STRATEGIC SOURCING AND TECHNOLOGY
SUPPLY- CHAINS

by

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ABSTRACT

The rapid pace of change has become the one constant in today's fast-paced and brutally competitive environment. As change becomes more pervasive, whether in the form of technological innovation, turbulent markets, or growing internalization, change will become an increasingly important source of competitive advantage. The competitive requirement to master change has caused many firms to seek dynamic capabilities over static advantages. This has focused attention over the last decade on the design of the firm as a critical strategic lever in creating and exploiting competitive discontinuities arising from change for competitive advantage.

Existing firm design models are ill-posed to exploit the competitive power of firm design in a world of constant change. Core competency-based approaches and other traditional mainstream methods seek to maximize today's opportunities based on today's capabilities. Their inward focus and emphasis on static advantage fails to capture the richness and potential opportunities in the future for sustained competitive advantage. As change becomes even more rapid, the failure to plan for tomorrow can make for short-lived competitive successes today.

The focus of this thesis is on the development of methods to support the extended evaluation and design of the firm and its value-chain optimized for today's business environment marked by change. A Strategic Sourcing model is presented for this purpose that is both forward and outward looking. The model represents a dramatic departure from traditional "inside-out" firm design methods by recognizing the impact of specialization choices on the future response of the firm to changes in its environment. The requirement is critical to exploiting today's opportunities while fostering option-like capabilities to tap into tomorrow's possibilities. The work therefore represents the beginnings of the next paradigm in firm design by emphasizing the family of possibilities to sourcing decisions in order to promote experimentation and evolutionary adaptation of the firm to changes in markets and capabilities for sustained competitive advantage.
The utility of the research and potential to dramatically improve a firm’s speed, flexibility, and cost-structure was demonstrated in its application and implementation at an automotive manufacturer. The firm design decisions were made simultaneously with respect to the firm’s product, process, and supply-chain requirements in the context of the firm’s value hierarchy of products and services. The grounding in the realities of firm design was key to achieving global and not only local optimums while facilitating the deployment and implementation of the results at the automotive manufacturer. Future research and opportunities to further exploit the dynamic character of firm design in the 21st century are recommended.

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Title: Associate Professor of Management
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TABLE OF CONTENTS

CHAPTER ONE: CHANGE AND THE DESIGN OF THE FIRM 7

1.1 INTRODUCTION 7
1.2 CHANGE AND BUSINESS STRATEGY 7
  1.2.1 CHANGES IN TECHNOLOGY 8
  1.2.2 CHANGES IN INTERNATIONALIZATION 9
  1.2.3 CHANGES IN SUPPLY AND DEMAND PATTERNS 10
1.3 THE NEW COMPETITIVE MANTRA 11
1.4 FOCUS OF THE THESIS 12

CHAPTER TWO: DOES FIRM DESIGN REALLY MATTER? 14

2.1 INTRODUCTION 14
2.2 FIRM DESIGN BASICS 14
2.3 EXAMPLES 16
  2.3.1 TOYOTA: SUCCESSFUL DESIGN 16
  2.3.2 GENERAL MOTORS: SUCCESSFUL REDESIGN 18
2.4 SUMMARY 20

CHAPTER THREE: THEORIES AND APPROACHES TO FIRM DESIGN 21

3.1 CHAPTER INTRODUCTION 21
3.2 OVERVIEW OF APPROACHES 21
3.3 TRADITIONAL APPROACH 22
  3.3.1 ISSUES IN PRACTICE 22
  3.3.2 COST-BASED ANALYSIS APPLIED TO ABS SOURCING 24
  3.3.3 SUMMARY OF COST-BASED ANALYSIS 26
3.4 TRANSACTIONS-BASED APPROACHES 27
  3.4.1 ISSUES IN PRACTICE 28
  3.4.2 TRANSACTION ANALYSIS APPLIED TO ABS SOURCING 29
  3.4.3 SUMMARY OF TRANSACTIONS ANALYSIS 31
3.5 CORE COMPETENCY APPROACHES 32
  3.5.1 ISSUES IN PRACTICE 33
  3.5.2 CORE-COMPETENCY ANALYSIS OF ABS SOURCING 34
  3.5.3 SUMMARY OF CORE COMPETENCY APPROACH 36
3.6 SUMMARY OF ISSUES AND OPPORTUNITIES 37

CHAPTER FOUR: STRATEGIC SOURCING MODEL FOR FIRM DESIGN 39

4.1 INTRODUCTION 39
4.2 CAVEATS 39
4.3 BACKGROUND 40
4.4 OVERVIEW 42
4.5 DECISION RULES 47
  4.5.1 FORM UNIT OF ANALYSIS 47
  4.5.2 ASSESS STRATEGIC IMPORTANCE 49
  4.5.3 SUSTAINABILITY 52
  4.5.4 VULNERABILITY 54
  4.5.5 UPSTREAM CAPABILITY ASSESSMENT 56
  4.5.6 BECOMING CAPABLE 58
4.5.7 SUPPLIER CAPABILITY TEST 60
4.5.8 DOWNSTREAM CAPABILITY TEST 62
4.5.9 INTEGRATION TEST 63
4.5.10 SUPPLY-CHAIN ASSESSMENT 65
4.6 SUMMARY 66

CHAPTER FIVE: IMPLEMENTATION IN INDUSTRY 67

5.1 INTRODUCTION 67
5.2 IMPLEMENTATION ISSUES 67
5.3 IMPLEMENTATION STRATEGY 68
5.4 RESULTS 69
  5.4.1 INITIAL TESTING PHASE 70
  5.4.2 VALIDATION PHASE 71
  5.4.3 DEPLOYMENT PHASE 82
5.5 KEY LESSONS 83
5.6 SUMMARY 85

CHAPTER SIX: SUMMARY OF THE THESIS 86

BIBLIOGRAPHY 89
Chapter One

Change and the Design of the Firm

1.1 Introduction

The rapid pace of change has become the one constant in today's dynamic world. Change extends not only to markets, technologies and industries, but to the guiding concepts and business principles governing competitive advantage. It should not be surprising to find the winds of creative destruction in full force as governments, companies, and business leaders search for, act on, and react to the many panacea's promised by the academic and the consultant communities. The objective of this chapter is to introduce the new competitive realities to both highlight the opportunities and motivation for research into firm design which is the subject of this thesis.

1.2 Change and Business Strategy

Change today is all pervasive. Firms are being attacked on all fronts as competitive discontinuities appear to be everywhere. Of particular relevance as firms enter the 21st century have been the continuous changes in internalization, the patterns of market supply and demand, and of course, the evolution and revolution in technology. The following is a brief summary of these changes and their impact on competitiveness and business strategy.
1.2.1 Changes in Technology

Perhaps the most pervasive agent of change is technology - in micro-electronics, telecommunications, and manufacturing (Bailey and Shan 1995). What was once unthinkable has become the accepted and even the expected. Technology has become a key enabler expanding not only the possibilities for products and services, but also to the way in which business is conducted (Davidow and Malone 1992).

The impact of technological change on the business process has occurred along a number of dimensions. The most telling has been the role of information technology in reducing the cost of communication. Improved communication capabilities have not only reduced the cost of business transactions, but also improved their quality, accuracy and speed (Goldman, Nagel, and Price 1995). The resulting shift in the cost of markets over hierarchies has forced many to rethink the boundaries of the firm, and in turn, fostered new and innovative forms of governance, such as the emergence of "networked organizations" and "virtual factories" (De Meyer 1993).

The rapid speed of business and ease of engaging in competitive arbitraging enabled by technology and these new organizational forms have further served to shift the sources of competitive advantage from tangible to intangible assets. Indeed, many believe that human capital and innovatory capability are the only true remaining sustainable sources of advantage in a world of ever expanding technological possibilities (Thurow 1992). As such, firms in the 1990's are challenged daily by the need to adapt to and exploit new technologies with their dual-fold potential to confer and or eradicate a firms competencies and competitive advantage (Grant 1995).
1.2.2 Changes in Internationalization

In addition to technology, the most fundamental trends since World War II has been the increasingly global nature of competition (Bailey and Shan 1995). Though much has been written about the growth of overseas producers and markets, less attention has been focused on the changing nature of internationalization and its impact on the competitive process. The success of Japanese producers in particular have challenged the conventional notions of globalization based on the product life-cycle model (Vernon 1966). U.S. producers can no longer rely on achieving competitive advantage through international integration that exploits home-market economies of scale, advanced market access, and low-cost overseas labor to produce standardized products on a global basis (Levitt 1983).

The new competitive approaches to globalization can be traced to a number of developments that challenge conventional assumptions regarding internationalization. This includes the increasing mobility of assets, the improvements in global scanning made possible by technological advancements, and the expanding sophistication of overseas consumers (Vernon 1992). Of greater significance, the new forms are increasingly enabled by new and innovative approaches to internalizing locational advantages through unique governance strategies and home-country derived capabilities (Bartlett and Ghoshal 1989). This is exemplified by the once seemingly impossible use of US laborers by transplant manufacturers to competitively supply both home and domestic automotive markets (Brown 1989). These and other approaches to internalization, which are difficult to appropriate and imitate in spite of much effort, are serving to re-write the rules of competition, and with them, the incumbent capabilities of many producers forced to compete in today's world economy.
1.2.3 Changes in Supply and Demand Patterns

A related phenomenon has been the dramatic changes in the supply and demand patterns of goods and services over the past several decades. This includes an explosion in product variety and seemingly endless outpouring of new products in every conceivable size, color, shape and price (Goldman, Nagel, and Price 1995). Such products are not only demanded at an increasing frequency, but also at a lower-cost and even higher quality than the products they replaced. These and other changes in demand can be traced in part to increasing product maturity, shifts in demographic patterns, changes in consumer tastes, innovation, and the intensity of competition precipitated by the availability of high-quality, low-cost overseas products (Bowman and Kogut 1995).

The changes in demand have had equally dramatic impact on supply strategies. Quality and service have replaced price as the principal medium of competition between firms (Grant 1995). No longer can firms count on long production runs of standardized products where service is an afterthought (Fisher and MacDuffie 1995). Nor can firms hope to find isolated profit havens and market segments sheltered from foreign and even domestic competitors. If anything, firms have become hostages to "consumerism" but at a global scale.

These developments have challenged the central strategic proposition of large industrial firms for much of the 20th century that sought competitive advantage through economies of scale and scope via investment in mass production and mass distribution (Dertouzos, Lester, and Solow 1989). In the 1990s, moreover, even industries that focused on product differentiation as the primary basis for competitive advantage were not immune from the demands of the marketplace (Grant 1995). Intensifying competition saw the quest for efficiency become a pre-requisite for profitability for firms in the
telecommunications, health care, aerospace, and banking industries. Cost and
differentiation, along with being fleet-of-foot, the once seemingly separate and mutually
exclusive strategies, have become central to mastering the competitive challenges imposed
by today's demanding and turbulent marketplace.

1.3 The New Competitive Mantra

As change becomes more dramatic and prevalent - whether in the form of
increasing internalization, innovation, or turbulent markets - change has become an
increasingly important source of competitive advantage (Bowman and Kogut 1995). The
desire to master change has caused many to seek dynamic rather than static advantages
(Grant 1995). As noted above, this includes a shift in the competitive focus increasingly
away from tangible to intangible assets. It also has caused a renewed emphasis on the
importance of organization and governance in creating and sustaining intangible
ownership advantages all the while preserving and securing the necessary economies of
specialization and scale to compete with razor-thin margins (Grundy et al 1994).

