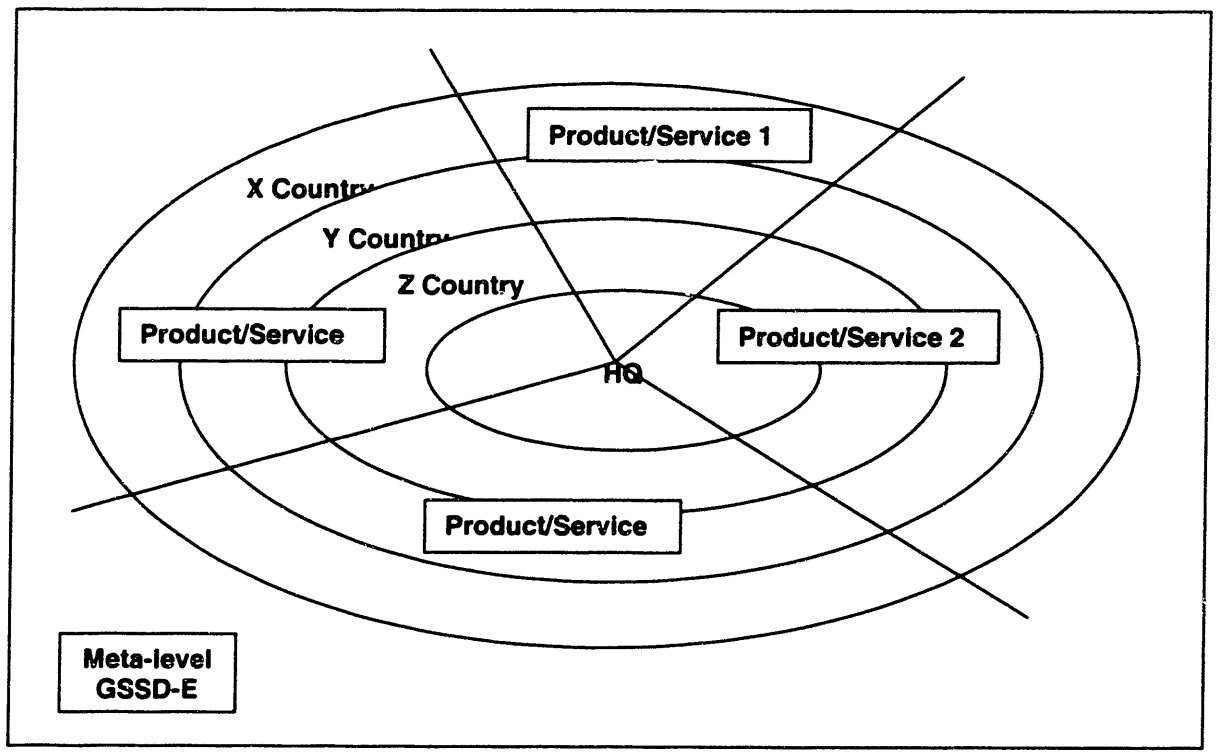


Figure 7: Design for Meta-Level GSSD-E Interface

GSSD-E

Types I-III Architecture

A User's Perspective

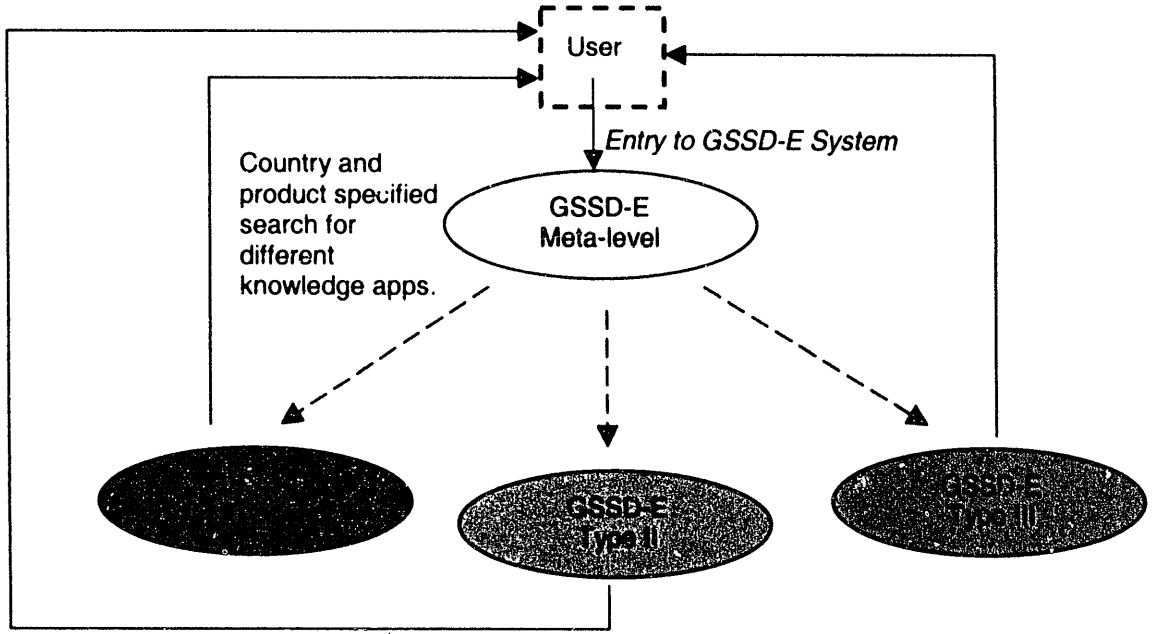


Diagram shows the possible development of GSSD-E – from the meta-layer, three possible types of GSSD-E models can be designed.
Type I GSSD-E encompasses knowledge base functionalities.
Type II GSSD-E encompasses knowledge management systems functionalities.
Type III GSSD-E encompasses enterprise integration software.
Each of these three types is stand-alone in terms of function.

LEGEND

- Possible User Choices and Pathways
- User Choices
- Results returned to User

Figure 8: GSSD-E Types I-III Architecture

5.4 GSSD-E Types I-III

Expanding on the four mooted designs above, the possible views are:

- Type I: Knowledge Base
- Type II: Knowledge Management Systems
- Type III: Enterprise Integration
- Type IV: Integrated Knowledge Base + Knowledge Management Systems + Enterprise Integration

There are two possible perspectives from which to view the 'user' of GSSD-E. The user can be either be using the system for collaborative and to aid decision-making, or using the system to upload information, or update certain documents, or allow general access to installed software. The former perspective will be considered, such that GSSD-E is the primary access-point for global knowledge networking as well and hence an e-portal for knowledge networking software applications. The user will hence be concerned with system usability and ease-of-use, integrity and timeliness in delivery of content, and system compatibility with other enterprise applications.

The following will be of salient concern:

(1) Usability of human-computer interaction (HCI) functionalities – HCI studies is a relatively new branch of information systems engineering that is concerned with the usability of computer-based applications. In this case, HCI design concepts should be used to guide the design of the knowledge base to ensure that the system is learnable and usable in the shortest time possible. Surveys and monitoring of usage are techniques commonly used to assess the usability of the system, and HCI intimately affects the 'actionability' of information.

(2) Quality of information that is uploaded into the knowledge base must be monitored both for its integrity and timeliness, since broadcasting the inaccurate information, or information that is obsolete, can have potentially disastrous effects.

(3) Standardization of data formatting and technological compatibility – Harmonization of software protocols and technological systems to ensure that seamless information and data exchanges are possible.

(4) Standardization of terminology and semantic equivalence must be maintained in translation across differences in language and exchange rates. Context mediation technologies like COIN developed in MIT must be leveraged to maintain consistency of meaning.

Type I GSSD-E: Knowledge Base (KB):

Type I GSSD-E directly adapts GSSD-basic for use as a knowledge base which serves as an enterprise knowledge map to facilitate employee self-help in accessing organizational and external related knowledge, as a mechanism for transferring and diffusing local knowledge from

one node within the MNE network to the entire organization, storage of organizational knowledge as part of organizational learning. Housed as mirror 'sites' at various nodes on the MNE intranet, the knowledge base is jointly built and maintained by the different nodes within the network, such that nodes are inter-dependent on each other as knowledge sources. This will be especially crucial within the transnational network structure that MNEs and MVNs are adopting (see Chapter 3), in which nodal units in the MNE network are highly specialized and interdependent on each other for knowledge inputs that are critical for timely and accurate decision-making.

Type II GSSD-E: Knowledge Management Systems (KMS):

Type II GSSD-E KMS combines the knowledge sharing objectives of a knowledge base with venues of joint knowledge creation and application. The latter activities refer to the virtual team-working functionalities that facilitates: (1) real-time communication across physical boundaries, (2) virtual teaming and joint problem solving, and (3) learning from employees in other divisions. Knowledge management systems supplement such virtual meeting-places with enhanced analytic tools for intelligent searches in intranets, information-to-knowledge facilitating technologies, and interactive e-learning resources as well as simulation and modeling packages. Unlike type I GSSD-E, which has only non-interactive content in the knowledge base, type II GSSD-E has both interactive as well as non-interactive content.

Type III: Integrated Enterprise Integration (EI):

Type III GSSD-E EI acts as a common gateway to the enterprise integration tools that form the enterprise's management information infrastructure. It comprises software like enterprise resource planning tools like transaction processing software, customer relationship management and human resource management applications. Type III proposes the deployment and accessibility to such decision-support EI tools on a global level, such that strategic planning and decision-making can take place in HQ or in subsidiaries with knowledge inputs from all nodes within the MNE network.

5.4.1 Type I GSSD-E KB (Knowledge Base)

Content Type

GSSD-enterprise in the form of a knowledge base will have non-interactive content that includes codified knowledge, information and data.

1. Reports – Mostly qualitative and some quantitative – Papers from journals and academia, reports in news and magazines, white papers, best practices case-studies, links to papers on the Internet
2. Data – Mostly quantitative in databases – Metrics, measures, internal audits
3. E-Models

The methods by which content is added to the knowledge base is similar to that which adds content to the GSSD knowledge base as previously introduced.

Here, nominations are made by, and encouraged from, employees, and these nominations will be assessed by researchers (in-house or outsourced) according to a common set of criteria established by headquarters. Accepted contributions are then used to form abstracts in the various languages of countries in which the MNE has subsidiaries, together with a link to the new addition and classified within GSSD-enterprise according to the appropriate classification taxonomy.

Design

(i) Rings: Issues

- Internationally and locally specific enterprise-related Strategic issues
- Internationally and locally-specific Regulatory/Economic/Political/Social Issues
- Scientific & Technical Issues
- Sustainability Issues
- Activities/Processes

(ii) Slices: Product/Service Sub-Type

- Differentiation of product/service sector into more specialized segments.
- E.g. Sony:
    - Electronics – Home, Mobile, Semiconductor, Core Technology, Broadband Solutions, Digital Telecommunications, Display
    - Entertainment – Computer (PC vs. TV vs. handheld), Movies, Music
    - Insurance and Finance – Different insurance services

(iii) Sub-Slice: Concepts

- Further differentiation of the product/service segment into constituents.
- E.g. Sony:
    - Electronics – Mobile – mobile telephony hardware and software design, 3G services (ubiquitous Internet connection), product design etc.

(iv) Sub-Ring: Content Type

- Papers, Reports, and Data-sets

This is shown in figure 4 and its taxonomic structure is shown in figure 5.

