

DEVELOPING AN INTEGRATED SUPPLY CHAIN COSTING APPROACH  
FOR STRATEGIC DECISION MAKING

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The supply chain management discipline suggests that information sharing is paramount when attempting to achieve cost reductions and quality improvements. In many cases, the traditional accounting data used to support strategic decisions reflect inaccurate supply chain costs. This research explores the applications of managerial costing techniques, and how they can be used to improve the decision making capabilities of firms in the aerospace and transportation industries.

The methodology used to address the research questions consisted of a hybrid of the grounded theory and multiple-case study methods. The objective of this research was to present the antecedents and barriers associated with implementing supply chain costing, and the impact that costing approaches have on strategic decision making.

The research identifies a theoretical model that can be used to explain the relationships and themes associated with supply chain costing and strategic decision making. Evidence suggests that there is some movement to implement managerial accounting techniques within these two industries to capture supply chain costing information. However, the reliance on traditional financial accounting suggests that the overarching principles of supply chain management and information sharing amongst of partner firms has yet to be realized.

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## CHAPTER 1

### OVERVIEW

#### Background

Corporate-level strategy is defined as any action taken that attempts to gain a competitive advantage in the marketplace by selecting and managing several businesses competing in multiple industries or markets (Hitt et al. 2001). By using this definition for strategy, successful managers will lead and direct several strategic business units (SBUs) to achieve an end-result exceeding that of the sum of its parts. In today's business environment, a definition similar to that above, where strategy entails an individual firm and its SBUs, is somewhat short-sighted as strategic decisions are rarely limited to the four walls of the factory or even a firm's boundaries (Cooper and Slagmulder 1999(a)). Situations where firms will compete on a one-on-one basis will be the exception rather than rule (Dyer and Singh 1998). Furthermore, strategy and decision-making will most likely span and affect the entire supply and customer chain.

With the emergence of supply chain strategy and supply chain management (SCM), companies are now competing as a network of firms (Ketchen and Hult 2007; Christopher 1992). As such, supply chain partners are attempting to be more competitive in the marketplace by increasing the visibility of supply chain costs in order to produce a

competitive advantage and allow managers to improve decision-making and generate higher profits (Aspinall et al. 2004).

SCM has been defined as the integration of all activities across the network to increase the efficiency or effectiveness at which a firm or organization designs, produces, and delivers its products and/or services to the end user (Ellram and Cooper 1993; Chopra and Meindl 2004). Lambert et al. (1998, pg. 1) define SCM as the “integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and stakeholders.” For the purposes of this study SCM is defined as:

The integration of all supply chain activities to achieve efficiency and effectiveness improvements by designing, producing, and delivering products and services to the end customer.

Moreover, supply chain partners will perform in a collaborative and cooperative manner to add value by delivering a higher quality product or service or by reducing total cost where the savings can be shared with partners and/or shared with the consumer. Because of the cooperative and collaborative efforts of multiple partners within the network, the impacts to strategy are called into question or remain unexplored by researchers.

Previous research has not addressed how and if, corporate strategy is affected by re-allocating the benefits and burdens associated with the shifting of performance functions or costs throughout the supply chain.

Porter (1985) suggests that coordinating with upstream and downstream partners is not a zero-sum game, as it shifts costs between firms. As such, the formulation of corporate strategy requires inter-organizational and inter-firm coordination and

collaboration between the lead-firm and its surrounding network constituting all partner firms. Previous research has taken a broad brush approach at the role SCM functions, yet their roles do not indicate clear roles. Companies espousing to the principles of SCM should use its principles to manage ongoing supplier cost management through the use of multi-functional teams in order to accurately reflect the necessary inputs for overall strategy determination (Ellram 2006). Supply chains compete on every aspect and efforts must be made that match corporate strategy with supply chain strategy (Ketchen and Hult 2007). The means to achieving this is through the strategic alignment of supply chain partners.