It is not surprising given these and other competitive thrusts to see the winds of
creative destruction in literal use. Firms this past decade have pursued strategies of
restructuring, downsizing, outsourcing, "lean production", and vertical de-integration with

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<td>Flexibility</td>
<td>• OutSourcing</td>
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<td>Speed</td>
<td>• Alliances</td>
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Figure 1: Impact of Change
brutal efficiency in response to change (figure 1). Businesses have further scrambled to redefine the very essence of their firms with alliances, partnerships, joint ventures, and cooperative relationship with both partners and even competitors up and down the value chain. Speed, flexibility and efficiency have become the new competitive mantra and nothing is sacred in their unholy quest.

1.4 Focus of the Thesis

While much attention has been paid to the immediate welfare effects of these business practices, less attention has been directed at examining and understanding the long-term competitive impact on firms from these extreme actions. The immediate effects seem clear enough: denominator management at face value has increased profits and competitiveness. The impact on longer-term capabilities, however, is always less self-evident. Many have begun to wonder "how many babies have been thrown-out with the competitive bath-water" (Fine 1995).

To a certain extent, the failure to comprehend the long-term implications of redesigning the firm can be traced to uncertainty. No one can anticipate the kinds of change firms will face in the 21st century. However, it is clear that change will be the one constant. As such, firms will need to constantly adjust their competitive focus and seek high-value differential advantages where ever they may arise - whether internal or external to the firm or even industry.

The focus of the thesis is on the development of methods to support the evaluation and design of the firm and its extended value-chain - the firm's technology-supply chain - for competitive advantage. As will be demonstrated, the rapidity of business has outpaced much of business theory on firm design. The academic community
has only begun to turn their attention away from the firm as the unit of analysis to the extended organization (Fine 1995). On the one hand, the traditional business tools for extended business analysis fail to reflect the dynamic character and richness of decisions facing managers today. On the other hand, more recent developments based largely on general theories of the firm suffer from their lack of specificity and descriptive capabilities. An integrated decision guide is presented optimized for today's business environment based on traditional and evolving academic thought to address the design of the firm and its extended supply-chain. Examples from implementation at an major automotive manufacturer are presented. Future research and opportunities to further exploit the dynamic character of firm design in the 21st century are recommended.
Chapter Two

Does Firm Design Matter?

2.1 Introduction

The burst of new thinking and renewed attention on the design of the firm is startling. Some believe the radical rethinking in the design of corporations is no less revolutionary than the wave of innovations associated with the names of Frederick Taylor and Henry Ford at the dawn of this century (Bowman and Kogut 1995). Whatever the future may hold, it is clear that the design of the firm will remain integral to corporate strategy and the pursuit of competitive advantage. The focus of this chapter is to briefly introduce the basic strategic issues and concepts associated with the design of the firm. To help illustrate the challenges and potential for competitive leverage, examples of innovative approaches to firm design will be briefly reviewed.

2.2 Firm Design Basics

The design of the firm has its roots in the most fundamental of economic laws. As Adam Smith observed so long ago, people can produce more if they cooperate, specializing in their respective activities and then trading with one another for the goods and services they desire (Milgrom and Roberts 1992). Indeed, the historical development
and existence of firms and the specific details of their structures, policies, and procedures reflects attempts to achieve efficiency and hence competitive advantage through choices in specialization and cooperation (Holmstrom and Tirole 1989).

At a strategic level, the issue of firm design can be reduced to the question of what the firm should specialize in. The “what” represents a wish list of the capabilities to support the firm’s product and marketing strategies. What a firm wants to be capable of doing, however, greatly depends on how it goes about achieving the gains from specialization. The what and how are inextricably linked and matter (Kogut and Zander 1992). The problem of firm design at a strategic level thus becomes:

- *What activities in the value-chain should a firm specialize in, that is, what activities should be performed by the firm?*

- *How should the firm internalize and coordinate these activities with the activities of other specialized producers in order to achieve the gains from specialization?*

The choice of specialization and approach to coordination define the firm, its boundary, and ultimately, the capacity to uniquely create value and achieve competitive advantage.

The lack of a competitive equilibrium in firm design confirms the difficulty of these decisions. Deciding what to do requires information about resource availability, technological capabilities, and market opportunities that is not readily available. Often this information is localized and dispersed among a complex web of value providers. The resulting presence of information asymmetries further complicates the question of how. Aside from uncertainty, information asymmetries can quickly give rise to market imperfections and market failure during coordination and cooperation. This may be the
result of explicit or implicit actions of competitors. Even if the all the information were available with certainty, determining what to specialize in, using what methods and materials with whom, for whom, would remain an overwhelming large and complex problem (Milgrom and Roberts 1992).

Finally, the choices of what and how are subject to the dynamic nature of competition induced by market turbulence and technological change. Indeed, many of the kinds of change noted in Chapter 1 have served to expand the options of what to do and how to do it. The issue is central as today’s specialization advantages can quickly become tomorrow’s incumbent rigidities and firm redesign traps (Prahalad and Hammel 1990). The choice of what to do and how to do it must therefore not only reflect today’s competitive realities but also anticipate tomorrow’s competitive opportunities. Firm design is a problem fraught with uncertainty, ambiguity, and lack of control of the variables affecting desired outcomes.

2.3 Examples

The attention on the design of the firm would seem justified given the central role of specialization and coordination in creating value and conferring competitive advantage. The business literature is full of examples of firms that have exploited the power of firm design for this purpose. The following will briefly illustrate the role of choices in specialization and coordination strategy in firm redesign for competitive success.

2.3.1 Toyota: Successful Design

Much of the success of Japanese automotive producers has been credited with their strategic innovation in “Lean Production” (Womack et al 1990). Toyota’s unique
approach to production has allowed Toyota and others to achieve a combination of performance objectives of low-cost and high-quality that were previously viewed as conflicting and unobtainable in the traditional mass production paradigm (Grant et al. 1991).

The uncertain imitability of the Lean Production System, as evident by attempts by Western producers to copy the specific elements such as Just-In-Time inventory systems, suggests Toyota’s competitive advantage is more than a combination of unique practices and systems (Reed and DeFillippi 1990). Indeed, research by Clark and others supports the view that the ability of Toyota to achieve low-cost, high-quality, and flexibility without the capital requirements of mass producers stems from their unique approach to firm design and supply-chain management. Forty years after it's inception, the differences between Toyota and traditional mass producers in specialization and coordination strategies are striking:

- **Choices in specialization**: Toyota currently enjoys a far lower degree of specialization and integration of component development than traditional mass producers in the automotive industry. The differences are especially pronounced compared to General Motors (GM). Toyota specializes in only 30% of their components versus General Motors that currently produces over 70% of its components internally.

- **Choices in coordination**: Equally significant differences have been noted in the approach to coordination and firm boundary management. Not only do suppliers have valuability, but the Japanese producers leverage that capability for mutual advantage (Clark and Fujimoto 1991). This stands in contrast to the adversarial, arms-length relations employed by traditional mass producers. The elevated levels of service,
innovation, efficiency, and reliability that characterize Japanese buyer-supplier networks are central to the reduction in variation, continuous improvement, and elimination of waste that are the cornerstones of Lean Production (Lamming 1993).

This unique approach to firm design, characterized by a tightly woven web of buyer and supplier networks, has allowed Toyota to enjoy the closeness, continuity, and reliability associated with vertical integration but with all the benefits from leveraging outside specialist providers (Clark and Fujimoto 1992). The success of Toyota over traditional vertically integrated manufacturers should come as no surprise.

2.3.2 General Motors: Successful Redesign

Given the above, it is imperative to examine how General Motors and other traditional mass producers are redesigning their firms in the face of a more successful model. It is somewhat ironic given that the early success of GM over Ford can be similarly traced to innovations in firm design by Alfred P. Sloan (Chandler 1962).

At face value, the strategic redirection and motivating redesign principle at GM and other US automotive manufacturers this past decade has been one of vertical de-integration. This includes the much publicized use of outsourcing, reductions in the workforce, and sale of several unprofitable component divisions. Many have further noted the abandonment of traditional adversarial supplier relation practices and the adoption of “Japanese-like” techniques (Bowman and Kogut 1995).

Less subtle but more significant have been changes in internal supplier coordination and firm boundary management practices. The heart of these changes are the use of market mechanisms to award contracts to both internal or external suppliers.
(except for core technologies). Once contracts are awarded to either the internal or external supplier, for example, hierarchical-like coordination mechanisms, such as resident engineers and life-time contracts, are employed to ensure mutual collaboration, knowledge-sharing, and cooperative problem-solving. The concept combines the best of vertical integration with lean production to create a truly unique approach to product development and supply-chain management. The advantages from this innovative approach to firm design include:

- economies of scope and scale by marrying the innovatory capacity of a global supply-base with the cost advantages from internalizing long-production runs of standardized components,

- automatic bargaining power and competitive leverage to ensure internal and external suppliers provide the lowest-cost, highest quality products and services without recourse to hold-up or hostage-taking,

- speed and flexibility advantages conferred from specialized providers without the motivational costs, investment requirements, and overheads associated with duplicating such capabilities through vertical integration

In addition, the permeable nature of the firm’s boundary facilitates the diffusion of new ideas and technological opportunities to nourish, enrich, and enhance GM’s core capabilities. The simultaneous diffusion of ideas into and out of the company should further enhance the capabilities of the quasi-integrated suppliers, and synergistically raise the combined capabilities of GM and its supply-base for mutual competitive advantage. These practices were well evident in GM’s recent sourcing of brakes. The eventual
sourcing decision provided the GM platforms with the latest in braking technology from the internal supplier but at a 40% reduction from the initial quoted price (WSJ 04/11/96).

2.4 Summary

As these brief examples illustrate, the design of the firm is key to creating a unique source of value and conferring competitive advantage. The redesign of the firm has similarly held an important role in changing the rules of the game as practiced by Toyota and GM in the past and present. Central to these decisions are the questions of what to do and how to do it. The problem is especially acute for established providers. Changes in the firms strategy and structure, while taking time and resources, also exposes the firm to competitive risk. The outsourcing of the firms crown-jewels has become a cliché. The subject of the next chapter is to examine the methods used by managers in redesigning the firm for competitive advantage.
Chapter Three

Theories and Approaches to Firm Design

3.1 Chapter Introduction

Research into firm design for competitive advantage is not a new concept in spite of the intensity and central pre-occupation of the business and academic communities this past decade with the redesign of the firm. It would be a mistake, however, to believe that the current public discourse on the design of the firm is simply a phase of some eternal cycle. The fundamental nature of change outlined in chapter 1 have challenged the very assumptions underlying theories on the design of the firm (Bowman and Kogut 1995). As illustrated in chapter 2, this includes a historic structural break in the practice of organization and management, and the shift from large to smaller, leaner firms (Grant 1995). It is therefore appropriate to survey the relevant literature and practical methods used in the design of the firm to assess their utility and value in today’s brave new world of change.

3.2 Overview of Approaches

Several competing schools of thought and dominate practices to firm design have emerged this past century. The most common and pervasive approach is based on the economic analysis of the alternatives to specialization in a firms value-chain, commonly known as the “make or buy” process. This practical, operation-based decision making
guide has been supplanted in recent years by methods founded on general theories of the firm. As detailed below, this includes an approach based on minimizing transaction-costs that arise from ownership advantages of specific assets. The approach represents an important contribution by addressing the role of coordination and boundary management decisions in the context of alternative methods to specialization. The final firm design guide of increasing practical significance is also founded on a general theory of the firm. The Core-competency based approach guides specialization and coordination choices to maximizes a firms unique advantage relative to the competitors.

To illustrate the strengths and weaknesses, the approaches will be applied to a real-world problem observed at a US automotive manufacture. The problem concerns whether the firm should continue to specialize in the development and manufacture of Anti-lock Braking Systems or should leverage an outside provider.

3.3 Traditional Approach

The most common and perhaps basic approach for deciding what activities a firm should specialize in is loosely based on the economic analysis of alternatives to a firms value-chain. The objective of the approach is to secure the most efficient source for each stage of the value-chain, whether internal or external to the firm. Ford and Farmer have termed this the operational approach to value-chain design.