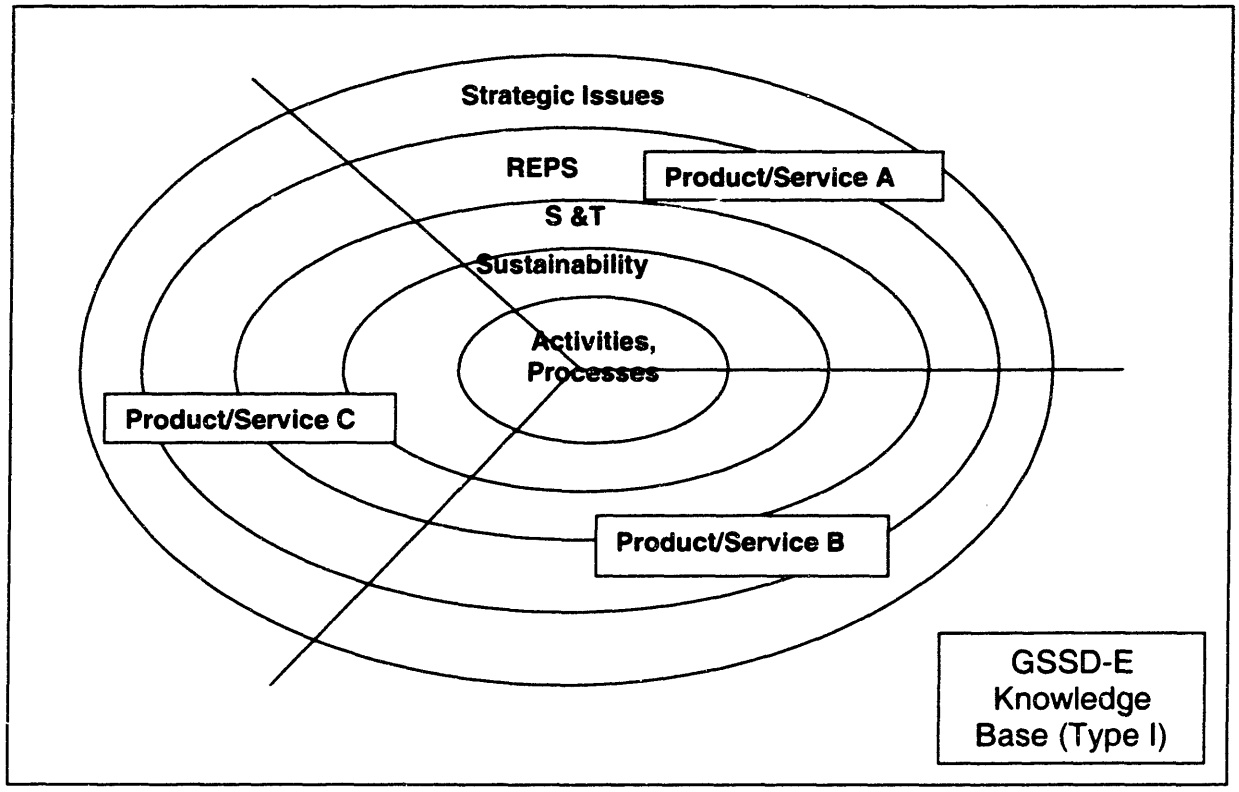
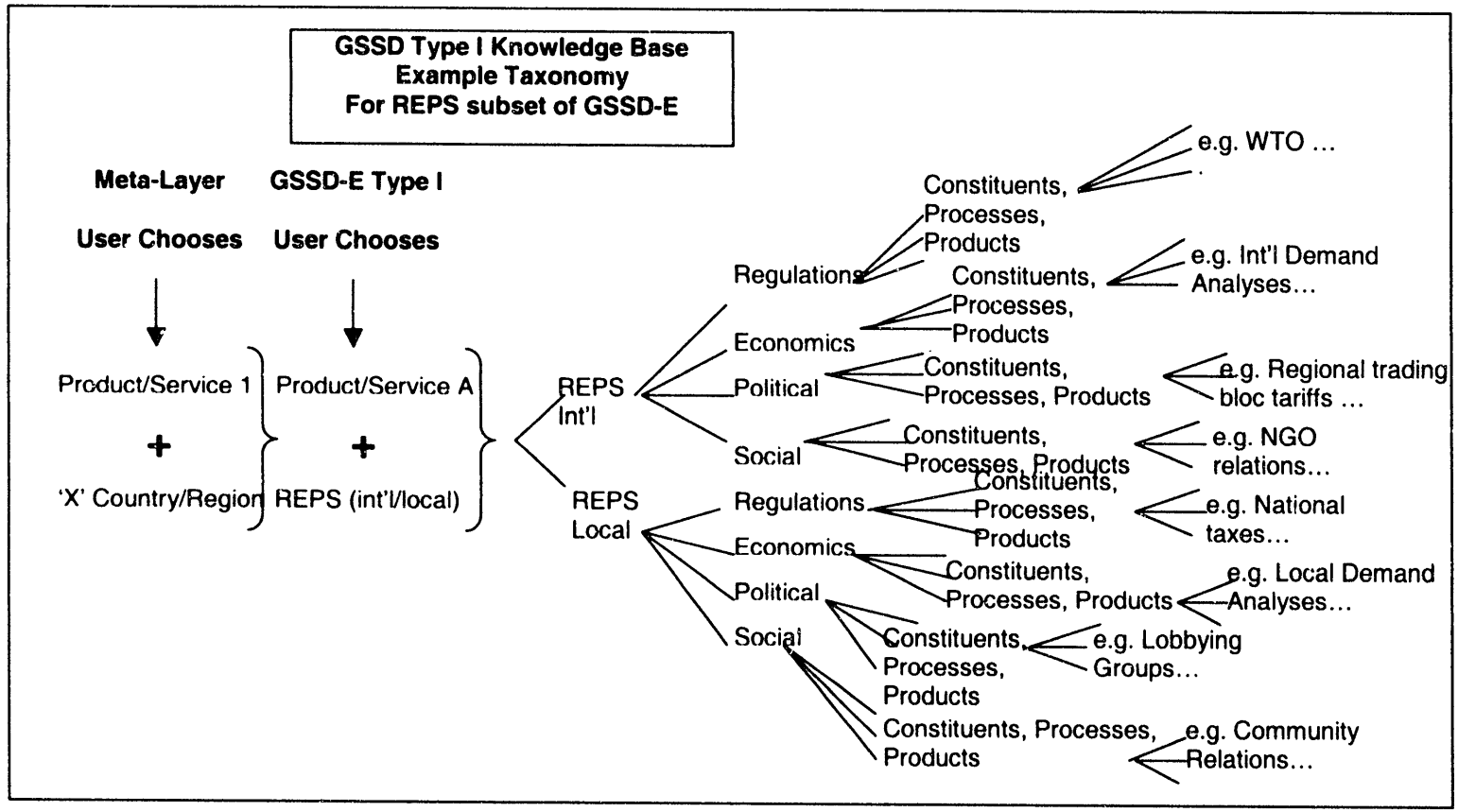


Figure 9: Type I GSSD-E Knowledge Base Generic Design

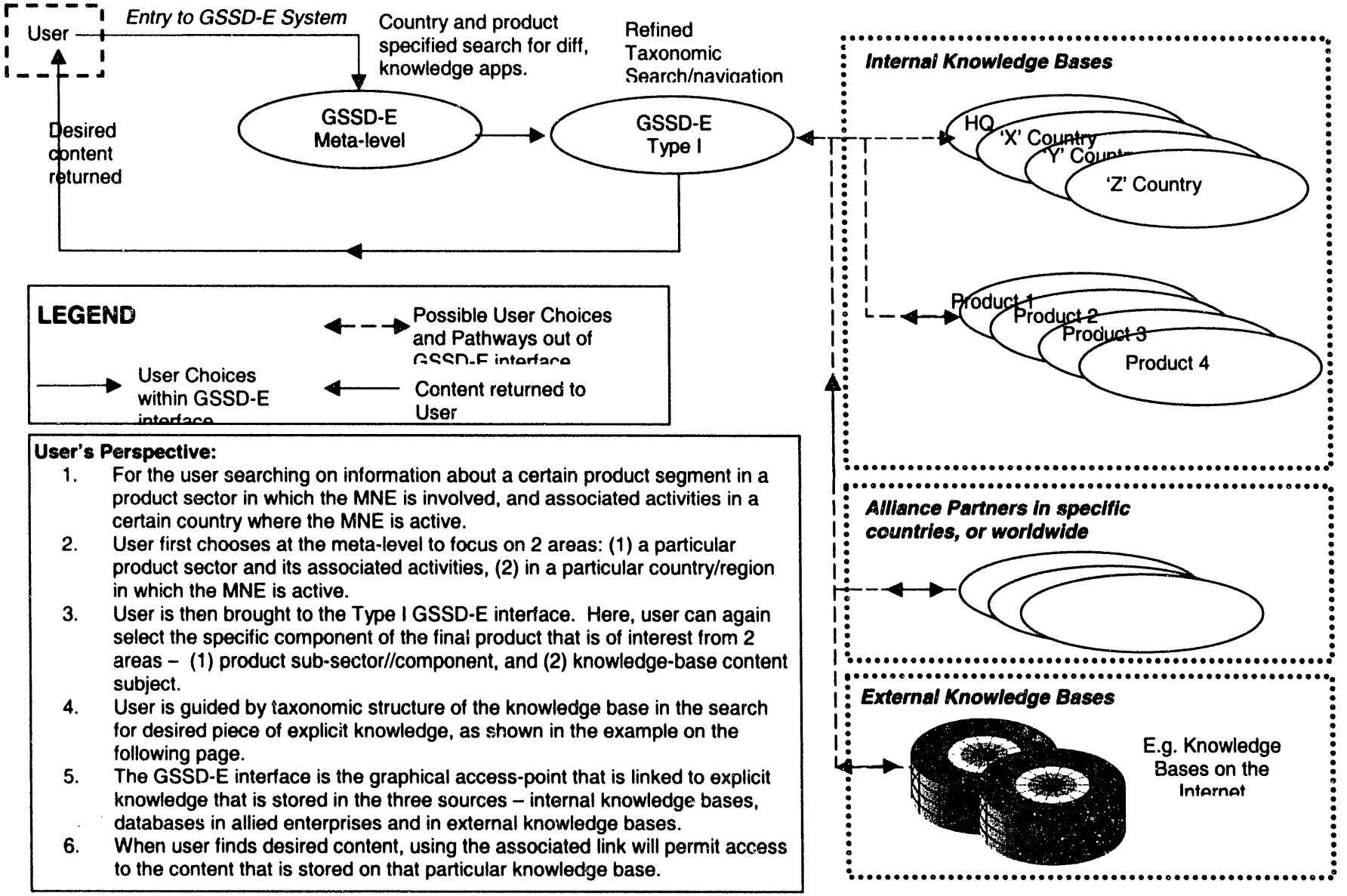


Searching the GSSD-E Type I model – Knowledge Base

1. The example here depicts the sequence of actions and the choices that the user can take in searching for **regulatory, economic, political, and social (REPS)** information about operations related to a certain product in a certain country.
2. Step 1: The user will make a choice at the GSSD-E meta-layer with regards to the specific product sector '1' and country/region, 'X', of interest.
3. Step 2: The user will make a choice with regards to the specific product segment, 'A', within the general product sector 1, and also chooses the content type, in this case – REPS content.
4. Step 3: Depending on which specific area of REPS content the user is seeking out, the taxonomic structure serves as a guide for the user, who may, for example, be specifically interested in the local regulations governing the manufacturing processes in obtaining the product 'A' within country 'X'.

Figure 10: Taxonomic Structure of GSSD-E

Type I GSSD-E
Enterprise Knowledge Base Function



User's Perspective:

1. For the user searching on information about a certain product segment in a product sector in which the MNE is involved, and associated activities in a certain country where the MNE is active.
2. User first chooses at the meta-level to focus on 2 areas: (1) a particular product sector and its associated activities, (2) in a particular country/region in which the MNE is active.
3. User is then brought to the Type I GSSD-E interface. Here, user can again select the specific component of the final product that is of interest from 2 areas – (1) product sub-sector//component, and (2) knowledge-base content subject.
4. User is guided by taxonomic structure of the knowledge base in the search for desired piece of explicit knowledge, as shown in the example on the following page.
5. The GSSD-E interface is the graphical access-point that is linked to explicit knowledge that is stored in the three sources – internal knowledge bases, databases in allied enterprises and in external knowledge bases.
6. When user finds desired content, using the associated link will permit access to the content that is stored on that particular knowledge base.