Strategic alignment is necessary for supply chain improvements in efficiency/effectiveness (Defee and Stank 2005). However, achieving strategic alignment with multiple firms is often difficult. Seuring (2000) suggests that firms implement inter-firm supply chain costing as a means to increase profit margins, and or improve the quality of its product or service. As such, and, what is largely the focus of this research, is the presentation of supply chain costing as an input to strategic decision-making at both the supply chain and corporate level. This study examined various applications of supply chain costing, which were utilized by firms in the aerospace and transportation and industries. Additionally, the study identified the relationship between supply chain costing techniques and how it can be used to improve the decision making capability of the firm's senior leaders. The importance of this research is that supply chain costing has the potential to become the first SCM tool that can be used to simultaneously manage improvements to product/service quality and potential cost reductions. For the purposes

of this research supply chain costing is defined as a method for identifying cost-based performance measures that span multiple supply chain members, which are subsequently used to improve aggregate efficiency or effectiveness (LaLonde and Pohlen 1996). Several articles have suggested that supply chain costing and cost knowledge, is used in a complementary manner and can be used to create a competitive advantage (Norek and Pohlen 2001; Cooper and Kaplan 1988; Porter 1985).

The means to achieving a competitive advantage for the entire network of firms may lie in the ability to capture supply chain costs. In most cases, the costs will span upstream and downstream suppliers and customers. If used properly supply chain costing can be used as an effective means for achieving improvements (Norek and Pohlen 2001). As a result, firms need to understand how supply chain costing will work and how it will affect decision making. In theory, the results of a supply chain costing effort will allow decision-makers to shift functions within the supply chain so that the most cost efficient or highest quality provider performs a designated task (LaLonde and Pohlen 1996). Decision-makers who have access to supply chain cost information will be able to make faster and more informed decisions that cannot be duplicated by competing firms or competing supply chains.

While the techniques identified for supply chain costing are not extremely difficult, few studies have attempted to provide more than a normative approach for supply chain costing. Additionally, the techniques identified stem from the management accounting literature and do not address multiple-firm considerations. To date, very little is known about supply chain costing. As a result, most U.S. and Western firms do not

know what it is or how to implement it (Cooper and Slagmulder 1999(a)). In general, firms lack the capability to identify and determine the costs of all activities across the supply chain (LaLonde and Pohlen 1996).

The total costs for a supply chain include the costs of the buying firm, the selling firm, its upstream suppliers, and its downstream customers. Capturing these various cost elements is often difficult. To compound matters most firms will default to traditional cost accounting rather than management accounting where cost analysis can be used to improve decision making capabilities. In this vein cost analysis spanning the supply chain can be conducted by the lead-firm to identify which partner can provide an activity, function, or process for the lowest cost (Cavinato 1991). Doing this requires a thorough analysis of the network of key firms and the associative cost drivers. Lambert et al. (1998) suggests a network modeling approach that maps supply chain members by key processes so that strategic partners or processes can be managed aggressively, while others can be managed with little or no effort. A key take-away with this point suggests that an all hands approach may be unnecessary.

The key processes that should be considered when mapping a supply chain include: customer relationship management, customer service management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization, and returns (Croxtton et al. 2001). Rarely does one firm carry out each of these functions independently. As a result, the costs of partner firms must be assessed and analyzed in a comprehensive manner in order to achieve supply chain process improvements.

While most supply chain professionals are not accountants, supply chain costing requires cost knowledge and cost management skills in order to achieve efficiency or effectiveness gains via enhanced decision-making. Furthermore, obtaining cost information across multiple firms requires access to accounting information. Not surprisingly, the fundamentals of supply chain costing that have been presented to date stem from the management accounting discipline. Titard (1983) defines accounting as the discipline responsible for generating company financial information, which is used for decision-making. In order to make good decisions, the true costs of doing business must be captured (Cooper and Kaplan 1988(a); 1988(b)). However, identifying cost information that can be used by managers for supply chain decisions is often difficult.

In most cases, supply chain costing information will not come from financial accounting efforts and/or corporate income statements. Supply chain costing requires another set of books. While a second set of books may represent a barrier for some firms, it is not entirely new or prohibitive. Drucker (1963) suggested that companies should not rely on traditional financial (i.e., cost) accounting in formulating corporate strategy. To address this dilemma and to enhance the decision-making utility of accounting information, the accounting discipline segregated its body of literature into two disciplines in the late 1960s and early 1970s (Scapens 2006). The two streams are now classified as cost or financial accounting and management or managerial accounting. The new classification became necessary because financial statements were being, and still are, written for outsiders (i.e., IRS, SEC, shareholders, lenders); they are not written for decision makers (Paris and Brassard 2004).