3.3.1 Issues in Practice

The traditional approach is characterized in practice by a near singular emphasis on cost as the deciding variable in sourcing business activities (Welch 1992). It is the apparent calculability of the financial aspects of specialization, with the often associated
assumption of precision, that leads to a basis towards these considerations (Newman 1989). The traditional approach is well suited to activities in the value-chain where the cost-structure can be calculable and the alternatives to specialization quantified. This is reflected in its historical application to production and manufacturing sourcing strategies (Drtina 1994).

The traditional cost-based approach is operationalized as a series of “make or buy” decisions shown in figure 2 (Gambino 1980). The decision to make or buy is generally made per item on the basis of cost savings or operational advantages, such as the optimal utilization of capacity (Dobler, Lee, and Burt 1984). Within this framework, the design of the firm is effectively treated as a series of independent events. The value potential of the firm becomes the sum of the individual value-contributions from the independent specialization choices.

![Figure 2: Lateral Slicing of the Value-Chain](image)

The serial approach to firm design based on cost minimization is exemplified by the Total Cost of Ownership (TCO) used to source business activities (Dobler 1993). The TCO calculates the costs from specialization at each stage of the value-chain using
the process shown in figure 3. This costs include expenses incurred in working with a supplier to develop a new or improved part all the way through warranty claims. The most cost effective source for design, engineering, and manufacturing, becomes the firms sourcing strategy.

3.3.2 Cost-based Analysis Applied to ABS Sourcing

The traditional method based on cost minimization was observed at the US automotive manufacturer. The use of the cost-based analysis to guide sourcing decisions was a well established practice at the firm and played a primary role in sourcing decisions in the past.
This policy was also applied to determine the sourcing strategy for ABS. As summarized in the following, the decision was based on the cost to “make” ABS versus “buy” ABS.

- **Option #1: Cost to Make**: Similar to the TCO method, the firm initiated a “cost request” to calculate the cost from specialization at each stage of the value-chain. This included the costs required to design, development, and test the system as well as the cost of the production system. In the case of validation, for example, the estimated costs were based on the number of test-engineers, development “mule” vehicles, and test-facilities needed. The cost of the test-site was also included based on transfer-costs. Standard overhead rates were next applied in proportion to the labor hours at each stage of the value-chain to calculate indirect costs. The total calculated labor costs and estimated capital expenditures to specialize in the development and manufacture of ABS were then reduced to a piece cost and investment estimate based on the anticipated volume projections.

- **Option #2: Cost to Buy**: The calculation of the cost to “buy” was provided by several suppliers bidding on the contract. The estimates were in the form of piece and investment costs covering ABS development and manufacture.

Table I is a summary comparison of the calculated costs. The reported costs to specialize internally were greater than leveraging outside specialist providers. A disparity in the costs were found even among suppliers. The Japanese provider, for example, was approximately 20 % less expensive than the leading German supplier, and approximately 30% less costly than insourcing ABS. The cost differentials primarily reflected differences
in the level of unionization. The initial recommendation was therefore to outsource the production of the component to the Japanese provider.

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<th>Piece Cost Estimate</th>
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<tr>
<td>Internal Downstream Division</td>
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<td>German Supplier</td>
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<td>Japanese Supplier</td>
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Table I - Comparison of Piece Cost for Make versus Buy

3.3.3 Summary of Cost-based Analysis

As exemplified by the above, the traditional method is based primarily on the comparison of calculable costs. A recent study by BCG of 100 manufacturing companies found similar examples. The study also demonstrated a bias in the traditional approach toward the lower-cost solution (Quinn 1994). While one would expect in general to find outside firms that specialize in a given activity to have lower costs, it is unclear whether the traditional methods accounts for all costs associated with utilizing an external value provider. Additional factors and potential problems in the traditional method noted by academics and practitioners include:

- *Missing costs*: By definition, the traditional method only incorporates those costs that can be articulated and measured. Often ignored as a consequence are organizational costs, especially the added costs from coordinating and managing a dispersed supply-chain arising from such cost-based sourcing decisions. Costs from poor quality arising from failures in coordination or integration are also not included.
• **Biases in estimates:** A related problem concerns the sources of the data used in the financial analysis of alternative. The use of traditional cost-accounting methods to estimate piece cost is often flawed, especially for low-volume production (Johnson and Kaplan 1987). The assumption of direct labor as an indicator of indirect cost is similarly problematic. These and other biases in calculating costs may greatly distort the costs from specialization decisions.

• **Veracity of assumptions:** A similar criticism concerns the validity of the inputs in the model. The quoted purchase prices by vendors may reflect competitive biases and or under-represent the cost from supplier opportunism and market failure (Walker and Weber 1987). This was apparent in the above estimates by the Japanese producers. The long-run costs may prove to be significantly higher as suppliers begin to exercise greater bargaining power.

As such, the lateral slicing and reconfiguring of the value-chain based on the economic analysis of alternatives is an important but incomplete tool to support firm design and value-chain management for competitive advantage. There are other deficiencies especially significant given the nature of change and future of business competition discussed in Section 3.6.

### 3.4 Transactions-based Approaches

An alternative approach to the traditional “cost-based” method is based on a general theory of the firm developed by Coase and operationalized by Williamson among others (Coase 1937). In place of evaluating the cost to a firm from specializing in an activity, the transactions-based approach extends the analysis to include the costs from transacting within and between firms arising from the need for coordination (Williamson
1979). This includes such costs as negotiating, searching, contracting, enforcing, and motivating, that depend on both the nature of the transaction and on the way it is organized (Milgrom and Roberts 1992).

In the search for efficiency, the theory assumes, firms will adopt an organizational mode that best economizes on these transactions costs. This includes the use of "hierarchies" (i.e., vertical integration) or "markets" (Williamson 1975). Changes in these arrangements, such as de-integration and outsourcing, are efficiency-enhancing responses to changes in the external environment in which the arrangements exit (Stuckey and White 1993). The lack of competitive equilibrium in firm design today reflects the changes in the costs of business transactions.

3.4.1 Issues in Practice

While a simple and profound idea, Coase and others have not been very explicit about the origin and nature of these transaction costs (Teece and Monteverde 1992). The concept has been operationalized by focusing on the notion of asset specificity. This can take the form of specific human capital, physical capital, something specific to a site or dedicated to a specific purpose (Klien 1978). The incentive to use hierarchies over markets depends on the quasi-rents that can be generated through the best-use of that asset (Williamson 1979). In other words, if something is valuable to a firm, there is a strong tendency to specialize in that activity rather than risk the costs from re-contracting, hold-up, and other forms of opportunistic behavior arising from market imperfections and or market failure.

Though empiricists have struggled to prove the validity of these concepts, the underlying premises concerning coordination and firm boundary management are common
to modern business strategy (Teece 1992). Surveys by purchasing managers have consistently shown that while cost remains the number one criteria in sourcing decisions, the threat from hold-up and recontracting either from supplier concentration or reliance on specific assets, remains a key influence. This is noted in the common practice whereby automotive manufacturers purchase the specialized jigs, tooling, and equipment used by the supplier (Monteverde 1995). This joint form of ownership of the productive assets achieves a measure of quasi-integration to lower transaction-costs to both supplier and automotive manufacturer (Monteverde and Teece 1982). The growth of alliances, partnerships, and cooperative relationship represent attempts at addressing the gains from specialization through unique and flexible coordination strategies. These stand in contrast to the development of large, vertically integrated structures motivated largely by cost-based decisions that dominated firm design and management during much of the twentieth century (Grant 1995).

3.4.2 Transaction Analysis Applied to ABS Sourcing

While the cost-based analysis of alternatives was the mainstream decision device to determine the ABS sourcing strategy for the automotive manufacturer, considerable discussion centered around transaction-related concerns. This includes the following:

- **Supplier Opportunism**: A chief concern with outsourcing ABS development and manufacture was the potential for supplier opportunism. External suppliers would make the firm overly “dependent” and “vulnerable”. Problems in recontracting and hold-up could occur in the form of cost-overruns and quality-problems “discovered late in the development process. Moreover, it would not be feasible to monitor or enforce original contractual obligations under such circumstances. The problem is especially true of defects and the potential damage to the firms reputation should
failure in the ABS unit contribute to fatalities. Finally, the leveraged position also opened the door to the potential for hostage taking as the supplier was especially interested in acquiring more business in other component areas within the firm.

• **Organizational (motivation) costs:** The other major transaction-related consideration was the impact of the union on utilizing an external value-provider. This included the threat of hold-up by the union owing to the potential loss of work overseas. In the case at hand, the decision to outsource ABS would require the firm to guarantee the jobs lost to the outside specialist. Conversely, further specializing in manufacturing would only add to the bargaining power and hold-up potential of the union. The decision to outsource took on a secondary importance in serving as an important signal to the union.

• **Organizational (coordination) costs:** Another concern given much less weight was the additional costs and potential for problem in coordinating and managing the external activity. The concerns were especially valid given the:

  - geographic separation,
  - cognitive distance,
  - lack of prior working arrangements, and,
  - incompatible technological infrastructures.

Many believed considerable up front effort would be needed to monitor the activities of the supplier in order to avoid a potential “11th hour disaster” at the start of production not included in the original “buy” purchase price.
The response to these additional factors were reflected in additional options to specialization and internalization. These include the following:

- Option #2a - Buy component but purchase the tooling: As was standard practice, the concerns over supplier opportunism given the duration and importance of the contract warranted purchasing the tooling to be used by the supplier. The intention was to achieve some level of quasi-integration and hence reduce the potential transaction-costs associated with market failure and market imperfections to both parties.

- Option #3 - Dual Source: The more substantial option was to pursue multiple suppliers. Rather than source solely from lowest cost supplier, the firm would hedge the risks from supplier opportunism by dual sourcing the ABS over the life of the contract. The preferred second source was the next lowest-cost provider. The decision to pursue another outsource supplier versus specialize internally would be determined by union acceptance of the proposal.

The above adjustments would further lower the initial cost estimates from the "buy" option. As such, the decision to outsource was further supported.

3.4.3 Summary of Transactions Analysis

The transaction-based approach provides additional decision criteria over the traditional cost-based method. The identification of costs stemming from coordination, especially the costs from market failure and imperfections, is critical to firm design decisions.
The assumption that firms are efficiency seeking and desire to minimize transactions costs, however, has come under criticism (Milgrom and Roberts 1992). This includes the failure to address industry and competitive dynamics that may not be consistent with efficient preferences. The focus on transaction-costs as the basis for firm design similarly ignores the primary role of specialization decisions in the search for competitive advantage, and hence, violation of the assumption of no welfare effects. Lastly, the methodology by itself lacks sufficient detail to guide firm design decisions. Using specific assets to guide sourcing decisions may be difficult to implement given the growing importance and difficulty in identifying intangible assets in the productive equation. The issue has second order effects given the increasing embeddedness of intangible assets within the architecture of the firms products and services (Henderson and Clark 1994). As such, basing decisions on minimizing transaction-costs alone - assuming they can be quantified with any accuracy - may negatively impact seemingly unrelated areas and ultimately effect the long-term competitive capabilities of the firm. There are other deficiencies particularly problematic owing to the changing nature of business competition summarized in Section 3.6.

In summary, Transaction-cost economics provides considerable insight into the choice of coordination, but under-represents competitive and strategic factors guiding firm specialization decisions.

3.5 Core Competency Approaches

The other dominant approach to firm design and boundary management is also derived from a general theory of the firm. The core-competency and resource-based approaches address more explicitly the question of specialization and it’s relation to competitive advantage. In particular, the approach advocates specializing in only those
sets of activities in the value-chain where the firm can achieve definable preeminence and provide unique value for customers (Prahalad and Hamel 1990). All other activities for which the firm has neither a critical strategic need nor special capabilities should therefore be performed outside of the firm (Quinn 1994).