Figure 11: Type I GSSD-E

5.4. 2 Type II GSSD-E KMS (Knowledge Management Systems)

Content Type

GSSD-Enterprise in the type II design adopts the knowledge management systems perspective and comprises both interactive as well as non-interactive content. It remains the same in terms non-interactive content as in the case of the knowledge base, but it will have added interactive functionalities in terms of analytical and collaborative software. These software applications are designed and linked to the interface via either an in-house IT team, or by outsourced IT development units that offer knowledge management systems solutions.

Design

(i) Rings: Organizational Functions

Local/Enterprise-wide Strategy, Production, Marketing, Accounting & Finance, R&D, Environment, and Stakeholder-relations

(ii) Slices: Knowledge Management Functionalities

Reports, Data, Info/Knowledge Extraction, E-Learning, Virtual Meeting-places, Human-resource, and Models

(iii) Sub-Ring:

- Strategy: Competitor Analysis, Local Plan, Global Plan, Internal Performance audits etc.
- Production: Process Methodology, Product specifics (sub-concept: product components attributes etc.), Plant plans/layouts, production-line-related industrial engineering plans
- Marketing: Methodologies, Competition etc.
- Accounting & Finance: Division/Enterprise audits, financial indicators, etc.
- R&D: Technologies, Product innovation, Process innovation, R&D methodologies etc.
- Environment: Pollution, Sustainable practices etc.
- Stakeholders: Customer, Service Provider, Retailer, Distributor, Supplier, Government, Society

(iv) Sub-Slice: 'Concepts'/'Associated Applications/tools' (passive and interactive):

- Reports – Mostly qualitative and some quantitative – Papers from journals and academia, reports in news and magazines, white papers, best practices case-studies, links to papers on the Internet
- Data – Mostly quantitative – Metrics, measures, internal audits
- Info-Knowledge Extraction – Context-mediated aggregation, data mining, knowledge-mining (text-intensive) over defined sources
- E-learning resources – Training/online educational material developed in-house or on Internet, interactive or passive
- Virtual Meeting-places – listservs, instant-messaging, virtual-conferencing, platform for virtual communities of practice.

- Human-Resource – Directory of personnel, personnel messaging (similar application to messaging in virtual conferencing), job-vacancies (applications)
- E-Models – simulated, interactive or passive, software-rendered models, links to process methodology reports in Reports slice.

GSSD-Enterprise Type II is shown in figures 12 and 13.

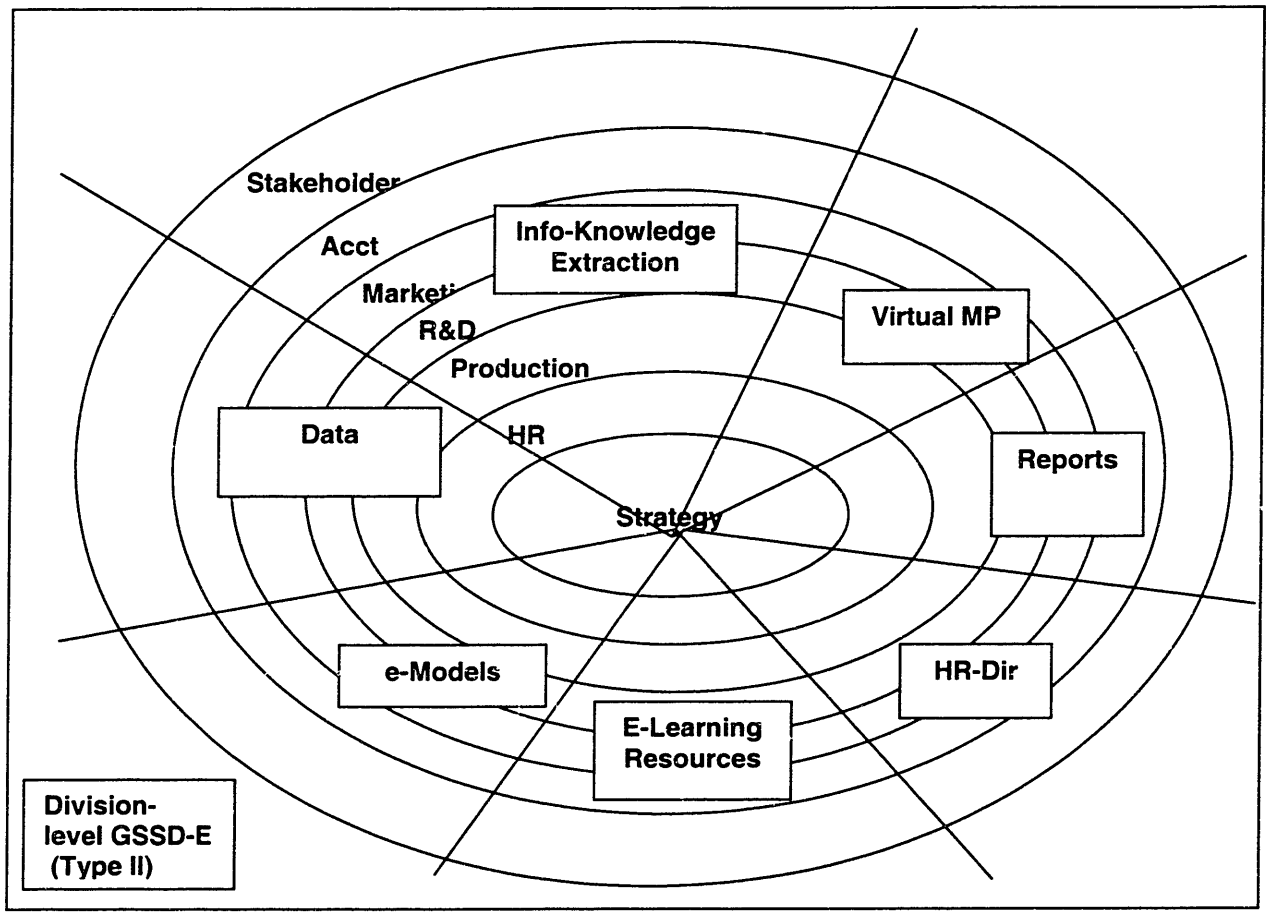
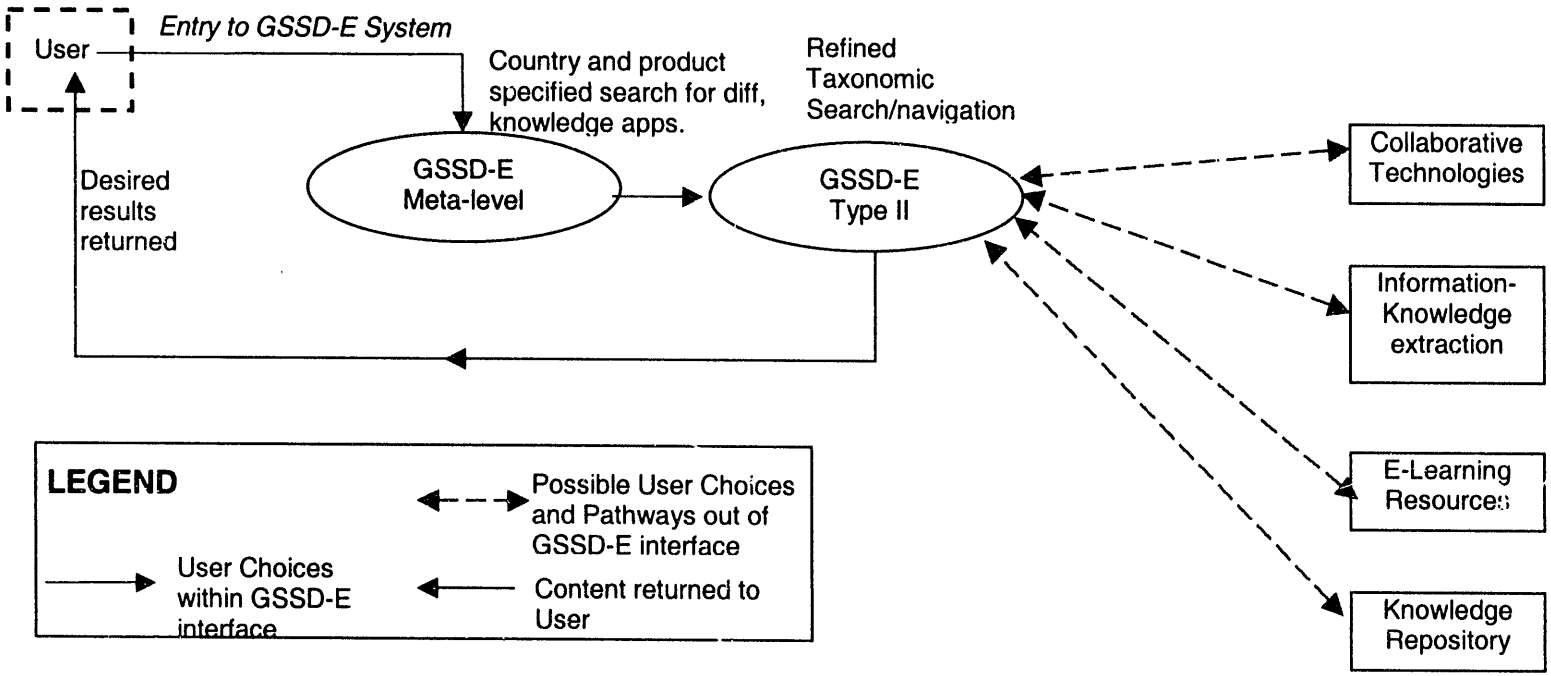


Figure 12: Type II GSSD-E KMS

Type II GSSD-E
Enterprise Knowledge Management Systems



User's Perspective:

1. For the user searching on information about a certain product segment in a product sector in which the MNE is involved, and associated activities in a certain country where the MNE is active.
2. User first chooses at the meta-level to focus on 2 areas: (1) a particular product sector and its associated activities, (2) in a particular country/region in which the MNE is active.
3. User can select the kind of tools or software that is encompassed by the knowledge management system – collaborative technologies like instant messaging, listservs and emails, info-knowledge extraction tools like data mining, information aggregation, and text mining, e-learning resources like simulations, tutorials and case-studies, and knowledge repository of organizational memory.

Figure 13: Type II GSSD-E

5.4.3 Type III GSSD-E EI (Enterprise Integration)

Content Type

The GSSD-E type III structure comprises enterprise integration (EI) software that encompasses, among many different interactive components, applications like Customer-Relationship Management (CRM) software, Supply Chain Management (SCM) software, Human Resource Management (HRM) software, Financial Process Management software, and Product Life-Cycle Management software, as well as non-interactive components like data and reports.

Design

(i) Rings: Organizational Functions

Local/Enterprise-wide Strategy, Production, Marketing, Accounting & Finance, R&D, Environment, Stakeholder-relations

(ii) Slices: EI applications

SCM, CRM, HRM, Financial Process Management, Product Life-Cycle Management, Data-Warehousing, Reports+Documents archives

(iii) Divisions on the ring are exactly similar to that of the type II design.

(iv) Sub-Slice will consist of the suite of EI applications (e.g. Transaction Processing, HRM, CRM, SCM etc.) that the user can access.

GSSD-Enterprise Type III is shown in figures 14 and 15.