Ramos (2004) contends that management accounting should be used to assist in supply chain managers attempting to integrate suppliers, producers, and retailers. In that realm, management accounting serves to assist in the formulation of strategies for achieving a competitive advantage (Ramos 2004). If used properly, management accounting can be used to capture timely and accurate information which can be accessed by the managers responsible for making short and long-term decisions that affect planning, coordination, control, performance measurement, and motivation (Gupta and Gunasekaran 2005). In essence, management accounting systems provide information that traditional cost accounting was not designed to collect.

Achieving the efficiencies or effectiveness improvements that SCM seeks requires a management accounting system that captures important cost data outside of the firm (Seal et al. 1999). Seal et al. (1999) suggest that there are three fundamental roles for management accounting in inter-firm relationships: 1) the make-or-buy decision that could lead to a partnership; 2) the use of a management accounting technique to manage the partnership; and 3) the platform for assessing each supply chain partner's responsibilities and their performance.

Tyndall and Busher (1985) suggested that logistics managers were continuing to lag behind their manufacturing counterparts because they had failed to identify a costing methodology that would allow them to solve problems and to optimize logistics functions. Numerous articles attempted to address this shortcoming by identifying management accounting techniques that could be applied to SCM. Indeed, the management accounting techniques of activity-based costing (Cooper and

Kaplan1988(a),1988(b); Cooper and Kaplan1998; Thomas 1994; Henricks 1999; Brac 2000; Horngren et al. 2000; Lin et al. 2001), target costing (Cooper and Slagmulder 1999(b); Elram 1999, 2000, 2006), total cost of ownership (TCO) (Cavinato 1991; Ellram 1993; Hurkens et al. 2006), and value chain analysis (Dekker 2003) have addressed the costs for a particular firm; however, prior research has not identified the processes for collecting and using inter-enterprise cost information. To date, management accounting has not offered a costing methodology which could be used by supply chain managers to improve decision making across the network of partner firms. Finally, firms have not demonstrated the ability to cost out the supply chain as a network (LaLonde and Pohlen 1996).

### Problem Statement

Strategic decision makers do not have an integrated approach for obtaining and using supply chain cost information. The SCM literature and concept suggest that this capability is paramount for achieving cost reductions and quality improvements. While several managerial costing techniques have been identified, a clear methodology for collecting and exchanging costs from multiple supply chain partners does not exist. Consequently, the financial data used for strategic decisions seldom represent accurate supply chain costs. As such, it can be quite challenging to identify supply chain efficiencies or product margin improvements when viewing the inventory or transportation costs that are reported in a financial statement. Firms who utilize traditional cost approaches in isolation run the risk of basing strategic decisions on the

individual firm alone. This approach could result in an increase in supply chain costs or a drop in quality that must eventually be passed on to the end customer.

### Purpose Statement

The purpose of this research was to explore and to understand the application of costing techniques used by firms for collecting and disseminating cost information up and down the supply chain, and how strategic decision makers use or can use supply chain costs to improve their decision making capabilities.

### Scope of the Research

The research focus of this study was to explore the SCM function of the firms identified and, more importantly, their familiarity and experiences when using supply chain costing. The firms identified helped to demonstrate the strategic importance of SCM via its organizational structure or corporate strategy. Many of the participating firms were selected because of their corporate emphasis on SCM and/or their demonstrated successes in reducing costs by working with multiple supply chain partner firms. Additionally, much of the attention given to the study of these firms was to query personnel within the logistics or SCM operations and management staff, the sales and marketing staff, the procurement staff, and the accounting staff collect intra and inter-enterprise cost information (e.g., methods for collection, who did the collecting, and how it was used). Interviews were carried out and qualitatively analyzed to establish a grounded theory and to identify cross-case similarities and differences. The open-ended

interviews were directed at a cross-functional sample of individuals who actively participated in the processes associated with collecting and disseminating supply chain cost data. Briefings and documents were also collected and used for analysis when they were provided by the interviewees or participating firms. Finally, the research was directed at upper-level management to assist in determining how supply chain costing information impacted strategic decision-making.

While the literature suggested that interest in supply chain costing was increasing, with the exception of an example of inter-organizational costing in the Japanese technology and automotive sectors (see Cooper and Slagmulder 1999(a)), a methodology or actual implementation of supply chain costing was not found. As a result, one of the tertiary goals of the research was to identify the experiences of firms and possible examples of home-grown supply chain costing techniques that allowed for cost analyses and decision-making at the strategic level. As a result, this effort was the bedrock of the research and was used to construct a framework for supply chain costing that could be used to build theory for future testing as the phenomenon matures.