3.5.1 Issues in Practice

Apparent from this description is an implicit inside-out approach to firm design. The decision to specialize in an activity, for example, is based on a comparative analysis of the firm’s existing capabilities relative to the it’s external environment. This introspection is further evident in the view of outsourcing. The decision not to specialize, for example, is viewed in offensive terms as it can help a company to strengthen its competitive advantage by enabling it to concentrate on its core competencies (Hammer 1994). As sourcing decisions become closer to the core competencies, however, the approach is quick to note of the increase in risk (Venkatesan 1992). The approach also incorporates elements of transactions-analysis to address the potential loss and need to protect a firms core competencies from appropriation.

The other significant characteristic is the challenge in defining what is a firms core competencies. There is little theory or consistency in the literature about what "core" really means (Quinn 1994). Too often, identifying a firm's core competencies has become a "feel good" exercise that no one fails (Collis and Montgomery 1995). Consequently, many executives have been understandably confused about the topic (Quinn 1994). Assuming some agreement can be reached on what is core to a firm, however, the approach can be a powerful vehicle for firm design and value-chain management. Honda and their focus on engine technology is an often used example of the competitive potential from this approach (Pascale 1984). There are countless other examples of the use of core-
competency to guide firm design and sourcing decisions in the literature. There are also notable examples of how firms have outsourced their “crown jewels” in the process (Huber 1993).

3.5.2 Core-Competency Analysis of ABS Sourcing

While the cost-based analysis was the primary determinant guiding the sourcing of ABS, equal consideration was given to the role of ABS in relation to the firms “core competencies”. A significant stumbling block concerned the lack of agreement on what where the firms core competencies. The firm had not articulated either through formal policies or explicit strategies the nature of the firms competencies. It was recognized, however, that the firm could not continue with the current high degree of specialization. The high level of vertical integration and high cost of internal development was cited as a major competitive disadvantage. As such, there was some question as to the role of component development and manufacture in the firms overall competencies though ill-defined.

The lack of ready agreement on the firms competencies added to the difficulty in applying the core competency approach to the ABS sourcing decision. Comparative benchmarking of the internal source to the external ABS providers yielded the following competency gaps which spanned many disciplines and activities in the value-chain:

- **Technological capabilities**: A significant difference existed in the technologies used by the internal and external provider. The internal supplier used an alternative and once innovative technology that had drastically reduced the price of ABS systems many years back. The external providers, in contrast, had steadily advanced the capabilities of the mainstream technological paradigm to the point where this “older”
technology conferred significantly greater advantages in terms of packaging, mass, and performance. The advancements from continuous improvement were enabled not only by deep competencies in ABS but also by complementary capabilities in unrelated fields, such as micro-electronic hybridization. The internal supplier had no experience in the use of these technologies, and to a large extent, was caught in a competency trap by focusing solely on their alternative approach to ABS.

- **Product-manufacturing capabilities**: A significant difference was also noted in the product-manufacturing strategy (and competencies) that allowed the external ABS providers to economically produce a family of ABS systems customized for individual vehicle platforms. This strategy was achieved by adopting a modular product architecture supported by a flexible manufacturing system. The integrated strategy provided a flexible and cost effective platform to support both horizontal and vertical product-line extensions such as the increasingly important Stability Management Systems. This approach stands in contrast to the product and manufacturing strategy pursued by internal ABS providers based on an integral product architecture optimized for mass-production. While the internal source was believed to have comparable competencies in manufacturing, the competencies of world-class ABS providers were deeply embedded within the product architecture and manufacturing process, making it difficult to imitate yet alone appropriate.

In summary, though the automotive manufacturer had unique competencies in an alternative and potentially promising technology as well as comparable capabilities in manufacturing, their state of readiness and value in the current product-process paradigm placed the firm at a competitive disadvantage to external specialist providers. In addition, many of the needed capabilities to become competitive were intangible in nature: economies of scope were as important as economies of scale. As such, it would be
difficult for the automotive manufacture to appropriate the necessary competencies in order to achieve pre-eminence and competitive advantage in ABS as a stand alone system. The decision by the automotive manufacturer were to therefore outsource the development and manufacture of ABS.

3.5.3 Summary of Core Competency Approach

The competency-based approach extends the cost-based (specialization) and transactions-based (coordination) approaches to include provisions for a firm’s competitive environment. As the example above illustrated and reported in the literature, however, the approach can be difficult to operationalize. The following traps noted by academic and business practitioners may result:

- *Static versus Dynamic*: The approach has also been criticized for its static approach to firm design owing to the inordinate amount of attention paid to the firm and inside-out approach to strategy development. If a firm is constrained by only doing what it is good at, how do firms exploit change and evolve? This issue is especially problematic given the technological and market turbulence this past decade summarized in Chapter 1 that has created opportunities increasingly *external* to the firm.

- *Intangible versus tangible assets*: In addition, the nature of a firm’s core-competencies are increasingly intangible, diffused throughout the firms products, services, manufacturing systems, and organizational processes. A firm may not posses a single set of core competencies, such as in product or process technologies, that a firm can list and use to base sourcing decisions. In fact, many ownership advantages are complementary and difficult to capture as noted in the ABS example.
This presents a significant problem for the core-competency based approach to firm design given it’s generality and lack of specificity.

- *Local maximums versus global optimums:* Finally, the failure to account for the above and desire to achieve "preeminence in a few activities" may miss important linkages up and down the value-chain for synergistic advantage. The choice of specialization and coordination strategy may end up achieving local maximums at the expense of global optimums both today and in the future. The failing further increases the potential for competency traps and the severity of incumbent rigidities.

### 3.6 Summary of Issues and Opportunities

As noted in the above sections, the mainstream approaches to sourcing and firm design address many of the critical issues in the choice of specialization and coordination strategy. The approaches are particularly well suited to the static competitive world that has characterized much of this past century.

As change becomes increasingly prevalent, however, the noted deficiencies in the above methods become more pronounced. The generality and lack of specificity to guide sourcing decisions further makes their application to firm design potentially dangerous.

As demonstrated in the ABS example, current approaches often fail to assess the longer-term effect of sourcing decisions on *the future capabilities of the firm.* In particular, the analysis did not address the implications from outsourcing ABS on *the ability of the firm to respond to changes in the markets, changes in technology, or even changes in the firms own capabilities.* As Whitney has noted, "once firms get off the bus, can they ever get back on?"
These considerations are especially important as current approaches under-represent the implications of outsourcing on related subsystems and their value generating potential. While ABS is increasingly a commodity, for example, it is also proving to be a cornerstone for higher-order, higher value applications, such as Automated Stability Management Systems, Integrated Occupant Safety and Crash Avoidance Systems, and other advanced safety systems that are critical to future competitive advantage. The embeddedness of intangible assets in the firms products, processes, and organizational methods increases the importance of collateral sourcing assessment.

Finally, the current approaches fail to consider other competitive strategies to create or exploit market imperfections for competitive advantage. This includes the use of a firms competitive leverage to alter or redirect the technology trajectory of components in the value-hierarchy for opportunistic advantage. In the case of ABS, this may include encouraging suppliers to decouple selective strategic elements, such as software, from other components where the firm is at a clear competitive disadvantage. Offensive activities coordinated with highly focused firm design and coordination strategies can better allow firms to retain sufficient access and control of the high-value links in the technology supply-chain for competitive advantage.

The focus of the next chapter is to introduce a design guide for strategic sourcing that reflects these considerations optimized for practical, business decision making.
Chapter Four

Strategic Sourcing Model for Firm Design

4.1 Introduction

The fast and furious pace of change and brutal nature of competition today places a premium on seeking competitive advantage where ever it may be. As described in Chapter 1, this increasingly resides outside the firm as new technologies, markets, and competitors change the rules of the game and basis of competition. As demonstrated in Chapter 3, the traditional business tools for extended business analysis fail to reflect the dynamic character and richness of decisions facing managers today. A new approach to firm design is needed that is forward looking: one that emphasis the family of possibilities and seeks to promote experimentation and adaptation of a firms design to changes in markets and capabilities. The objective of this chapter is to introduce the beginnings of such an approach that builds on past design methodologies summarized in Chapter 3 and the changing nature of the competitive environment in Chapter 1 to support strategic sourcing for competitive advantage.

4.2 Caveats

No single theory or practical methodology can describe all the possibilities or dynamics involved in the design of the firm. The focus of the proposed firm decision guide is therefore not on the development of general theory of firm design per se. The
objective is to provide a practical road-map for determining the pattern and extent of firm specialization and coordination decisions for competitive advantage. In short, a competitive guide that combines the best in theory and practice optimized for the 21st Century.

Compromise is always a part of any development process. As such, the decision guide is biased toward the end-user: the senior level executive. The model makes no assumption of knowledge of advanced business concepts, such as a firm core-competencies or resource heterogeneity. Instead, the model attempts to work from first principles to implicitly address these and other theoretical constructs within the decision process.

In the same vein, the model is focused on the practical realities of firm design. This includes the need to make choices in product, process, and supply-chain design simultaneously to achieve global optimums. At the same time, in order to affect maximum advantage, these decisions are viewed from a strategic vantage point. This is critical to ensuring alignment between a firm's strategy and structure. As such, the unit of analysis is the nested sets of products and services that form a firm's value-hierarchy. The developed model is therefore but the starting point to operationalizing firm design for competitive advantage.

4.3 Background

The above considerations, the importance of change, and the limitations of existing firm design methodologies, formed the guiding principles for model development efforts. A fundamental requirement, as noted above, was to promote a forward looking approach
to firm design. This represents a departure from traditional inside-out analysis by recognizing the impact of specialization choices on the future response of the firm

![Diagram of Corporate Strategic Focus](image)

**Corporate Strategic Focus**
*The Firm*

- **Environmental Scan:** Vision of the Future
  - Opportunities & Threats
- **Internal Scrutiny:** Vision of the firm
  - Strengths & Weaknesses

**Formulation of Sourcing Strategy**
*Plan for Action*

Figure 4: Conceptual Model of Strategic Sourcing Process

to changes in its environment. This is achieved by first identifying the family of options for firm design reflecting today's opportunities and tomorrow's possibilities through a scan of the firms environment. As shown in figure 4 above, this *vision of the future* is balanced against the *vision of the firm* to define the firms sourcing strategy. The outside-in and inside-out analysis is critical to safeguarding the capacity to exploit and create future competitive discontinuities for competitive advantage and to promote opportunistic redesign as both markets and capabilities evolve.

A second and key requirement is to treat the firm design problem as a simultaneous process. This is critical to ensuring global and not local optimums are achieved. The requirement is approached by decomposing the firm design problem into the various stages of the value-chain. Each stage is evaluated in the context of upstream
and downstream firm design decisions to achieve both the lateral and longitudinal advantages in firm design. The simultaneous resolution of the strategic possibilities become the basis for the firms integrated sourcing strategies for product, process, and supply-chain design as suggested in figure 5 below.

![Flowchart Image]

Figure 5: Conceptual Overview of Decision Process

4.4 Overview

The above conceptual requirements were used to develop a detailed decision flowchart shown in figure 6 below. The following is a high-level overview of the decision nodes and decision logic discussed in greater detail in subsequent sections.

- **Form Sourcing Units**: A critical preparation step is to identify the “units” to base sourcing decisions. As noted above, these "units" should directly follow from the
decomposition of a firm's value-hierarchy, such as the firm's products and services, into the constituent subsystems, components, and subcomponents. ABS, for example, is both a subsystem but also a part of a larger value network. The decomposition and aggregation of items should therefore reflect the integrality and interdependencies.

![Flowchart](image)

**Figure 6: Strategic Sourcing Decision Logic**

between subsystems and components in creating and sustaining value. Considerations should extend to not only functional demands, such as tolerance propagation, but also to value-chain life-cycle needs, such as manufacturability, proprietary issues,
coordination requirements, integration tasks, and so forth. The decompositions may be modified during iteration in the decision model.