Increasingly, specialized IT consultancies like Accenture and IBM are offering solutions that integrate EI applications onto a common platform of standards and protocols. GSSD-E complements such development by acting as a framework that leverages such integrated software packages as the main mechanisms for operationalizing global knowledge networking.

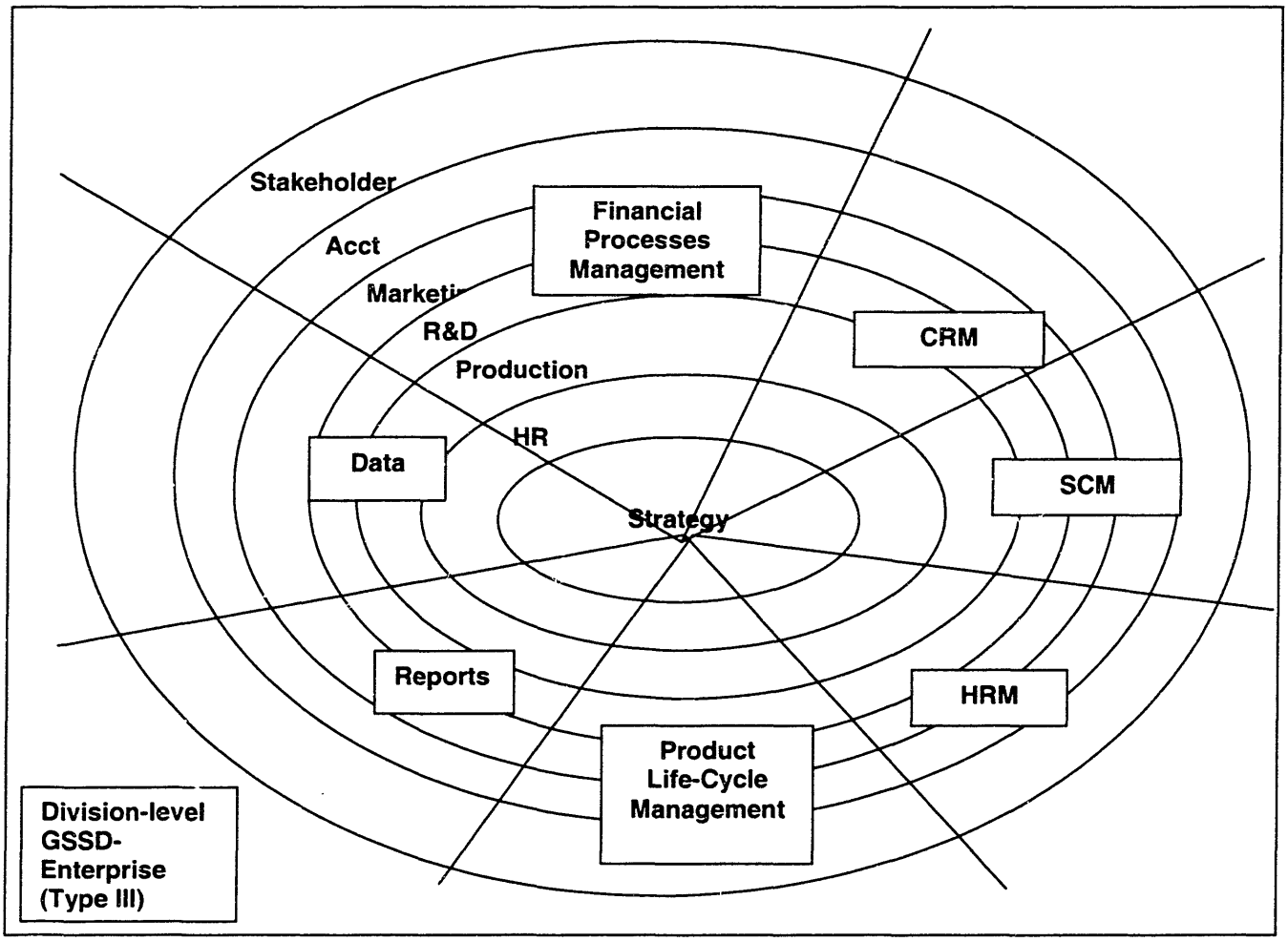
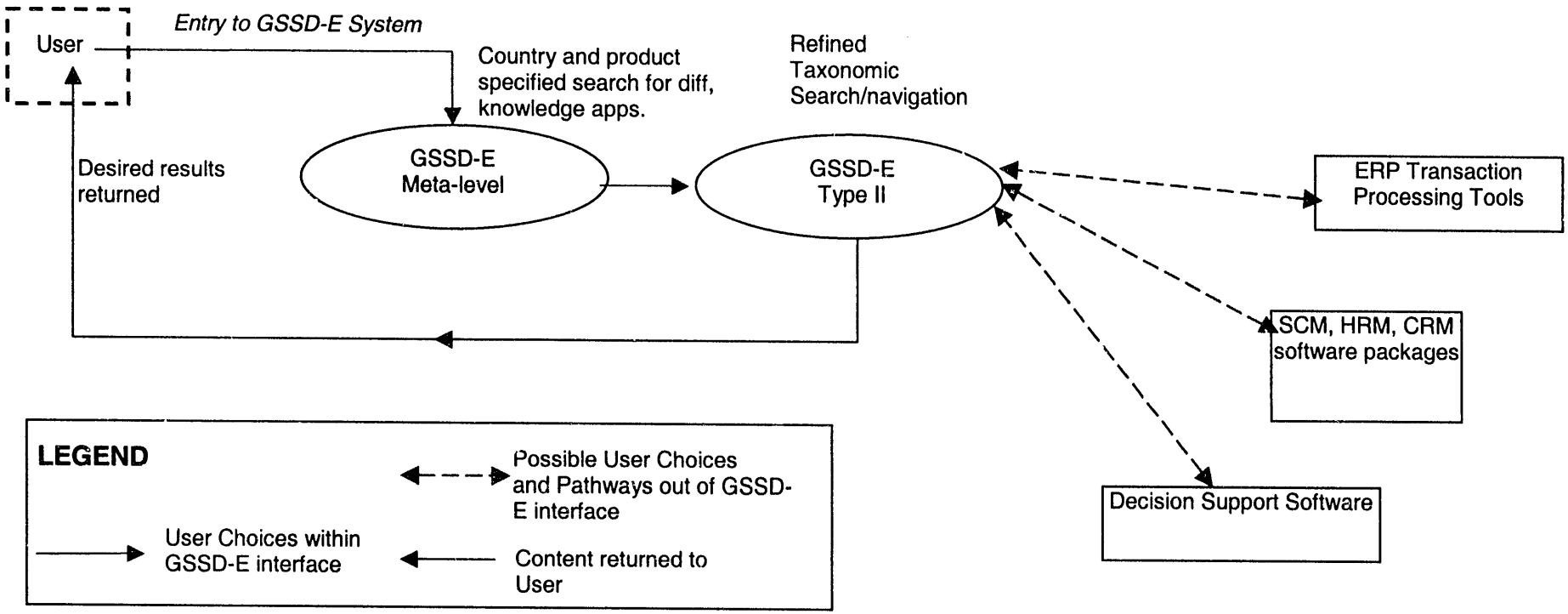


Figure 14: Type III GSSD-E

Type III GSSD-E
Enterprise Integration Systems



User's Perspective:

1. For the user searching on information about a certain product segment in a product sector in which the MNE is involved, and associated activities in a certain country where the MNE is active.
2. User first chooses at the meta-level to focus on 2 areas: (1) a particular product sector and its associated activities, (2) in a particular country/region in which the MNE is active.
3. User can select the kind of tools or software that is encompassed by the enterprise integration software tools – ERP tools like workflow management, transaction processing or information management software, supply-chain management, human resource management, customer relationship management software, and decision support software.

Figure 15: Type III GSSD-E

5.5 GSSD-E: Knowledge Sharing among Value-Chain partners

The knowledge base design can be shared among multiple enterprises in multinational value networks that include MNEs, its suppliers, down-stream customers (businesses) and service providers like distributors and retailers. The key issues of knowledge sharing in this context pertain to the security of the system, and the latter is again contingent on robust technology and people policies. People policies – impacting employees and the conduct of relationships with employees of partner enterprises – are required to cultivate trust and commitment in employees in the enterprise.

In chapter 3, the convergence in enterprise characteristics between transnational network MNEs and MVNs was discussed, and it was observed that MNEs are adopting a more decentralized organizational structure that coordinated the activities of highly specialized subsidiary units in attaining organizational goals, while MVNs are adopting more formal governance mechanisms in joint activities between member units. In both organizations, the risks of knowledge networking – spreading of misinformation, deliberate theft of knowledge, and knowledge hoarding – require human networking policies that generate sufficient trust between the two parties to prevent distrust from disrupting or sub-optimizing the process. Also, while human networking policies are preventative in nature, technological solutions are required as safeguards to deter and minimize the risks arising from cheating.

In designing GSSD-E, such technology-based security systems must be implemented for this purpose. The enterprises that have access and that will contribute to the common knowledge base can view content as governed by a security classification as deemed fit by the MNE and possibly its partner enterprises. Conceptually, the type I GSSD-enterprise model can be most easily extended for the case of the MVN. One can view partner-enterprises as member units of an MNE, with the key difference being the security measures that must be put in place. Changes to the taxonomic structure will also help to discriminate content that is most relevant to each actor in the value chain, from supplier to service provider to MNE to customer enterprises. This change is reflected in the figure 16.