This research was an exploratory and descriptive effort, but made a concerted attempt to isolate specific techniques that can be used by the practitioner, particularly as an aid for strategic decision making within the firm and across the network. Additionally, the research identified both normative and prescriptive techniques based on the information collected from the leading-edge firms whom participated in the study, and the concepts previously identified in the literature. Note: There was a concurrent grant effort secured by the University of North Texas and sponsored by the Council of

Supply Chain Management Professionals that called for the publication of a how-to-guide for supply chain costing. This effort did not duplicate the grant work by any means, but rather, focuses on the relationship between supply chain costing and strategic decision-making.

The firms selected for participation all agreed to the provisions of the Institutional Review Board. Each of the firms selected had demonstrated a commitment to SCM or received acknowledgement as top performers in the supply chain community. The downstream and upstream members of various supply chains which participated had been further identified by the supply chain lead-firms and agreed to participate on a limited basis. These firms and the representatives participating in the interviews were not identified by name in the study to maintain anonymity and to prevent compromising proprietary information.

### Research Questions

The following questions assisted with the identification of an integrated supply chain costing model that can be tested in future research and was used to identify what the drivers to supply chain costing are and which supply chain costs should be captured. Second, the questions were used to identify the barriers to implementation and the supply chain personnel actively involved in the collection and dissemination of cost information. Finally, the questions were used to address the relationship between supply chain costing and strategic decision-making. In total there were three primary questions and six investigative questions.

The research questions:

- 1) How do managers cost out supply chain processes?
- 2) How is the information used for strategic decision making?
- 3) What costing techniques provide the greatest insight into the factors driving supply chain costs and best support decision-making?

In order to further address the research questions, a series of investigative questions are presented below. The following questions are answered after the conclusion of the data analysis which was based on the interview data or documentation provided by the participating firms. Additionally, some of the investigative questions were answered by the literature review which is presented in the next chapter.

#### Investigative Questions

- 1) How can the financial rewards associated with supply chain costing efforts be distributed equitably (not necessarily equally) with supply chain partners?  
(supports research question 2)
- 2) What does a taxonomy of existing costing techniques look like? (supports research questions 1 and 3)
- 3) What type(s) of supply chain costing information is being collected by firms?  
(supports research question 1)
- 4) Who (i.e., which decision makers) generates supply chain costing information and who are the recipients (i.e., users) of the data within the firm? (supports research questions 2 and 3)

- 5) What are the barriers to implementation for supply chain costing? (supports research question 3)
- 6) What techniques can be used to overcome the barriers associated with supply chain costing? (supports research question 3)

### Research Objectives and Guiding Propositions

The first objective of this research was to understand the phenomena of the supply chain costing process. Second, the research explored the supply chain costing phenomenon and its relationship with decision-making by carrying out a multiple-case study, which was generalized to the theoretical propositions that were modified as the research progresses (Yin 2003). Furthermore, the research attempted to identify the barriers associated with implementing supply chain costing techniques and the resources required for improving the techniques. The propositions listed below are based on information gathered from prior research and were used as a guide to address the primary research questions as well as the investigative questions. These guiding propositions were further developed as the study progressed. The end result is propositions which were formulated and supported by the findings of the interviews and case study analysis. These propositions are then operationalized later for future research where they can be tested via hypotheses in a more empirical manner.

1. Supply chain costing involves the activities and functions directly related to product or service information flows across multiple firms (i.e., the entire supply chain) (see Seuring and Goldbach 2002, Cooper/Slagmulder 1999).

2. The level of collaboration between firms is positively related to the amount of supply chain costing data that is collected by supply chain partners (Combs and Ketchen 1999; Handfield and Nichols 1999; Paris and Brassard 2004).
3. Firms engaged in a management accounting technique such as activity-based costing, target costing, direct product profitability, or Total Cost of Ownership accounting will demonstrate a greater propensity to engage their suppliers in their costing efforts and derive mutual benefit (Berry et al. 1997; Dekker and Van Goor 2000).
4. Senior executives from the lead supply chain firm will be the most likely candidates to initiate a costing initiative (Lambert et. al 1998).
5. Supply chain costing will be used to support a wide variety of strategic decisions throughout the supply chain (Lambert and Pohlen 1996).
6. Strategic decision making is impacted by supply chain costs and firm characteristics (Mintzberg 1973).
7. Activity based costing or an alternative management costing technique should be used in conjunction with traditional cost accounting to formulate financial reports (Cooper and Kaplan 1988(a), 1988(b), 1998; Lippa 1990)