- **Strategic Assessment**: Once the units or items have been identified, the next step is to assess their importance to the firm's competitive success. As discussed previously, the determination is based on an outside-in analysis of the item by considering the item’s importance to the customer, potential for growth, and the firm’s competitive position vis-à-vis the competition. The assessment is further made for both today (0 to 5 years) and tomorrow (5 to 10 years), biased toward the future to promote a forward-looking design principle. Items that are not important to the customer, are mature, and where the company is at a competitive disadvantage, become candidates for outsourcing. All other items are considered strategic, and represent the family of possibilities offering competitive leverage and the potential for long-term competitive advantage.

- **Sustainability Assessment**: The process of pruning strategic specialization possibilities starts by examining the sustainability of the advantage conferred by the item. The consideration includes the actions of competitors as well as the potential for imitation and obsolescence. This is a critical step in the firm design process to link strategy, not only the firms, but also the competitors to avoid competency traps and other forms of incumbent rigidities affecting future capabilities. If the advantage can potentially be sustained, the item becomes a candidate for specialization (insourcing).

- **Vulnerability Assessment**: If the item is only marginally strategic, either from a competitive importance or sustainability perspective, the risks from leveraging an outside value provider are next considered. This includes traditional outsourcing risks stemming from market failure and market imperfection. It also considers and heavily
weights the longer-term impact of outsourcing, such as becoming dependent on a supplier, on the future capabilities of the firm and ability to respond to competitive possibilities. If the risks from outsourcing are unacceptable in both the short-term and longer-term, then the item becomes a candidate for insourcing. Alternatively, if the risks are acceptable, the item becomes a candidate for outsourcing.

• **Product Capability Assessment** (Candidates for Insourcing): The “outside-in” analysis in the above is balanced by a detailed “inside-out” analysis of the firms capabilities for items that are candidates for insourcing. The intent is to ensure the decision to specialize is competitively viable. The process entails a comparative analysis of the firms capabilities vis-à-vis the competition in upstream activities, such as design, engineering, testing, and integration. The analysis further reflects the requirements to support downstream activities - whether internal or external to the firm - such as evaluating the producibility of product designs. If this inside-out analysis of the firms capabilities is favorable, the firm should specialize in that item and the item becomes a part of the firms product development strategy. If the firm is not capable, on the other hand, the firm should explore the potential to become capable.

• **Becoming Capable**: Items that were candidates for insourcing but where the firm is not capable become a critical decision node in the firm design process. The firm must exhaust every possibility to examine ways to become capable. Aside from investment, the use of alliances, partnerships, or even licensing agreements should be investigated to either acquire the missing capability or secure a safe source. Offensive opportunities should also be pursued, such as efforts to redirect the technology trajectory for opportunistic advantage through the specification of favorable standards or purchasing patterns. In the event these options are not competitively feasible,
reflecting long-term considerations, the item becomes a candidate for outsourcing. In these situations, the firm may wish to re-examine the early decisions and impact on interfacing subsystems.

- **Manufacturing Capability Assessment:** (Candidates for Insourcing) Items where product development is internalized further become candidates for manufacturing specialization. The process is again an assessment of the firms capabilities relative to outside value providers. The analysis also reflects the coordination requirements as represented by the level of integration and coupling between downstream and upstream activities. If the firm is not capable and cannot become capable, then the model loops back to earlier decisions. This reflects the importance of concurrent product and process development and increased coordination demands (and potential risks) now required. Iteration also forces a re-examination of upstream specialization assumptions and decisions.

- **Supplier Capability Assessment:** (Candidates for Outsourcing) If the firm is not capable of specializing in the engineering development of the item and there are no viable paths to become capable either through investment or partnering arrangements or the item is not of competitive importance, the item becomes a candidate for outsourcing. A similar analysis is conducted with respect to the capability of the outside provider. If found capable, the final question becomes the issue of ownership of integration activities, such as validation and testing of the item by itself and with the interfacing items in the product hierarchy. Coordination issues, including both organizational and technical, are key factors examined in the decision nexus. This is a critical and an often overlooked area in specialization decisions impacting not only current performance, but also future capabilities through the acquisition or loss of critical integration knowledge affecting upstream capabilities.
• **Supply-Chain Assessment**: The final decision node concerns the design of the actual (logistical) supply-chain. The intent is to capture the potential for economies in logistics management increasingly important and enabled by the growth of "component modules". If key leverage points are found and are inconsistent with earlier specialization decisions, such as the ownership of manufacturing or integration activities, the model iterates back up to re-examine the systems advantages from this new information.

The model thus provides a working guide to the detailed questions of specialization and coordination for the products and services in a firm's value-chain.

### 4.5 Decision Rules

The following is a detailed description of the individual rules used to guide the decision process summarized above.

#### 4.5.1 Form Unit of Analysis

The first step in the decision model is to identify the “units of analysis” to base sourcing decisions. In broad terms, these "units" should directly follow from the decomposition of a firm's value-hierarchy. For a product such as an automobile, for example, the units might consist of the sets of subsystems, components that together in their entirety form a vehicle.

The initial decomposition must reflect both the technical and organizational dynamics and interactions within the value-creation process. As such, the use of
functional interactions alone to define the "boundaries" and groupings is insufficient. The groupings should reflect such value-cycle "systems considerations" as:

- **Technological constraints**: Similarly, decision makers may elect to decouple and or decompose units to allow for the freedom of innovation in subunits and related subsystems.

- **Manufacturability requirements**: Units may be grouped together to ensure manufacturing and assembly needs, such as tolerance management concerns, are not overlooked.

- **Proprietary issues**: Units that embody proprietary knowledge or competitive assets should be separated from other units that are not as sensitive to competitive concerns.

![Interface Matrix to Determine Sourcing Units](image)

**Figure 7: Interface Matrix to Determine Sourcing Units**

These and other factors should be used to identify the related requirements to establish the aggregation of items for sourcing analysis. The use of an interface matrix and or Design
Structure Matrix, as represented in figure 7, is recommended to assist in this process (Eppinger et al 1994). It is further recommended that the matrix serve as a score-card to ensure the above life-cycle concerns, especially proprietary issues, are addressed at a systems-level during specialization and coordination decision making of individual items.

4.5.2 Assess Strategic Importance

Once the unit of sourcing has been determined, the next step is to assess its strategic importance to determine whether the item should be considered critical to the competitive success of the firm. This is based on an outside-in assessment of the firm and it’s environment for that item through the simultaneous consideration of the following factors for both today and tomorrow:

- *Customer Importance*: A central external measure of strategic importance is the value placed on the item by the customer. Items that are key differentiators in the market place, or that delight the customer, for example, should be considered of high importance. Since not all items are visible or even noticeable to the customer, it is important to consider the items direct and indirect contribution to value. An example from the automotive industry would be the cross-bar beam in the instrument panel. Though not evident to the customer, the cross-bar is critical to minimizing shake and shudder and indirectly noise and harshness within a vehicle’s interior, and hence would be considered of high customer importance. Some knowledge of the value-network, and the embeddedness of items, is needed to measure the relative importance of an item to the customer. The interface matrix of describe above can be instrumental in the process.
• *Technology Life Cycle*: Another external and “forward-looking” measure of strategic importance is the location of the item in the product-life cycle. Three levels are provided - mature, growing, and emerging. The evaluation should be made with respect to the industry and specific application and not relative to the history of the item itself. For example, anti-lock braking systems (ABS) technology has been in wide-spread use in the aerospace industry since the 1950’s. In that industry, ABS is considered a mature technology. Within the automotive industry, on the other hand, ABS has only seen widespread use this past decade and remains a growing technology. In summary, the measure of the items location in the life-cycle is respect to industry and specific application within the product hierarchy in satisfying some function or purpose.

• *Competitive Position*: The complimentary assessment to the previous external and firm-independent measures is an evaluation of the perceived competitiveness of the firm for the item. Ideally, the assessment of the firm’s competitive position should be made by the its customers and competitors. The desire is to identify those areas that the firm is well known for, such as safety systems in the case of Volvo, and hence are central to the firms unique competitive advantage. By using external data at this point in the decision process, the decision model avoids internal biases and difficulties in explicitly identifying the firms competencies. Three levels are also provided reflecting a leadership, follower, or midpack competitiveness position.

As shown in figure 8 extended from Welch and Nyak, the above assessments are evaluated simultaneously (step 1) to derive a net importance rating represented as red for strategic, green for not-strategic, or yellow for marginal
• **Strategic** (red): Regions that are red imply areas of high competitive potential and are critical to the firms' unique competitive advantage. Such regions generally reflect a high or moderate customer importance rating, a growing or emerging technology, and a midpack or leadership competitive position.

**Step 1: Assess Today & Tomorrow**

![Relative Competitiveness Diagram]

**Step 2: Net Result = Today x Tomorrow**

![Legend and Assessment Diagram]

Figure 8: Decision Logic and Process for Competitive Importance

• **Not Strategic** (green): Regions conversely that are green denote low competitive criticality. As may be noted, such areas reflect low customer importance, a mature technology, or a low competitive position vis-à-vis the competition.

• **Marginal** (yellow): The in-between regions are represented as yellow. These regions depict competitive arenas that may or may not be critical to the competitive success of the firm, reflecting an emerging or growing technology with potential or even area that is important to the customer, yet the firm may not presently be good at it. The
region is key to promoting a forward looking approach to firm design, emphasizing
the family of possibilities both today and in the future.

As noted in step 2, the process is evaluated for both today and tomorrow to calculate an
overall strategic competitiveness rating. The following decisions rules then apply:

- **Items that are red are considered to be a critical source of competitive advantage
  and are next evaluated relative to the sustainability of that advantage (Section 4.5.3).**
- **Items that are classified as green (not strategic) do not connote unique competitive
  advantage and hence become candidates for outsourcing (Section 4.5.7).**
- **Items that are yellow (marginal) are further analyzed to examine the strategic
  vulnerabilities from not specializing in the item (Section 4.5.4).**

As may be evident, the decision matrix is biased toward the future to further promote a
forward-looking approach to firm design.

4.5.3 Sustainability

Items that are considered strategic and provide a unique competitive advantage to
the firm are evaluated for their sustainability. This is critical in the firm design process to
link strategy, not only the firms, but also the competitors to avoid competency traps and
other forms of incumbent rigidities.

- **Competitor Response:** A key issue in assessing the sustainability of the firms
  competitive advantage in a given item is the anticipated response by the firms
  competitors. Items that provide unique value and high rents are likely to evoke a
  competitive response. The assessment of the competitor response should reflect the
attractiveness of the rents mitigated by potential competitive barriers, such as economies of scale, the threat of retaliation, and other offensive measures available to the firm.

- Appropriability: In parallel, an assessment must be made to the potential for imitation or the use of substitutes to supplant the item and undermine its competitive importance. The potential for technological obsolescence should also be considered. Finally, some consideration should be given to the potential for labor or other internal suppliers to appropriate the rents from the item.

Both factors are used to derive a net sustainability measure as shown in figure 9 below.

![Diagram](image)

Figure 9: Decision Logic for Sustainability

The decision rules are as follows:

- Regions that are red (strategic) indicate the firm can sustain the unique competitive advantage and should consider specializing in the development of the item (Section 4.5.5).
- Regions that are yellow (marginal) suggest the firm may not be able to sustain a unique advantage in the item further analysis is needed to assess the potential strategic implications and vulnerabilities from outsourcing (Section 4.5.4).

The decision logic is somewhat biased to reflect the short-lived nature of competitive advantage today, and hence promotes a more conservative assessment. Sensitivity analysis is highly recommended.