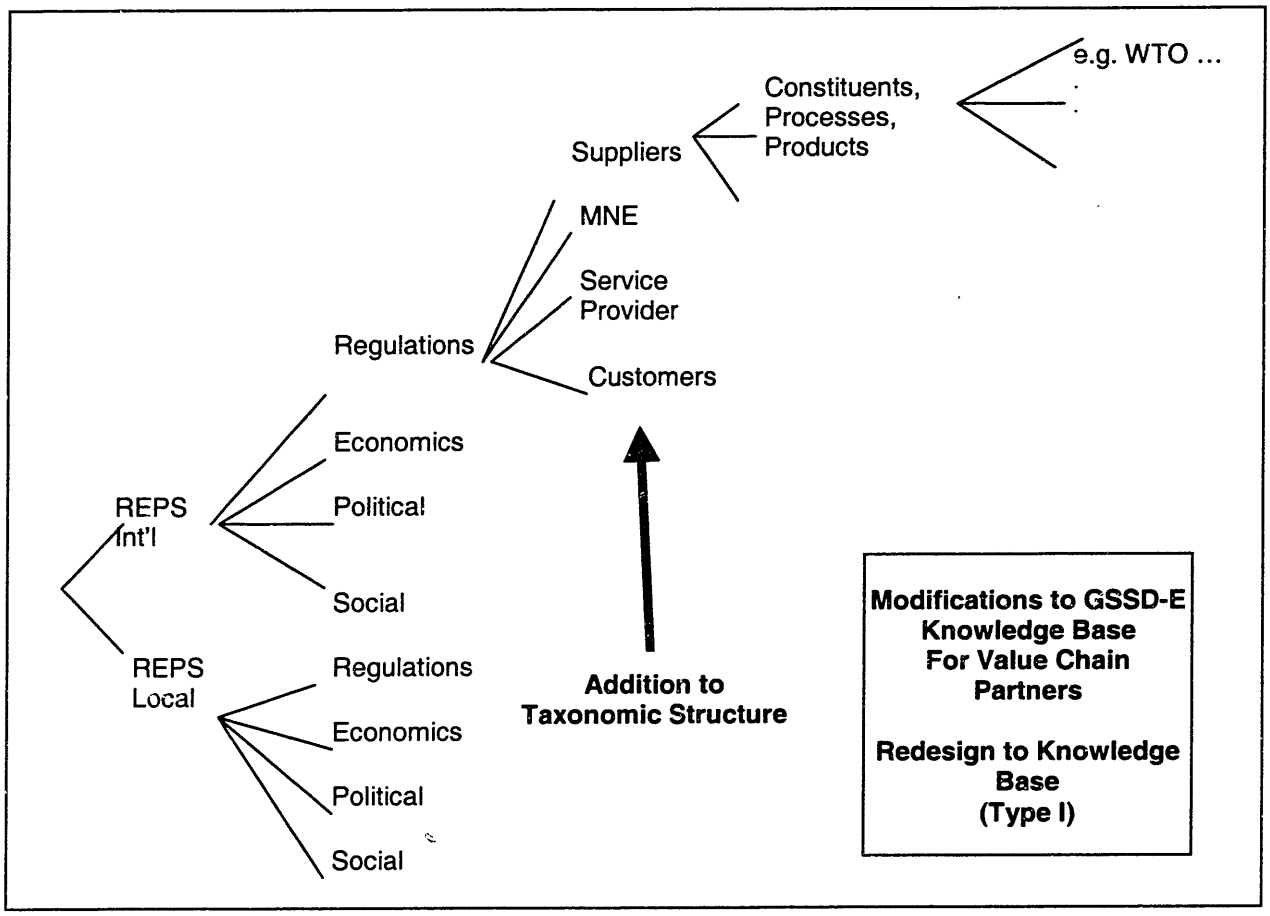


Figure 16: Modification of the Taxonomic Structure of the Knowledge Base

6. INTEGRATED GSSD-E

6.1 An Integrated Model: Type IV GSSD-E

The three designs of GSSD-E proposed in the preceding chapter were largely un-integrated – type I was purely a knowledge-base jointly developed and built by a global knowledge network, type II was a global knowledge management system that provided virtual collaboration mechanisms that allow real-time knowledge networking in geographically separated teams, and type III was a integrated platform for various enterprise integration tools that leveraged of data and management information for decision support purposes and in planning enterprise operations. Integrating all three knowledge-related functionalities is a logical extension in the design of GSSD-E, since the workings and desired outcomes of the three are complementary and reinforcing. A type IV GSSD-E will be more complex to develop than in either type I or type II, and involves, at minimum, some measure of integration of the software protocols and data formats of the three software systems that may be have been separately deployed by different vendors. This therefore requires extra attention to incompatibilities between the systems, and in the harmonization of data and information formats such that the three systems can access a common pool of knowledge and information. One immediate method of combining the access-point to the three functionalities will be to adopt a 'sub-meta' level navigator that allows the user to choose between using either KB, KMS or EI functionalities from the outset, hence keeping the three on separate interfaces.

Type IV GSSD-E design will be implemented in a modular and incremental fashion to mitigate the risks of doing so correspond to the risks, arising from business, technical and control-and-coordination complexities, which are outlined in chapter 4 for EI initiatives. Developed module by module, each module in the type IV design will have stand-alone operational capabilities. Some re-design can be made to type I and type II in this arrangement, since type II GSSD-E encompasses the functions of type I in its cyber-libraries. In this case, the knowledge base will incorporate all non-interactive content, while the knowledge management systems gateway will link to interactive components of the knowledge creation/sharing/transfer/re-use process. The redesigned type II GSSD-E (having only interactive components) can be called Type IIb and is shown in figure 17. Together, types I and IIb form a conceptual knowledge management technology infrastructure for the MNE while type III - enterprise integration system – forms the management information infrastructure. Taken together with the ICT backbone infrastructure, these three elements form the conceptual knowledge networking technology strategy that was proposed in chapter 4 can be achieved for a global enterprise. The scheme of type IV GSSD-E design is shown in figure 18.

Type IV GSSD-E can also be designed for use in a multinational value network, where security and privacy applications, as designed and configured to the specifications of the partner enterprises, can be seamlessly added to the system as an additional module. In this case, both the knowledge base (type I) and the knowledge management systems software can be shared (type II), though type III Enterprise Integration systems will encounter the technical challenges of ensuring that factors like interoperability and security are resolved when management information across multiple enterprises is integrated in such a system.

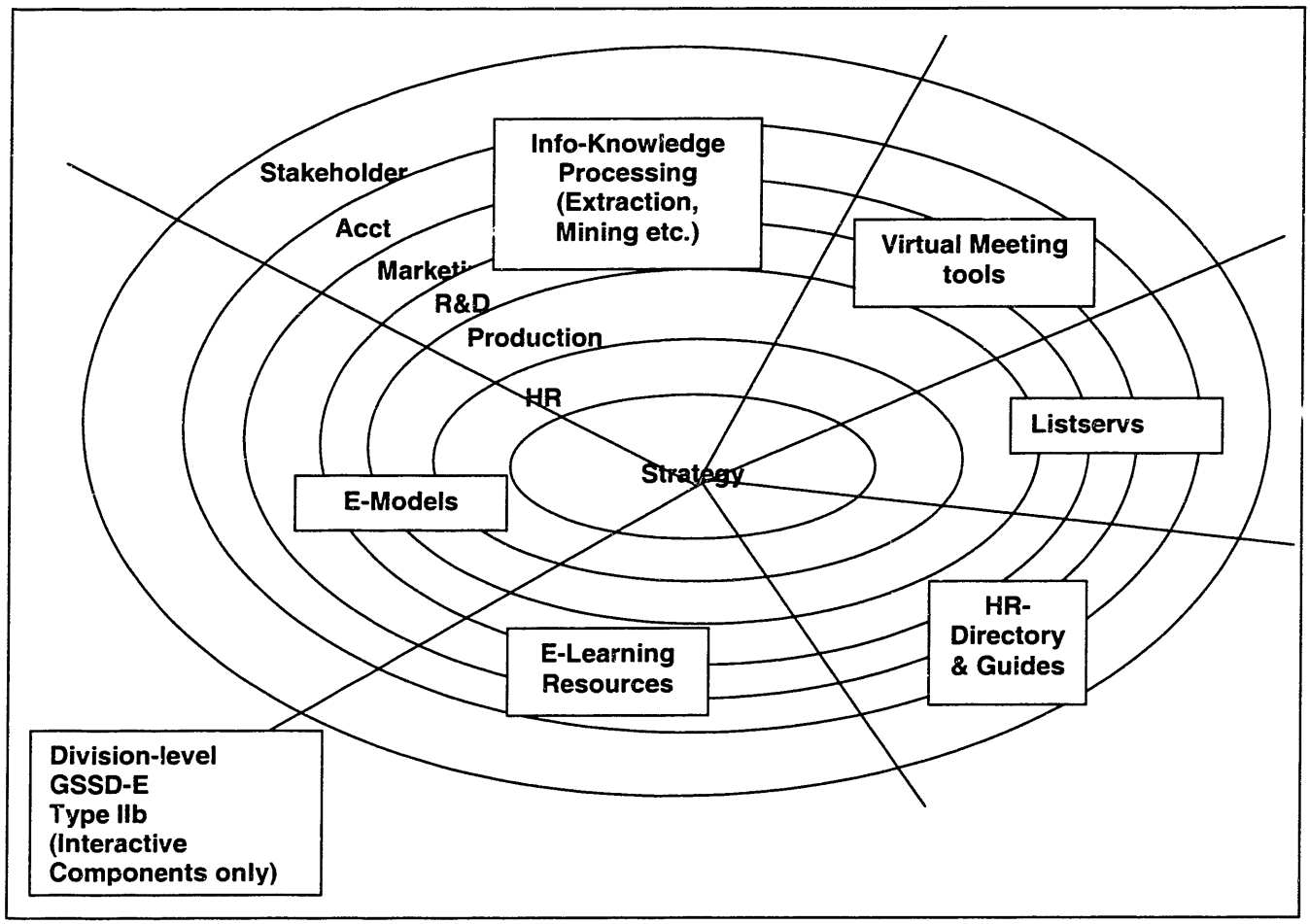


Figure 17: Type IIb GSSD-E

6.2 Implementing Type IV GSSD-E

The development of a type IV GSSD-E can proceed, broadly, in the following stages:

Planning Stage I

1. Conduct a knowledge audit[69] – the extant technological, structural and cultural enablers and constraints of knowledge life cycle processes – of the organization.
2. Conduct consultation with knowledge workers in various nodes within the knowledge network
3. Define a meta-knowledge-networking strategy for the enterprise as a whole, assigning goals and strategic tasks for business units within the organizational network

[69] See section 4.3

Planning Stage II

1. Identify extant knowledge needs and inadequacies that are constraining knowledge sharing and organizational learning
2. Identify areas that require change, and analyze the change process needed and the required resources to successfully manage this process
3. The technological vehicle for knowledge networking is GSSD-E, and will be implemented concurrently with the appropriate people policies and changes to the organizational structure

Design Stage I: Designing and implementing type IV GSSD-E global knowledge networking system, KB implementation

1. Pilot project deploying GSSD-E Knowledge Base among several nodes in the network
2. Assess the results of GSSD-E KB via a set of enterprise-defined metrics. If unsatisfactory, re-evaluate the challenges preventing successful implementation and identify solutions.
3. If results are satisfactory, the GSSD-E Knowledge Base can be deployed to link up all nodes in the global enterprise.

Design Stage II: Designing and implementing type IV GSSD-E global knowledge networking system, KMS implementation

1. Deployment of GSSD-E type IIb KMS variant (sans non-interactive content) as an additional module added to the GSSD-E system. Type IIb comprises the interactive components of KMS and GSSD-E will act as the portal from which to access these KMS components.
2. KMS components can use data from KB for analytical purposes.

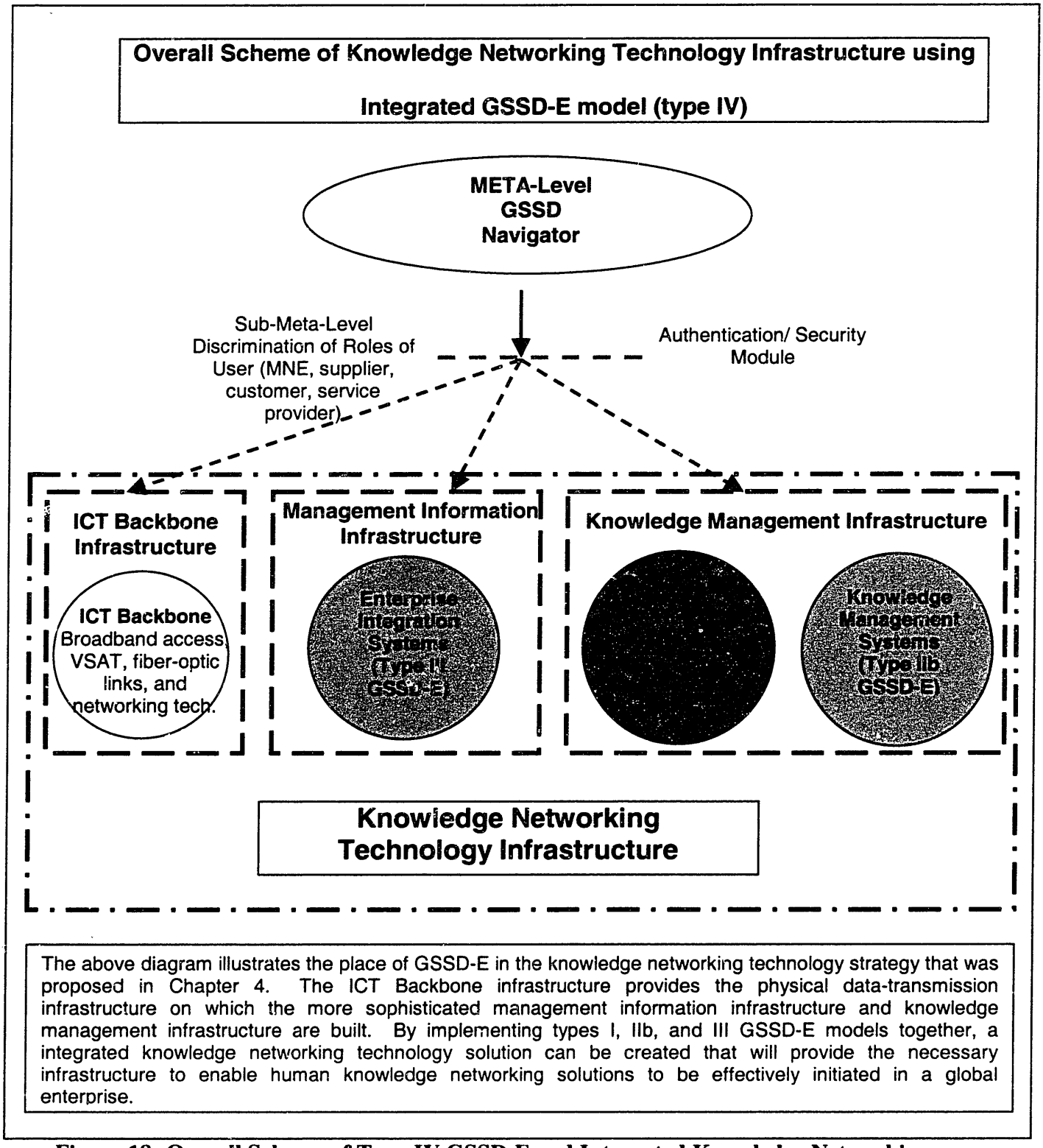
Design Stage III: Designing and implementing type IV GSSD-E global knowledge networking system, EI systems implementation