## Method

This research used a hybrid approach that combined the grounded theory methodology proposed by Strauss and Corbin (1990) with the multiple-case study method proposed by Yin (2003). These methods are both designed for phenomenon

where very little is known about the antecedents and the outcomes. In the case of supply chain costing, a conceptual model did not exist, nor was there prior literature that suggested variables that could be tested empirically. As a result, the research questions could not be addressed by using a quantitative methodology. Hence, the research is predominantly exploratory.

Neither the grounded theory methodology nor the case study method was appropriate by itself as a research method. The key facets of both are necessary for theory development and describing the themes of supply chain costing. However, because the grounded theory method allows the researcher to begin with an area of study rather than a theory, the theory can emerge. As mentioned earlier, the literature does not identify supply chain costing theories. By using the grounded theory method, the theory can emerge and be further developed as the research progresses. With case study research, theory is developed from prior research and is established a priori in a case study (Yin 2003). For this study, a theory does not exist and so grounded theory is ideal because the research can be performed in a natural setting and constant comparisons and additional interviews can be conducted where necessary (Charmaz 2001). Conversely, the case study method is useful because it helps to identify the sample up-front, while still providing a means to reconcile evidence and data collected across cases (Eisenhardt 1989(a)). The case study method also allows for a cross-case comparison of the firms and the industries identified and selected in the sample.

Ultimately, the key facets of each methodology were both utilized in an effort to build-theory during the research process. The grounded theory approach used in

conjunction with Yin's (2003) case study approach has previously been tested and outlined by Eisenhardt (1989(a)) and Ellram (1996).

### Data Collection and Analysis

Data was collected from multiple sources. Corbin and Strauss (1990) and Yin (2003) suggest that a triangulation approach helps to ensure the reliability of the findings. The data consisted of personal interviews, which were recorded, and additional documentation was collected when provided by the participating firms (e.g., briefings, memos, etc). Personal interviews began at the firms' location with multiple team members from SCM, sales, marketing, finance/accounting, and operations. Additionally, the literature review was used to answer several of the questions posed in the research which had been previously addressed.

The research targeted eight supply chain lead-firm cases from two different industries. The industries selected for this research were the transportation and the aerospace industries. Attempts were made to capture individual firms that performed various roles across the supply chain network (e.g., supplier, manufacturer, or distributor). Consequently, the supply chain costing roles and responsibilities based on one's supply chain position could be captured. The interviews and supporting documents were transcribed and converted to text documents and coded within MaxQDA. Finally, the coding was analyzed to examine themes and patterns within and across industries. The analysis and coding was performed in accordance with Strauss and Corbin (1990)

and Miles and Huberman (1994). More detail is provided in chapter 3, which addresses the open, axial, and selective coding of the analysis phase.

### Research Contribution

This research represents a rare opportunity where academia can get out ahead of the practitioner. Research can lead practice in formulating a costing approach and to understand its affect on decision-making. The present literature, both peer-reviewed and practitioner oriented, lacks a definitive approach for integrating supply chain costs across multiple firms. Theories pertaining to management accounting techniques capable of capturing costs for a single firm exist; however, collecting cost information throughout the supply chain does not. The theory developed during this research will represent SCM's first attempt to define the relationships and constructs that explain supply chain costing and its affect on strategic decision-making. Furthermore, this research will extend the conceptual research found in the literature by exploring supply chain costing in a more empirical manner.

During the Council of Supply Chain Management Professionals (CSCMP) annual conference in 2006, practitioners expressed considerable confusion with regard to the supply chain costing techniques that had been previously offered as a means for reducing costs and/or improving performance across the supply chain network. Additionally, practitioners explained that they do not know how to implement or manage an inter-organizational management accounting system and use it for decision-making.

Answering investigative questions five and six attempts to bridge these gaps through the identification of the successes and barriers of supply chain costing and by identifying their relationship with strategic decision making. Effectively, the research builds theory by examining the processes that various firms have instilled. Finally, by conducting a cross-case comparison and by identifying the patterns associated with supply chain costing and decision-making, across or within firms, future prescriptive research is motivated.