4.5.4 Vulnerability

For items that are marginally strategic, the firm must evaluate the potential risks from leveraging an outside value provider. The risks include traditional considerations as well as the risks from supplier opportunism stemming from market imperfections and the firms dependency on the supply-base. The following factors are suggested to evaluate the vulnerability of the firm from outsourcing:

- **Supply-base Breadth**: The first risk factor reflects traditional concerns from outsourcing based on the breadth of the supply-base. The purpose of this evaluation is to determine whether the supply-base would potentially limit the ability of the firm to pursue alternative locational strategies. The availability of suppliers with a global presence, for example, presents less risk to outsourcing than a supply-base that is restricted to a particular region or locality. This includes concerns over currency exposure, capacity concerns, and global supply-chains logistical requirements.

- **Supply-base Depth**: A related risk factor is the depth or concentration of the supply-base. The objective of this risk factor is to measure the relative "power" of the supply-base. Higher concentrations, even if the suppliers are global, would
potentially give rise to greater supplier bargaining leverage through the exercise of monopoly power. As such, the depth of the supply-base provides an indirect measure of the potential for supplier opportunism and potential for market imperfections and market failure.

- **Dependency**: The nature of the firms dependence on the supply-base from outsourcing influences the exposure and sensitivity of the firm to the kinds of supplier opportunism identified previously. Firms that are dependent on the supply-base for knowledge, for example, increase their long-run exposure to hold-up and

```
<table>
<thead>
<tr>
<th>Supplier Power</th>
<th>Local</th>
<th>Regional</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak (competitive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong (monopolistic)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

![Supply-base Depth](image)

*Potential for Supply-base Opportunism (capacity hold-up, control of architecture, hostage to critical know-how)*

Figure 10: Decision Logic for Vulnerability

hostage taking at a far greater level than if the firm is only dependent on the supply-base for capacity (Whitney and Fine 1995). Dependency for knowledge further limits future flexibility and threatens upward and lateral development opportunities.

Figure 10 represents the intersection of these risk factors to derive a net result. The decision rules for the outcomes are as follows:
• Red indicates the risks to the firms competitive capabilities from outsourcing are potentially too great, and hence the firm should consider insourcing that item (Section 4.5.5).

• Green implies it is okay to consider outsourcing that item as the risks from outsourcing are acceptable and/or can be managed (Section 4.5.7).

In practice, these sets of decisions are often pivotal. Sensitivity analysis and/or iterations to earlier assumptions may be required. As before, the interface matrix should also be updated to reflect the potential impact of outsourcing a marginal or once strategic item on interfacing subsystems.

4.5.5 Upstream Capability Assessment

The above outside-in assessment of whether the firm should specialize in the item based on its competitive importance are now complemented by a detailed, traditional (Core Competency-based) inside-out analysis. The objective of this decision node is to confirm that the company owns the necessary capabilities to competently perform the required activities in the value-chain for that item, and therefore should specialize in the items development.

The assessment is first made with respect to the upstream activities in the value-chain as shown in figure 11. The needed capabilities must also account for the requirements to support interfacing systems and subsystems within the items value-network. This includes both horizontal as well as vertical needs, such as the ability generate specifications for items down a level (e.g., - at the component or subcomponent level).
The assessment is further made relative to the firm's resources, infrastructure, knowledge, and availability. Given the strategic nature of the item, the firm need only be comparable to other alternative value providers.

<table>
<thead>
<tr>
<th>Vehicle-Level (VTS)</th>
<th>SubSystem (SSTS)</th>
<th>Component (CTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>knowledge resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>knowledge resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>knowledge resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infrastructure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key:**
- □ Required for SubSystem Development
- ■ Not Required for SubSystem Development

![Value Chain Diagram]

Figure 11: Elements of the Firm's Capability Test

The decision rules are as follows:

- **If the firm has the necessary capabilities to support the upstream development of the item, the firm should specialize in its development. The item becomes a candidate for downstream specialization (Section 4.5.8)**

- **If the firm does not presently possess the necessary capabilities, the firm should investigate acquiring those sets of capabilities as discussed in the next decision node (Section 4.5.6)**

Items that are capable become the basis for the firm's product development strategy.
4.5.6 Becoming Capable

If the firm is presently not capable, the next sets of decisions are to evaluate the feasibility of becoming capable. This includes investment, joint ventures, partnerships acquisitions, and other methods to appropriate the needed competencies.

The first step is to identify the "gaps" in the firms capabilities. The extension of the above capability test can be used to score and identify the critical deficiencies as

![Diagram showing gaps in capability identification process]

Figure 12: Score-Sheet in Identifying Capability Gaps

simplified in figure 12. The gaps must be assessed for each category with an estimate of the effort in time and dollars to close the gap, weighted to reflect importance and contribution within the value-chain.
The next step is to determine whether the firm should elect to commit to becoming capable. The decision logic for the “becoming capable” node is shown in figure 13 below.

**Steps:**

- Identify "Gaps" in firms Capabilities
- Estimate closure ($/yrs): Acceptable ?

- **No:**
  - Allied Divisions capable ? Can we form i nternal alliance an acquire critical capabilities ?

- **No:**
  - Alliance/Partnership ? Can we appropriate needed skills and competencies ?

- **No:**
  - Long-term contracts ? Can we enact defensive measures to protect strategic interests ?

- **No:**
  - Can we decouple non-capable elements ? Repartition the Item ?

- **No:**
  - Re-classify and outsource

Figure 13: Decision Logic in “Becoming Capable”

As suggested, even if the firm cannot close the gaps, other strategic options should be investigated before deciding to outsource the item. This includes offensive measures, such as the establishment of interface or architecture standards favorable to the firms current competitive position. If these and other such options are not feasible, the model further advocates re-examining the decomposability of the item. From an offensive or even defensive perspective, for instance, it may only be necessary to access and control selective high-value links in the units value-chain. Other business practices should be further investigated before the decision to consider outsourcing the item is made.

In summary, the decision rules are as follows:
• If the firm can appropriate the necessary capabilities to support the upstream development of the item, the firm should specialize in its development. The item becomes a candidate for downstream specialization (Section 4.5.8)

• If the firm cannot acquire the necessary capabilities and/or enact proper defensive measures, the firm should investigate outsourcing the item (Section 4.5.7). Lateral examination of the competitive implications to interfacing subsystems must be performed.

4.5.7 Supplier Capability Test

Before a firm elects to outsource an item, it is imperative to ensure the supply-base is sufficiently capable. Similar to the above capability test for the firm, the supply-base test examines the competitive capabilities in each of the key value-chain activities - both upstream and downstream - for that item as shown below in figure 14.

Figure 14: Elements of Supplier Capability Test
(It is important to note the change in required capabilities compared to the internal capability assessment test. Outside suppliers need not possess the capability to generate detailed item specifications. Nor are suppliers expected to have the capability to support system level activities. These activities are assumed to be the responsibility of the firm).

Assuming the supply-base is capable, the next evaluation is to examine the coordination and boundary management requirements to the firm from outsourcing the item. The evaluation should reflect not only the item itself, but also the item in relation to the sourcing strategy of interfacing items. Such factors as the integrality of the item and level of coupling within the product architecture may influence coordination requirements and hence the necessary capabilities of the outsourcing firm. In turn, the second consideration is to assess the resultant coordination overheads and transaction-costs from outsourcing. This assessment must be made in tandem with the firm's internal coordination capabilities, the coordination requirements of the item, and the competency levels of the supply-base. Trade-offs in terms of flexibility, speed, and cost may warrant a reconsideration of outsourcing the item even if the supply-base is found capable. (Note: issues of opportunism and market failure were addressed above)

If the supply-base is not capable, on the other hand, the firm should not automatically elect to (continue to) specialize in that item. Strategies should be pursued that attempt to bolster the capabilities of the existing supply-base. This may include joint operating agreements, partnerships, technology-licensing strategies and so forth. Only after these strategic options are exhausted, should the firm decide to insource the item.

The decision rules are as follows:
• If the supply-base is capable, and the firm possess the necessary coordination capabilities, and the coordination requirements are manageable, then the item should be outsourced (Section 4.5.9)

• If the supply-base is not capable and it cannot become capable, then the item should be insourced (Section 4.5.8)

4.5.8 Downstream Capability Test

Items that are strategic and integral to the firms upstream product strategy (Section 4.5.5) are next evaluated relative to the question of specialization of downstream activities. A similar assessment as the above is recommended where each of the value generating activities are examined to ensure firm capability.

The assessment of the firms manufacturing capability must also address the linkage to upstream activities. This is in contrast to traditional "make or buy" analysis noted in Chapter 3. If a high degree of interdependence is found, for example, the need to insource becomes imperative. In this case, the relative capabilities of the firm may be biased downward to reflect the additional (potential) coordination costs and or cost from failure should the item be outsourced.

A similar consideration should be made relative to the potential exposure of upstream knowledge from outsourcing of downstream activities. As suggested in 15, both issues may determine the approach to outsourcing coordination, such as the use of grey box or white-box strategy. If the risks are unacceptable, and the firm is not capable, the earlier upstream decisions should be re-evaluated to ensure anticipated strategic advantages will be realized.
4.5.9 Integration Test

For items that are to be outsourced, the firm must further decide ownership of integration activities. As noted above, this is a critical and often overlooked area that is key to ensuring the objectives for the item, the system, and the firm in the long-run are achieved.

Integration is significant for a number of reasons. The following factors should be used to assess the importance of the integration task for internal or external ownership.

- *Integration Requirements*: First and foremost, integration is primarily a problem solving process. Errors in the transmission of design attributes are often not identified and resolved until integration and testing. For many items, the bulk of the problem solving process in fact occurs during integration and testing. For such items, greater
attention is needed to ensure integration efforts are conducted with care. The issue is further determined by the location of the item in the integration "chain". Late changes in the integration activities of upstream items can force costly iterations and redesign loops of dependent items. Conversely, items at the "tail" of the integration chain are less critical, though fast response capabilities are key.

- **Coordination Capabilities:** The nature of the item’s integration determine the coordination requirements and technical demands of the specialist providers. Proficiencies in systems engineering, validation, and testing are central, especially in root-cause analysis of problems found during integration activities. Managerial skills are equally important as the integration event may span several organizational and firm boundaries. The assessment of the outside firms capabilities should therefore be weighted to reflect the technical and managerial capabilities arising from the nature and importance of the integration task for the item at hand.

Even assuming the supplier is capable, and the risk from failures in integration are acceptable, additional competitive factors must be considered. A critical consideration is the potential exposure of proprietary information during the integration activity. Items that interface to core items, such as powertrain in the case of an automotive supplier, may need access and or advanced knowledge of the operating parameters and functional characteristics of the core item. In addition, integration is a key learning event. Many of the lessons during integration must be captured and feedback to enrich the knowledge-base and competencies of the firm, such as the ability to develop and generate “smart specifications” or design robust processes.
Retaining integration responsibilities in-house may be critical to minimizing dependencies on suppliers for knowledge and control. A simplified flow-chart is suggested in figure 16 to guide users in determining ownership of integration activities.

![Flowchart](image)

Figure 16: Integration Decision Logic

4.5.10 Supply-Chain Assessment

The final specialization decision concerns the issue of the supply-chain design. This refers to the logistical tasks involved in the distribution and delivery of goods and services either to the customer or the firm’s factories as input to the productive process.
The issue of outsourcing of logistics responsibilities should follow a similar assessment process as with other activities in the firms value chain. Particular attention should be given to earlier insourcing activities, such as manufacturing. The growth of “component modules”, for example, may present opportunities to bundle item assembly activities with logistics procurement and supply-chain management activities. This may be pursued to reduce non-value added activities as well as support global supply-chain strategies, such as delayed configuration. Supply-chain design decisions must carefully reflect earlier firm design decisions to promote simultaneous product, process, and supply-chain development.

4.6 Summary