1. Addition of EI-applications module to the GSSD-E system. GSSD-E will act as the portal from which to access these EI tools.
2. Synergy can be achieved in integrating these software tools – KMS and EI software can leverage each other as well as the data content of the KB module for analysis and decision support purposes.

It will be useful to explore, conceptually, the implementation of at least the initial stage of this proposed framework, since this would flesh out the principal design considerations that would have been germane to the implementation of the rest of the other stages. Such a conceptual implementation on a case-study will be explored in the next chapter in a specific application of the knowledge base.

Summary Table of GSSD-E design alternatives (Types I-IV)				
	Type I – KB	Type II – KMS	Type III – EI	Type IV - Integrated
Content Type	KB – Knowledge Base Non-interactive content: Reports – Mostly qualitative and some quantitative – Papers from journals and academia, reports in news and magazines, white papers, best practices case-studies, links to papers on the Internet Data – Mostly quantitative in databases – Metrics, measures, internal audits E-Models	KMS – Knowledge Management Systems Both interactive as well as non-interactive content. It remains the same in terms non-interactive content as in the case of the knowledge base, but it will have added interactive functionalities in terms of analytical and collaborative software.	EI – Enterprise Integration systems Principally interactive content – comprises enterprise integration (EI) software that encompasses applications like Customer-Relationship Management (CRM) software, Supply Chain Management (SCM) software, Human Resource Management (HRM) software, Financial Process Management software, and Product Life-Cycle Management software, as well as non-interactive components like data and reports.	Interactive and non-interactive components. Non-interactive components: Type I KB content Interactive components: Type II KMS (sans non-interactive components, see figure 17 for type IIb GSSD-E) and III EI interactive applications and functionalities Type IV is an interfacing unit that seamlessly unifies the functionalities of types I-III. (See Figures 19-21)
Rings	Knowledge Domains: Internationally/locally specific enterprise-related strategic issues Internationally/locally-specific Regulatory/Economic/Political /Social Issues Scientific & Technical Issues Sustainability Issues Activities/Processes	Organizational Functions: Local/Enterprise-wide Strategy Production Marketing Accounting & Finance R&D Environment Stakeholder-relations	Organizational Functions: Local/Enterprise-wide Strategy Production Marketing Accounting & Finance R&D Environment Stakeholder-relations	User has the option to choose between functionalities ranging from types I, IIb and III. These follow those specified in the respective types. Refer to Figures 9, 14 and 17
Slices	Knowledge Base Product/Service Sub-Type Differentiation of product/service sector into more specialized segments.	Knowledge Management Functionalities Reports, Data, Info/Knowledge Extraction, E-Learning, Virtual Meeting-places, Human resource, and Models	EI applications SCM, CRM, HRM, Financial Process Management, Product Life-Cycle Management, Data-Warehousing, Reports and Documents archives	User has the option to choose between functionalities ranging from types I-III. These follow those specified in the respective types. Refer to Figures 9, 14 and 17

Table 11: Summary Table of GSSD-E Design Alternatives



The above diagram illustrates the place of GSSD-E in the knowledge networking technology strategy that was proposed in Chapter 4. The ICT Backbone infrastructure provides the physical data-transmission infrastructure on which the more sophisticated management information infrastructure and knowledge management infrastructure are built. By implementing types I, IIb, and III GSSD-E models together, a integrated knowledge networking technology solution can be created that will provide the necessary infrastructure to enable human knowledge networking solutions to be effectively initiated in a global enterprise.

Figure 18: Overall Scheme of Type IV GSSD-E and Integrated Knowledge Networking Technology Strategy

GSSD-E

Type IV Integrated Architecture

A User's Perspective

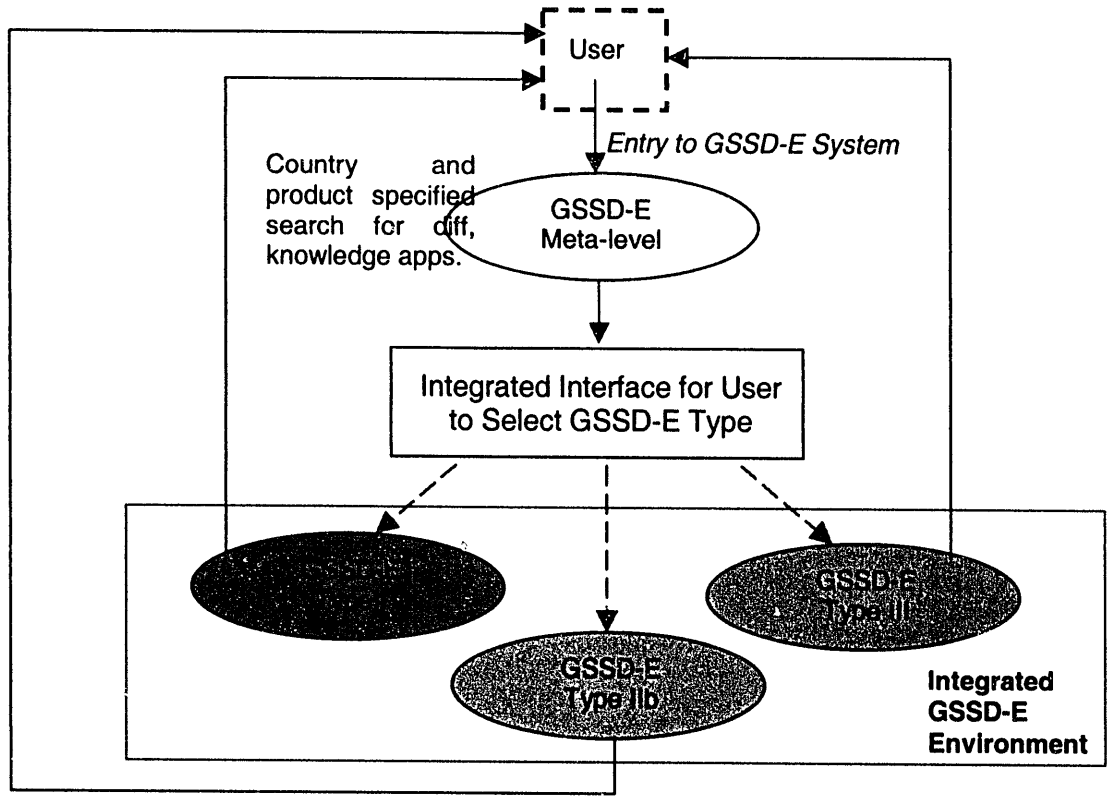


Diagram shows Type IV GSSD-E, which integrates the three types of GSSD-E into a combined system where user can choose between using these functionalities, and use one in combination with the other.
Some redesign of the previous GSSD-E systems are required to minimize overlap (for example, Type IIb GSSD-E is modified from Type II), and the resultant integrated GSSD-E will include both knowledge content as well as the software to leverage it.