The chapter introduced the beginnings of a firm design decision guide that extends traditional thinking to reflect the new competitive realities marked by change in the firms external environment. This is achieved by balancing an outside-in analysis of future and current opportunities with an inside-out assessment of the firms current and potential capabilities. The decision to specialize is made simultaneously with respect to product, process, and supply-chain requirements in the context of the firms value hierarchy of products and services. As demonstrated in the next chapter, the combination provides the business leader with a practical and powerful decision tool to realize the gains from firm design for competitive advantage.
Chapter Five

Sourcing Model Implementation

5.1 Introduction

The test of any theory or academic exercise is the value in practice. For the academic, this requires a fortuitous happenstance of need and opportunity. The decision model was blessed with the both. As discussed in the following, the decision model was adopted and indeed largely developed to address the firm redesign needs at a major US automotive producer. Specifically, the company was interested in developing a corporate-wide sourcing strategy for all of the subsystems and components that comprise the vehicle. The following is a summary of the implementation strategy, results, and key lessons learned for future application in other industries.

5.2 Implementation Issues

Attempting to implement anything in an organization can be challenging at best. The issues are magnified when the objective concerns the very design of the organization itself. Downsizing, right-sizing, and layoffs leap to the imagination. Emotions understandably often run ahead of logic, undermining not only the quality of the effort, but also the acceptance of the results. The environment at the test-site was particularly volatile due to the strong union presence and high degree of vertical integration.
In addition to addressing the above organizational and cultural dimensions of implementing the strategic sourcing model, there are practical issues to consider. A central implementation question is the method to administer the model. Some knowledge of the domain and model are needed. One option is to employ a centralized group to administer the model. This would ensure consistency and uniformity of results at the potential expense of accuracy and integrity. Another option is to allow for self-administration of the model. Again, the issue of minimizing bias becomes a factor as does the issue of model training and consistency. The last option is to employ outside consultants though at the risk of acceptance and domain ramp-up costs.

A related issue concerns the targeted users and method acquiring the data. Several options are available with similar risks as above. The first is to target the affected individuals at either the staff or line manager level. As before, concerns over bias and ownership conflicts are dominant. The other consideration is to employ some peer group outside of the affected area or potentially an external agency. These sets of alternatives, while minimizing opportunistic influences, would potentially undermine the confidence in the inputs as well as the final acceptance of the outputs.

In summary, implementing a firm design process must cope with organizational, cultural, political, and administrative concerns that will ultimately determine the cost, speed, accuracy, acceptance and success of the implementation effort.

5.3 Implementation Strategy

A Strategic Sourcing team was formed consisting of senior-level managers from the various engineering, purchasing, and product organization staffs to develop and oversee the implementation strategy at the host company. The team recommended a phased-
approach to deployment, progressing from a simulated testing and development phase, to a verification and validation phase, and finally to a full corporate-wide deployment.

A staged implementation approach is key for a number of reasons. First, an evolutionary path to deployment provides the kinds of checks and balances need to ensure the accuracy of the model and hence the acceptance of the outputs - no small matter given the importance of the activity. A staged approach is also advocated as a means to gauge the severity of the organizational and cultural dimensions of the firm design process. The final deployment decisions, as such, would be based on the results from the initial testing and verification phases.

The team adopted an operational strategy where the core team would initially administer the model. The targeted users for the purposes of data collection would be the Councils that owned each of the subsystems, consisting primarily of divisional and staff senior-level managers from engineering, manufacturing, and purchasing. Aside from expediency, this choice is consistent with the strategic nature of the model and need for ownership in the process. An advisory team was also formed. This consisted of the Chief Council that has overall ownership for the company's products and services. This last decision was critical to ensuring the broad-based acceptance and buy-in for the implementation effort. The involvement of the Chief Council was also needed to ensure the model was consistent with the overall strategic objectives and future corporate focus.

5.4 Results

As of this writing, the model is currently being deployed throughout the organization. The following will therefore review the findings from the initial testing and validation phases.
5.4.1 Initial Testing Phase

The function of the initial testing phase to refine the model. Several small and manageable subsystems were evaluated. The results confirmed the models utility and potential.

One key finding from the initial testing concerned the method to administer the model. For these early test rounds, the model was administered in its pure form shown in Chapter 4. As such, the user was able to understand the decision logic as the evaluation was being performed. Several individuals exploited this information to determine their desired end-state, and then backtrack to ensure their responses would end up at the desired outcome.

These and other key lessons were incorporated into implementation strategy. Two key changes were enacted for the validation phase and beyond:

- *Decision Dialogue:* The first and most significant change was to reformulate and repackage the decision model as an interactive decision dialogue process. The decision nodes were re-cast into an expanded set of introspective questions. Examples and references were also included to serve as guide posts. These helped to ensure the proper intent of the question was conveyed during delivery while removing the potential for ambiguity and uncertainty during response formulation and knowledge capture. The use of questions also masked the details of the decision logic from the user to avoid opportunism.
• *Model Administration:* A second and related modification concerned the model administrators. In moving from a quasi-self administered model to more of an engaging and interactive process, greater requirements were placed on the model delivery process. Model administrators soon became facilitators, actively participating in the dialogue process. As such, the facilitators were required to have some knowledge of the domain. This was needed to ensure the host group correctly interpreted the intent of the questions during the discussion process as well as to ensure the validity and integrity of the responses.

Several other test-cases were evaluated using the revised strategy. Reviews by the Advisory Board recommending proceeding to the Validation phase.

**5.4.2 Validation Phase**

The revamped model and delivery process was next applied to several full-blown test-cases. The following is an example of one such effort applied to the development of a strategic sourcing strategy for the Heating Ventilation And Cooling (HVAC) subsystem.

The users of the decision model were the HVAC Council. This included product and manufacturing representatives from each of the company’s divisions along with associated members from the central purchasing and engineering organizations. The model was administered by the core team but facilitated by one lead member. The following is a summary of the decision process.

**Step 1: Form Unit of Analysis.**

The starting point of the analysis as detailed in Chapter 4, is determine the proper scope or unit for sourcing. HVAC consists of the following subsystems:
• Engine Cooling subsystems,
• Interior Heating subsystems,
• Air Condition subsystems, and,
• Ducting/Ventilation subsystems

The HVAC council elected to treat the entire HVAC system as one unit for the purposes of analysis with the exception of the Ducting/Ventilation subsystems. This was against the recommendation of the facilitator. The justification, however, was based on the interrelatedness of the above subsystems. As one Council member noted, “they (the subsystems) effectively interface to the same sets of subsystems that either generate or dispel thermal energy”.

Step 2: Assess Strategic Importance

The next step was to assess the “strategic” importance of HVAC to the company. As detailed in Chapter 4, this assessment is based on an external analysis of the firms capabilities, the relative importance of HVAC to the customer, and location on the technology life-cycle. Each of the assessments were made relative to the opportunity windows over the next 5 years (e.g. - “today”) and also for years 5 through 10 to capture “tomorrow”. This is again key to promoting a forward looking approach to firm design.

• Location on Life-Cycle: The facilitator applied the questionnaire shown in figure 16 below to interactively determine the location of HVAC on the product life-cycle. The question sparked some debate. Some were quick to note that HVAC is an “old technology... having been on the vehicle forever”. Others, however, pointed out the recent evolutionary advances in HVAC. Examples cited included
the recent development of “dual-zone heating and cooling zones” where a
temperature differential of up to 20 degrees could be maintained, as well as plans
for tri-zone, and other advances. The competing viewpoints were rationalized,
yielding a net assessment as shown in figure 17.

<table>
<thead>
<tr>
<th>Subsystem mature</th>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
</table>
| • based on well understood technology, with few, if any,
  new features or major enhancements |        | ✔️       |
| • commonly used and widely available; well-entrenched
  within the vehicle. |        |          |

| Subsystem growing | ✔️ |          |
| • employs advancements and innovations to provide
  new capabilities and/or features. |        |          |
| • enjoys limited availability; an “option” to the customer
  though increasingly in demand. |        |          |

| Subsystem emerging |          | ✔️ |
| • predicated on radical innovation or breakthrough
  technologies with potential to change existing paradigm. |        |      |
| • may or may not be available within the marketplace;
  more R than D. |        |      |

Figure 17: Life Cycle Assessment

• Importance to the Customer: The next sets of question in assessing the strategic
  importance of HVAC examined its importance to the customer. Representatives
  from car divisions noted that HVAC has become an accepted, if not required item,
  no longer an option on several car makes. HVAC is no longer a core differentiator
  in the market place. As such, this contingent felt HVAC should be considered of
  moderate importance.

This argument was countered by individuals from the truck division. Given the
increasing popularity and “car-like demands” placed on trucks these day, this
contingent felt HVAC should be considered of high importance. The representative from marketing referred to a recent JD & Power study confirming this viewpoint where A/C is currently a premium option on some truck lines.

The facilitator furthered the discussion by inquiring how long this advantage would remain in the market place. The truck contingent conceded that the high importance of HVAC to the buyer would be short-lived, diminishing within 5 years. Marketing further supported this assessment, noting the rapid convergence of truck and product attributes, and hence customer tastes within this initial evaluation window. The final assessment is shown in figure 18 below for today and tomorrow.

<table>
<thead>
<tr>
<th>Dimension/Evaluation</th>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Customer awareness of value provided</td>
<td>-  - ✔️  -</td>
<td>- ✔️ -  -</td>
</tr>
<tr>
<td>- Customer willingness to pay for item</td>
<td>-  - ✔️  -</td>
<td>- ✔️ -  -</td>
</tr>
<tr>
<td>- Contribution to brand image</td>
<td>- ✔️ -  -</td>
<td>- ✔️ -  -</td>
</tr>
</tbody>
</table>

**Figure 18: Customer Importance Assessment**

- *Relative Capability*: The final question in the strategic assessment process concerned the relative capability of the company in HVAC as viewed by the
companies external environment. To help reduce bias, the team performed benchmarking and collected customer evaluations to determine whether the firm enjoyed a leadership position in HVAC vis-à-vis the competition.

As before, the results were mixed. Some disparity was noted between the car divisions and truck divisions. An even greater difference was found between the A/C and Engine Cooling Subsystems. For the former, the company as a whole was on par with the competition as measured by the quality, cost, and lead-time dimensions. The Engine Cooling assessment, on the other hand, was not viewed as being competitive with the competition. This was reflected in the high degree of defects and customer complaints. The projection for the future revealed a lack of anticipated competitiveness in A/C and Engine Cooling subsystems. Figure 19 below, is the final "averaged" competitive assessment rating.

<table>
<thead>
<tr>
<th>Dimension/Evaluation</th>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unfavorable</td>
<td>Same</td>
</tr>
<tr>
<td>Quality (Delivered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency</td>
<td></td>
<td></td>
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<tr>
<td>Speed</td>
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<td></td>
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<tr>
<td>Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 19: Competitive Assessment
(At this point, it became clear that the assessment should be performed separately for both A/C and Engine Cooling subsystems. The decision not to separately consider truck requirements, on the other hand, was based on the strategic direction to have a common sourcing policy for the entire corporation, cutting across all product lines and divisions).

• *Net Assessment:* The above responses for “today” (0 to 5 years) suggests HVAC should be considered strategic in the short-term. This reflects the fact that HVAC is growing, is important to the customer, and the company is on par with the competition. The forward analysis for "tomorrow", however, is less than favorable. The lack of a competitive leadership position combined with the maturation of the technology makes the projected importance not strategic.

The combination of strategic today with not strategic tomorrow yields a net assessment that of marginal. As a result, further analysis was needed to determine whether the firm should internalize HVAC based on the strategic implications of leveraging an outside value provider.

**Step 3: Vulnerability Assessment**

Given the “in-between” state of the HVAC strategic evaluation, the council next evaluated the potential issues should the firm elect to outsource the outcome versus specialize in its development. As detailed in Chapter 4, the primary emphasis is to assess the potential for supplier opportunism and hence measure the potential strategic risks.