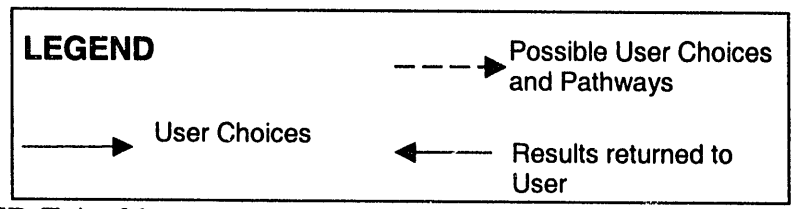


Figure 19: Type IV GSSD-E Architecture

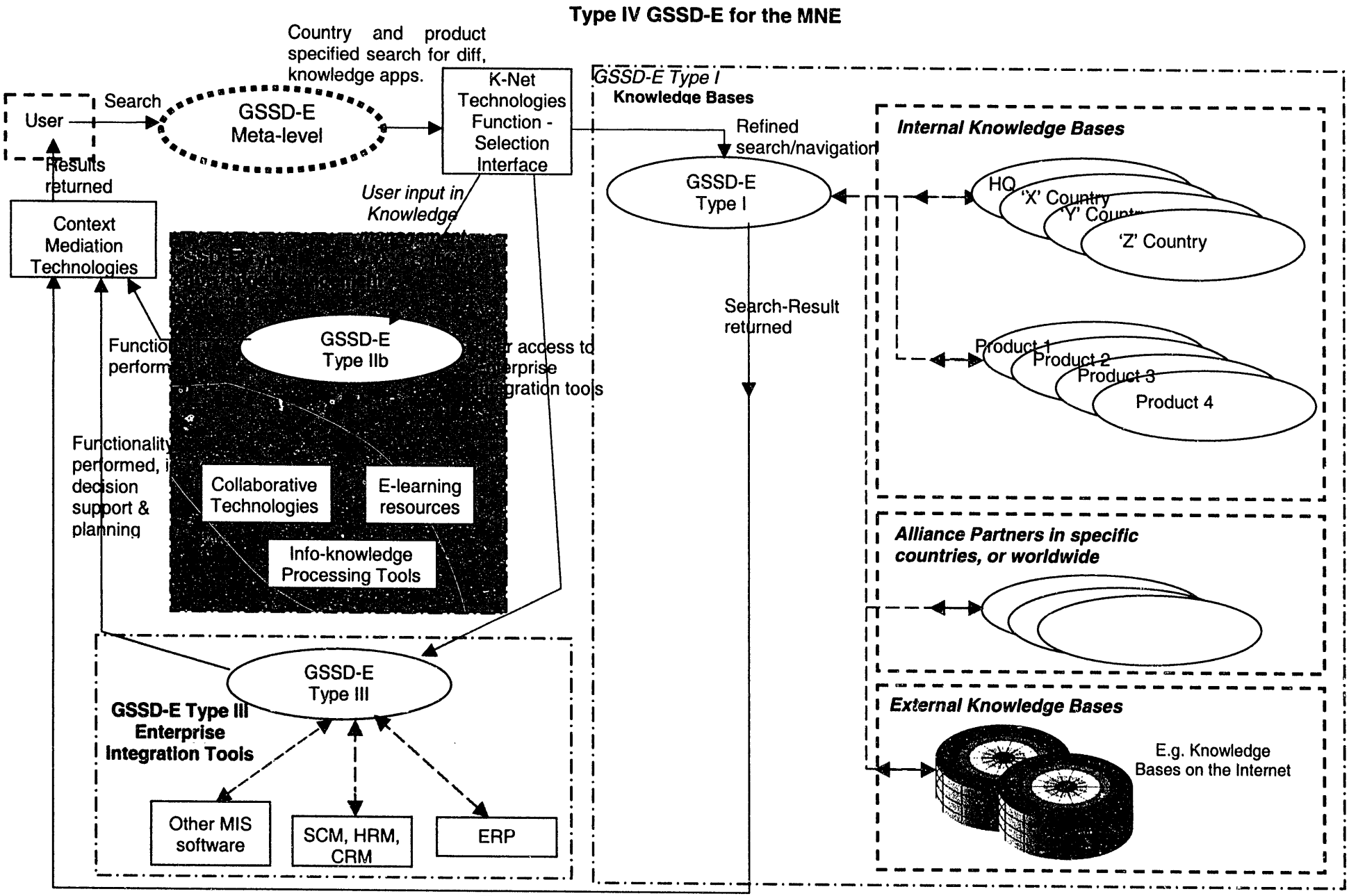


Figure 20: Type IV GSSD-E for the MNE

Type IV GSSD-E for MNE and Value Chain Partner Enterprises

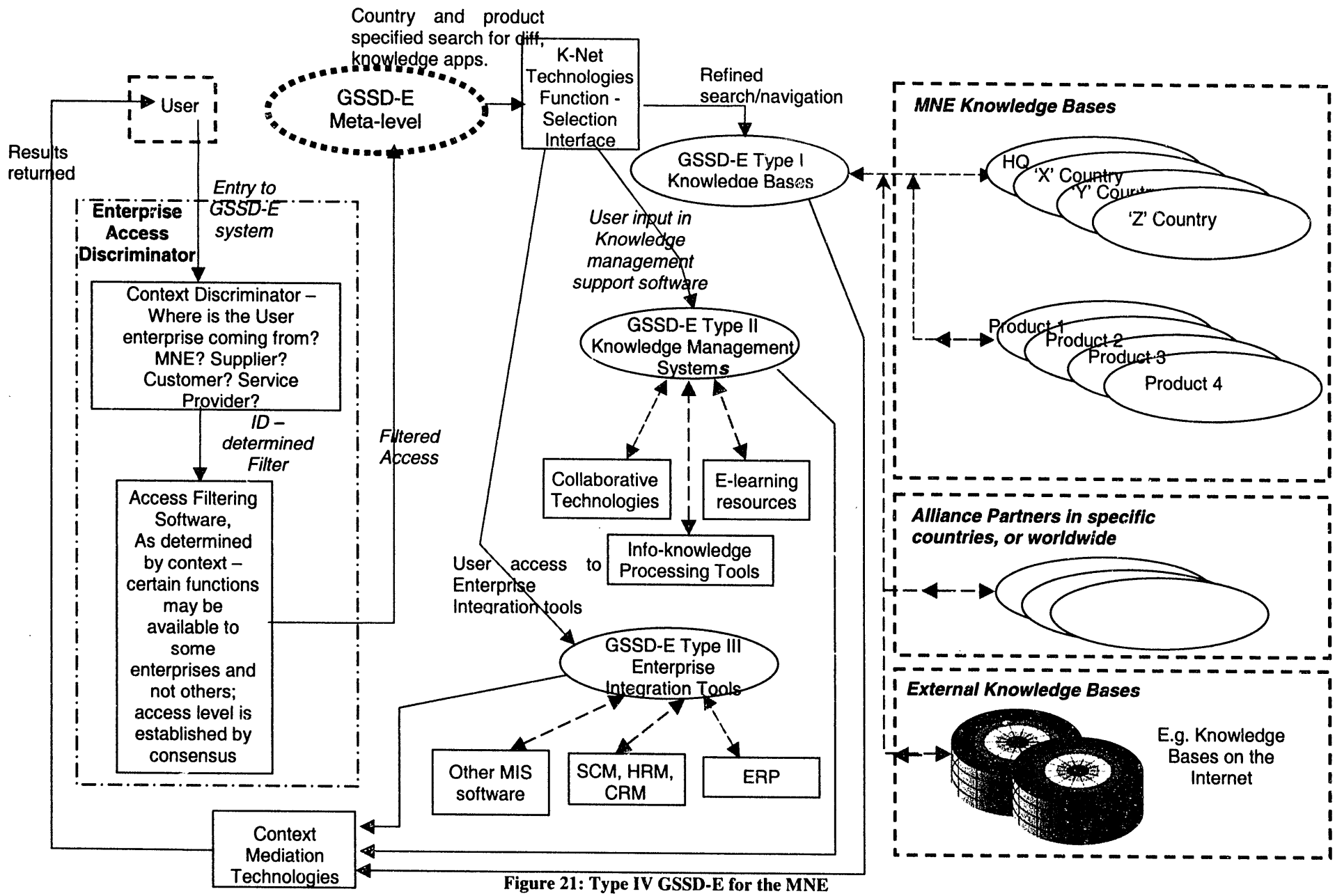


Figure 21: Type IV GSSD-E for the MNE

7. GSSD-E AND ENVIRONMENTAL MANAGEMENT[70]

7.1 Introduction

In its basic form, GSSD focused on the sustainable development domain pertaining to multiple sectors, and hence it is possible that designing a GSSD-E prototype can be developed as the knowledge-networking infrastructure for the global environment management system in the MNE. In particular, the theme of sustainable product/services design, manufacture, marketing, use and end-of-life disposal is one that is salient to MNEs that are increasingly aware of the impact of their operations on the environment. This awareness has arisen as a result of a host of factors that could ultimately affect their economic performance, including legislation in the countries of their operation, media/NGO attention and the reputation of its brand. Indeed, the loss of reputation as a result of being branded a 'polluting' enterprise directly threatens a core intangible asset of the enterprise in terms of the brand name of its products. Internal MNE-initiated programs and public policies in many countries are ensuring that MNEs assume at least some responsibility for the environmental impacts of their products and services over the entire product life cycle.

As previously discussed, type IV GSSD-E, a design that integrates knowledge base, KMS and EI functionalities, is an incrementally developed and phased approach to deploying a global knowledge networking system for a multinational enterprise. The staged implementation framework presented can therefore be applied in the context of environmental management of the MNE's worldwide operations. Here, the first stage of designing the type IV GSSD-E will be discussed, that of developing a knowledge base of environment-related content for the environmental management system. GSSD-E can also be deployed for the multinational value network – this will require consideration of issues that pertain to the formality of partnering as well as the level of trust between the enterprises, and as a result, the security and privacy measures that must be implemented between each enterprise and its partners. As discussed, the GSSD-E model will be tailored to specific needs and characteristics of enterprise-partners who will use and/or contribute to the GSSD-E knowledge base for the enterprise to derive maximum utility.

A case-study in the conceptual implementation of stage I of type IV GSSD-E in designing the knowledge base can be done using Sony Inc. as an example MNE. Sony's global business operations are divided into five functional units: network companies, group companies, computers, games, and music. A global organization led by the Head Office coordinates environmental management in each business unit and geographic region. Additionally, Sony conducts environmental programs that are unique to each business category, country and region. The GSSD-E meta-level matrix of product/service sector versus area can hence fit this categorization appropriately, while a knowledge base design will be germane to the environmental dimensions of Sony's operations.

[70] Choucri, N., 2000

7.2 Sony Environment

Sony has developed an environmental strategy that is summarized in the table below. Led by a vision that is supported by four enabling pillars of commitment, technology, business models and education, Sony has developed clear activities and supporting systems to support its environmental aims, and have developed assessment measures that draw on clearly defined data sources. Environmental management in Sony is clearly knowledge-driven, and knowledge networking mechanisms will be effective in helping Sony HQ and its worldwide subsidiaries strategize and align their activities towards these strategies.

Sony Environmental Strategy	
Environmental Vision	Vision, Commitment, Technology, Business Models, and Education
Action (Activities)	Green Procurement and Purchasing, Energy Conservation, Resource Conservation and Waste Management, Chemical Substances, Facility Design and Construction, Product Planning and Design, Environmentally Conscious Products, Distribution, Sales and Services, Product Recycling, & Environmental Activities in Various Business Operations
Supporting Systems (Environmental Management Systems)	Environmental Technology Development, Environmental Education and Support Programs, Environmental Business Models, Environmental Communication, Risk Management System and Environmental Auditing, Occupational Health and Safety and Disaster Prevention, & Community Relations Activities
Data	Environmental Accounting, Energy, Water, Chemical Substances, Waste, and Products

Table 12: Sony Environmental Strategy Components

7.2.1 Sony Global Environmental Organization Perspective

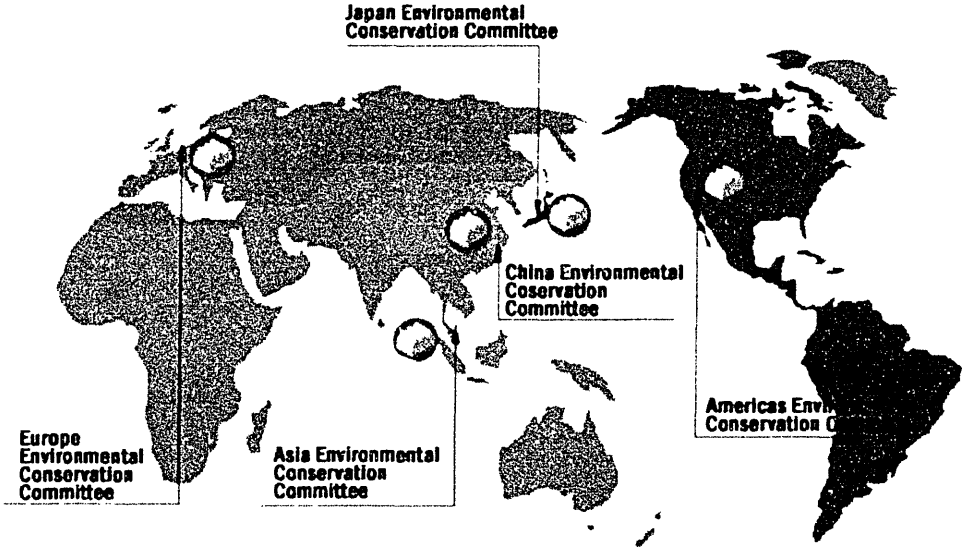


Figure 22: Sony's Environmental Organization Structure

Design Parameters

The parameters that will be considered in designing GSSD-E for Sony Environment are listed below:

Core Product Sectors

1. Electronics – Audio, Video, Televisions, Information and Communication, Electronics components and others.
2. Games – Games console and software business
3. Music – Music software business
4. Pictures – Movie/TV programming business
5. Insurance – Life insurance and non-life insurance business
6. Others – Leasing and credit card businesses, development and operation of location-based entertainment complexes, and other businesses

Functional Units

- Regional Environmental Conservation Committees (5):
  1. Europe
  2. China
  3. Asia
  4. Japan
  5. Americas
- Environmental Offices at Business Units:
  1. Network Companies (7): Home, Mobile, Semiconductor, Core Technology, Broadband Solutions, Digital Telecommunications, and Display
  2. Sony Computer Entertainment, Entertainment Business (Music/Picture), Insurance and Finance Business
  3. Group Companies

7.3 GSSD-Enterprise for Sony Environment

Using the template developed earlier, a meta layer can be defined that will act as a portal to a knowledge base function and to a knowledge management systems function.

7.3.1 Meta-Level:

Ring: Regional Environmental Conservation Committee – Asia, China, Europe, Japan and the Americas
Slice: Network Companies, Group Companies, Sony Music, Sony Pictures, Sony Computer entertainment

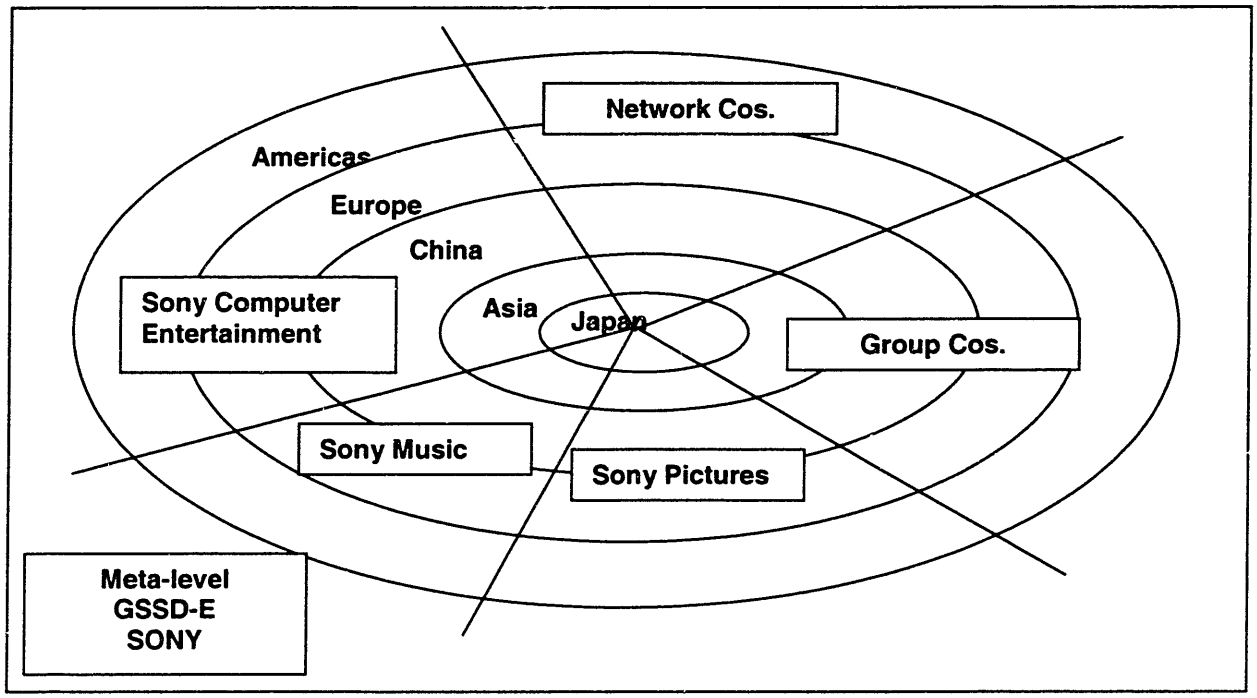


Figure 23: Meta-level GSSD-E for Sony

7.3.3 Type IV GSSD-E Design Stage I: Knowledge Base

From the meta-level above, a knowledge base can be designed for Sony Network Companies with the following design parameters below:

Ring: Sustainability Action Issues, Sustainability Support Systems Issues, Environmental data, Regional Regulatory/Economic/Social/Political Issues and Environmental Strategy
Slice: Function – Home, mobile, semiconductor, core technology, broadband solutions, digital telecommunications and display

Concept: Sub-Ring:
Sustainable Action Issues: Green Procurement and Purchasing, Energy Conservation, Resource conservation and Waste Management, Chemical Substances Management, Facility Design and Construction, Product Planning and Design, Environmentally Conscious Products, Distribution, sales and service, Product Recycling, and Environmental Activities in various business operations.
Sustainability Support Systems Issues: Environmental Technology Development, Environmental Education and Support Programs, Environmental Business Models, Environmental Communication, Risk Management System and Environmental Auditing, Occupational Health & Safety and Disaster Prevention, and Community Relations Activities
Environmental Data: Environmental Accounting, Energy, Water, Chemical Substances, Waste, Products
Int'l/Regional/Local REPS: Treaties, legislation, policies, societal perceptions of enterprise impact on environment, etc.

Environmental Strategy: Vision, Commitment, strategic plans for environmentally conscious operations, etc.

Concept: Sub-slice
Further differentiation of product/service sector into more specialized component market segments – e.g. Broadband solutions can be further divided into software and hardware, product design, manufacturing and delivery, and multiple types of broadband solutions like fiber optics, cable, ADSL or ISDN.

The GSSD-E Knowledge Base design for Sony is shown in figure 24.

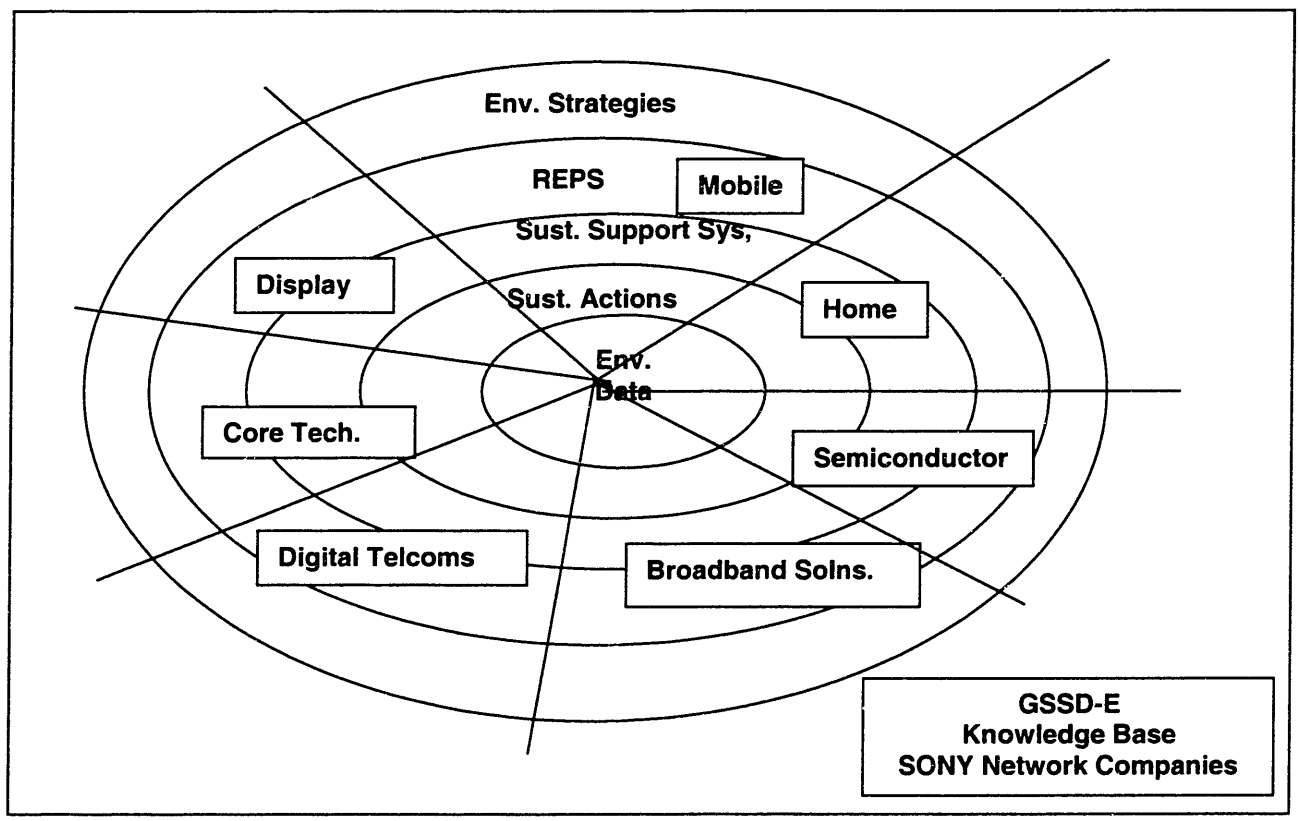


Figure 24: Design Stage I, Type IV GSSD-E Knowledge Base

7.4 Further Research and Implementation

While design stage I has been presented in this chapter, design stage II and stage III, and indeed, further necessary refinement of the knowledge base design will be required, and this will be possible only with the availability of more information about Sony and its enterprise organizational structures, its alliances, and other enterprise information that may be available in a consistent form. It will require a much more thorough investigation, survey and audit of Sony's enterprise activities, organizational structure and planning processes in order to construct a more precise and useful knowledge base, and the designs above show that a GSSD-type knowledge system can be deployed to provide an integrative mechanism for creating a knowledge

networking technology infrastructure. What follow will be issues of people actually using the infrastructure in ways that are optimal for innovation and organizational learning, and these will be governed in some sense by the organization's knowledge networking people policy, the other crucial competence in mobilizing competence in leveraging the proposed infrastructure.

The focus of the examples and designs have been on multinational enterprises (MNEs) thus far, and a more thorough investigation of GSSD's applicability to the multinational value network (MVN) has yet to be explored. IT and human policies can be used creatively to resolve the challenges that multinational value networks pose to knowledge creation and knowledge sharing.

8. CONCLUSION

This thesis set out to investigate the nature of knowledge networking and to synthesize an appropriate knowledge networking strategy for global enterprises and enterprise value-networks. This thesis then adapts a non-profit research-focused knowledge networking technology strategy for the context of multinational enterprises and multinational value networks. The thrust to conceptually seek out a global knowledge networking strategy was in response to two salient trends - the increasing global expansion of business enterprises as a result of advances in information and communications technology, and the formation of multinational value networks of multinational enterprises and domestic enterprises. The imperative for firms to go global with the increasing pace of IT-fueled globalization and the market dynamics arising from enterprise innovations and the demand for increasingly sophisticated products and services have more than ever, accentuated the need for knowledge-based thinking. Rapid decision-making of the right kind is needed. It is also absolutely contingent on knowledge. Hence empowering 'knowledge-workers' with decision-making authority and mobilizing knowledge to ensure organizational learning and facilitate innovation requires mechanisms that are presently inadequate. The knowledge network, a conceptual innovation that draws on information systems engineering, organizational design, behavioral studies and political science, is the solution proposed in this thesis. Yet there are knowledge networks that have not been successful in the past as candidates for global-scale knowledge networking – those that focused solely on either human policies or on technology policies – and there are fundamental inadequacies that need to be resolved in order to formulate a knowledge networking strategy that has the capabilities of human-centric and technology-centric networks. The integrated knowledge network has been analyzed and presented, as has the integrated knowledge networking strategies for the multinational enterprise, the value networks and the multinational value networks. In the case of the latter, the complexities of cross-border, global knowledge networks were discussed, as were the assessments and knowledge required in finding the right partners for the value network and in ensuring the success of the value network.

A major contribution of this thesis has been to propose a global knowledge networking technology strategy for global businesses, as a foundation on which more enterprise-specific human-policies could be deployed. A core component of this technology strategy is derived from the GSSD (Global System for Sustainable Development) initiative that was developed in MIT to establish a global knowledge base in sustainable development. The proposed analog for GSSD for enterprises, known as GSSD-E, was expressed in a series of four possible designs, with the fourth design being an integrated platform for all the technology strategy components earlier articulated as part of the integrated knowledge network. The focus of design for GSSD-E here is the multinational enterprise, with a brief account of applications for the multinational value network. A general task framework was proposed that could schedule the roll-out of the technology strategy in its entirety, and a case-study involving just the initial design stage for an MNE, in this case Sony, was examined. Further work on this thesis will involve actual fieldwork in surveying MNEs and value network enterprises to ascertain the use of knowledge networking practices, the practicability of integrated knowledge networking and the most common pathologies that could defeat a global knowledge networking initiative. Using GSSD concepts to develop a pilot GSSD-E model will be a next step in the actual testing of a university-developed solution for the knowledge demands of the enterprise.

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