• *Breadth of Supply-base:* The first component of this assessment concerns the geographic presence of the supply-base. This is an important criteria given the
firms strategy of globalization. The HVAC council readily agreed that the supply-base for HVAC was indeed global. There were several suppliers in the US, Asia, and Europe that were currently supplying completed HVAC systems, including engineering support, to various OEM's. As such, the breadth of the supply-base was considered favorable for outsourcing and would not present risks to the process of globalization as shown in figure 20 below.

- What is the geographic presence of the supply-base?

  -> Where are the suppliers primarily located ?

  - Supply-base is localized
  - Supply-base is regionalized
  - Supply-base is global

Figure 20: Supply-base Breadth Assessment

- Supplier Dependency: The next question, keeping with the inside-out and outside-in balanced analysis, is to understand the potential for the firm to become dependent on the supply-base. The HVAC council all agreed that the nature of the dependency would be minimal. Inquiries by the facilitator showed the HVAC organization had strong technical competencies supported through aggressive research and development efforts that could be retained for some time in an outsourcing regime. As such, the HVAC council did not feel they would become
overly dependent on outside suppliers for knowledge, limited to capacity, making a net assessment of moderate risk to low risk (figure 21).

- Will firm become hostage to the supplier from loss of knowledge, control of architecture, or reduced capacity?
- Is this likely to limit access to leading-edge technologies or potentially reduce innovativeness?

- **Low Risk**
- **Moderate Risk**
- **High Risk**

Figure 21: Supply-base Opportunism Assessment

- **Depth of Supply-Base.** The final measure of strategic risk from outsource concerns the relative depth of the supply-base. As noted in Chapter 4, the intent of this metric is to abstract the relative strength and hence potential bargaining power of the supplier-base. As was soon noted, the choice of phrasing was less than ideal as shown in figure 22. The decision to use the dimensions of “few”, “some”, and “many” became a source of confusion. Because there were only a handful of suppliers as identified above, even though they were capable of supplying HVAC systems on a global basis, the HVAC council thus inferred that depth of the supply-base was not favorable - “there were only a few suppliers”. In the end, the Sourcing Team recommended a compromise, suggesting that there
were some suppliers, and hence the depth of the supply-base was not favorable or unfavorable.

- Are there many suppliers?

  -> Suppliers powerful?

  - Many/no bargaining power
  - Some/moderate bargaining power
  - Few/suppliers are monopolistic

Figure 22: Supply-base Power

The net outcome suggests the strategic risks from outsourcing were acceptable, and hence the firm did not need to specialize in HVAC to protect strategic interests and competitive capabilities. As such, HVAC was considered a candidate for outsourcing.

Step 4: Supplier Capabilities

Given the above outcome, the HVAC council next evaluated the capabilities of the supply-base to support the engineering development requirements from outsourcing. The presence of global system suppliers, such as GM’s Delphi and Nippondenso, made this a short analysis as shown in figure 23.

Given the favorable and even world-class capabilities of the outside suppliers, the strategy was to pursue outsourcing of engineering and manufacturing of HVAC. The
determination of the actual coordination strategy would be determined by a detailed sourcing operating process that is outside the scope of the strategic sourcing process.

![Value Chain Diagram]

**Figure 23: Supply-base Assessment**

**Step 5: Integration Responsibility**

The next major decision block was to determine whether the supplier or the firm would assume the integration of outsourced HVAC systems into the vehicle. Several considerations were examined. These included:

- *location in integration chain*: HVAC is both dependent on and influences the integration activities of subsystems up and down the product hierarchy. Powertrain is a particularly critical consideration. Fast response, stability of the integration process, and close cooperative effort are essential. Attempting to coordinate this activity
through outside value providers would greatly add to the risk and potential for errors in the integration success of the product system as a whole.

- *exposure of critical information:* For many of the above reasons, integration of HVAC requires extensive access and advanced knowledge of the operating parameters and functional characteristics of the interfacing subsystems. As noted, this includes Powertrain which is considered strategic and core to automotive manufacturers. As such, relying on an outside source to assume integration of HVAC and by definition many of the interfacing subsystems would potentially place at risk sensitive, proprietary information central to the firm's competitive advantage.

Finally, integration is a key learning event. Capturing and incorporating the lessons, issues, and opportunities during integration which as noted above, includes interfacing subsystems that are strategic, would be difficult if outsourced. For these and other reasons, it was agreed to the firm would insource integration.

**Step 6: Supply-Chain Assessment**

The final decision was to determine the design of the logistical supply-chain. In this case, the analysis was straightforward given the integrality of the HVAC systems. Outsourced HVAC systems provided by the Nippondenso's and Delphi's as routine practice assume the supply of the completed HVAC subsystems to assemblers.

**Follow-up**

The results of the sourcing model which recommended that the company should not specialize in HVAC development and manufacture were reviewed with the Sourcing Advisory Team. The recommendations were consistent with the longer-term objectives of the firm and corporate strategy. *When adopted, the above strategic
sourcing policy would save the firm approximately $20MM per year through head-count and infrastructure cost reductions. The decision to retain integration responsibilities would further ensure the strategic benefits from accessing specialized producers would not be offset by the risks from outsourcing. Moreover, the Advisory Team believed the retention of this function would further enable the firm to synergistically exploit the innovatory capacity of the supply-base with internalized activities for mutual advantage.

The application of the sourcing model to other subsystems yielded similar results. The recommendations to opportunistically outsource selective elements of the firms value-chain were projected to significantly:

- reduce costs,
- increase flexibility, and,
- improve firm response,

to changes in the market or technology for competitive advantage. These structural changes were believed to greatly improve the competitive capabilities of the firm and allow it to become world-class in those elements of strategic importance both today and in the future. The Advisory Team therefore recommended the model be advanced to the deployment phase.

5.4.3 Deployment Phase

The success of the model during the validation phase required nominal changes for the deployment phase. The only significant modification was to train additional facilitators. This decision was motivated as much by practical considerations in assessing
the over 133 major subsystems in the company as by the need to address domain expertise identified in the earlier phases. The later was especially critical to ensure the accuracy and integrity of the decision process.

As of this writing, the model has been applied to several major subsystems. Additional facilitators are also being trained. In conjunction with these model deployment activities, efforts are also underway to set-up corporate wide mechanisms to ensure the results are accepted and implemented. The results of the model, for example, will be used to establish a corporate wide “Bill of Sourcing” that all divisions - truck and car - will follow. In addition, efforts are also underway to develop an operational sourcing model to link the strategic recommendations with the practical sourcing decisions at the divisional level. Finally, consideration is being given the human resource implications of the sourcing model.

The adoption of these and other activities may be delayed due to union negotiations. The union to date has not been involved with the decision dialogue process.

5.5 Key Lessons

The anticipated success of the strategic sourcing model demonstrates the potential to effectively apply academic theory to the practical realities of firm design. Though many of the decisions will involve significant redesign of the firm and its structure, the results are expected to greatly improve the cost-structure of the firm, and more importantly, its speed, flexibility, and hence capability to exploit to change for competitive advantage.
In applying the model to other industries or firms, several lessons from the experiences at the automotive manufacturer should be noted. This includes:

- **Corporate Commitment**: An absolute requirement and critical success factor is acceptance and buy-in from senior management. The nature of the decisions preclude a bottom-up approach to strategic sourcing. Buy-in is key to acquiring the kinds of commitment and staying power needed to implement the often hard-choices in firm redesign.

- **Early-Involvement**: A second key success factor was the early involvement of “lead-users” and key stakeholders in senior management. The latter is especially critical to fine-tune the model, such as adjusting the importance weights in the decision logic, to the clock-speed and strategic focus of the firm and its industry. The former is also essential to package and sensitize the firm redesign decision process to the corporate and cultural dynamics at the site.

- **Staged Deployment**: A final and key success factor was the decision to stage the deployment of the firm design process. This is extremely important to ensure early “teething” problems do not become excuses by politicized interests to undermine the decision process. Gating the deployment process also offers management an important lever to minimize risk. The reduced pressure and use of “safe” environments early in the development process can help the team acquire the necessary learnings as well the confidence of senior level management and the effected organizational interests that will ultimately determine the success or failure of the firm redesign effort.
Finally, of course, provisions must be made to account for the political and organizational dimensions of the process.

5.6 Summary

Firm redesign is an imminently practical and powerful tool for competitive advantage. Implementation at the automotive manufacturer demonstrates the potential of firm redesign to significantly reduce a firm's structural costs while improving its speed and flexibility to change.

As noted by the experiences and lessons learned from the automotive manufacturer, many of the challenges in firm redesign are less technical and more organizational in nature. Considerations include the method to administer the model, the sources of the data, and the choice of deployment strategy. Early involvement, senior-level commitment, and a staged approach to model deployment were used and found to be key success factors. The implementation effort further pointed to the political and cultural dimensions of the firm redesign effort. Care must be taken to ensure the affected interests and key stakeholders are accounted for and reflected in the model deployment efforts. This Chapter presents one implementation mechanism for possible application in other firms and industries.
Chapter Six

Thesis Summary

As demonstrated in this thesis, firm design is no longer a competitive afterthought. It has become a competitive necessity that will enable firms to exploit today's opportunities while fostering option-like capabilities to tap into tomorrow's possibilities for sustained advantage. The design of the firm will remain an important and essential competitive lever for use by business managers.

Existing firm design models are ill-posed to exploit the competitive power of firm design in a world of constant change. As demonstrated in their application to a real-world problem at an automotive manufacturer, core competency-based approaches and other traditional mainstream methods seek to maximize today's opportunities based on today's capabilities. Their inward focus and emphasis on static advantage fails to capture the richness and potential opportunities in the future for sustained competitive advantage. After all, today's decisions define tomorrow's capabilities and possibilities. As change becomes even more pervasive in technology, markets, and international competition, the failure to plan for tomorrow can make today's competitive successes short-lived if at all.

The Strategic Sourcing that is the subject of this thesis represents the beginnings of the next paradigm in firm design. The model extends current thinking to embrace the new competitive realities marked by change in the firm's external environment. This is
reflected in the movement away from today’s static and reactive firm design processes focused on the firm to that of a dynamic, fluid and opportunistic conceptual model that is both forward and outward looking. These concepts represents a dramatic departure from traditional inside-out analysis by recognizing the impact of specialization choices on the future response of the firm to changes in it’s environment. The requirement is critical to safeguarding the capacity to exploit and or create future competitive discontinuities for competitive advantage. The decision process thus seeks to promote experimentation and opportunistic redesign as both markets and the firm’s capabilities evolve to achieve a unique and sustainable competitive advantage.

The Strategic Sourcing model achieves these objectives by balancing an outside-in analysis of future and current opportunities with an inside-out assessment of the firm’s current and potential capabilities. The decision to specialize is further made simultaneously with respect to product, process, and supply-chain requirements in the context of the firm’s value hierarchy of products and services. The grounding in the realities of firm design is key to achieving global and not only local optimums while providing the business leader with a practical and powerful decision tool to realize the gains from firm design for competitive advantage. The utility of the model and potential to dramatically improve a firm’s speed, flexibility, and cost-structure was demonstrated in its application and implementation at an automotive manufacturer. To facilitate implementation and deployment, the Strategic Sourcing model was recast as an interactive decision dialogue process as represented in Appendix A.

In summary, the research has highlighted the importance of firm design in the competitive equation. In addition to combining the best of existing methodologies, the thesis has also advanced the state of the art by building on these foundations to create new cornerstones in firm design for the 21st century. The key contributions include:
incorporating the impact of today's firm design decisions on tomorrow's capabilities and opportunities; promoting concurrent product, process and supply-chain design within the firm design process; and, finally, using the firm design process to affect opportunistic change in the firm's markets and technology supply-chain for favorable advantage. More research is needed to further extend these concepts to fully leverage the power of firm design for competitive advantage.
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