#### Research Limitations and Assumptions

First, the research conducted was primarily exploratory and descriptive, and was limited to a purposeful and theoretical sample of approximately eight lead-firms. The research was limited to eight firms because multiple interviews within each firm had to be transcribed and analyzed. The individual interviews ranged from one to two hours in length and were often in excess of 30 pages of single-spaced typed pages in length. Each of the transcribed interviews was then coded for qualitative analysis purposes.

Since the research was limited to such a small sample of firms, great caution was given when attempting to generalize the findings to all firms within a particular supply chain position within an industry. For example, there were many firms where particular supply chain functions did not consume the same percentage of costs within the organization (e.g., line-haul trucking companies vs. a trucking manufacturer). Additionally, some firms were limited in their ability to depict the complete span of their supply chain visibility due to the position within the supply chain that they occupied.

It is important to note that the resultant propositions cannot be inferred as a causal relationship. Operationalizations of the proposed constructs have not yet been identified, and were not included in the scope of this exploratory research. Additionally, there are many factors that affect the design of a supply chain costing method within a firm. It is quite possible, that one firm may have a great deal of leverage over its suppliers. As a result, the suppliers may not receive extensive cooperation or collaboration from the lead supply chain firm. It is often quite common where some supply partners are not willing to share any cost information with partners in fear of compromising an existing competitive advantage.

While a deliberate attempt was made to explore the relationship between supply chain costing and decision making, many of the companies that were interviewed were in various stages of utilizing supply chain cost collection methods. For example, those who may have just implemented inter-organizational costing with a short-term partner may experience different barriers during implementation than those with a long-term partner where a strategic alliance exists. Lastly, while the supply chain functions within a firm have received increased strategic visibility, there are still decision-makers within the firm that view the supply chain as the “box-kickers in the warehouse.” Consequently, the supply chain’s impact on decision-making may be relegated to a lower level in those firms.

### Research Organization

This research is presented in five chapters. The first chapter provides the

background for the study, the importance of the research, the problem statement, the objectives and propositions, and is followed by the contribution and the limitations of the study. Chapter 1 is a summary of the research effort and attempts to argue the importance of supply chain costing and further identifying why and how the research will contribute to the literature. Supply chain costing is a rather new phenomenon where the research can drive practitioner behavior and help to identify cost and quality improvements which can be passed on to the end user. Chapter 2 presents the existing literature pertaining to supply chain costing and is the bedrock of the motivation for the research questions. It includes all prior research pertinent to the research questions as well as the discourse behind the research problem. The literature review is somewhat abridged in order to allow the grounded theory to emerge and mitigate further bias to the emerging theory. In summary, the literature review revealed that many researchers had scratched the surface of supply chain costing leaving fertile ground for research in this area.

Chapter 3 contains the methodology, and a detailed discussion on interview protocol, data collection, and analysis. The rationale for choosing a qualitative method based on the research questions over a quantitative method is also provided. Because the phenomenon is relatively new and much of it unexplained, a qualitative method was the most logical approach for identifying theory capable of explaining the constructs and relationships depicting supply chain costing and its impact on decision making.

Chapter 4 includes the analysis performed to answer the research questions and the findings which led to further refinement of the seven propositions that were suggested

earlier. Much of this chapter addresses the individual findings from the interviews and coding exercises where the characteristics could be framed in the context of the aerospace and transportation industries. Finally, Chapter 5 discusses the conclusions and generalizations which were based on the findings encountered. This chapter also includes the implications for theory and the relevance for practitioners. At the conclusion of Chapter 5 are the suggestions for future research which can be empirically tested in a more quantitative manner.

In summary, supply chain costing can play an integral role in linking multiple partners and can be used to help establish a competitive advantage for a network of firms.

## CHAPTER 2

### LITERATURE REVIEW

#### Overview

This chapter identifies the basic concepts of supply chain management (SCM) and its relationship with multiple management accounting techniques which can be used to identify efficiencies and effectiveness gains across multiple firms. Each of the management accounting techniques presented in previous research is addressed as are the linkages to strategic decision making. At the conclusion of this chapter a research matrix is presented. The matrix was used to help identify the common themes and principles found in the literature. Lastly, the matrix was used to motivate and to refine the research questions posed.

#### SCM and the Integration of Costs

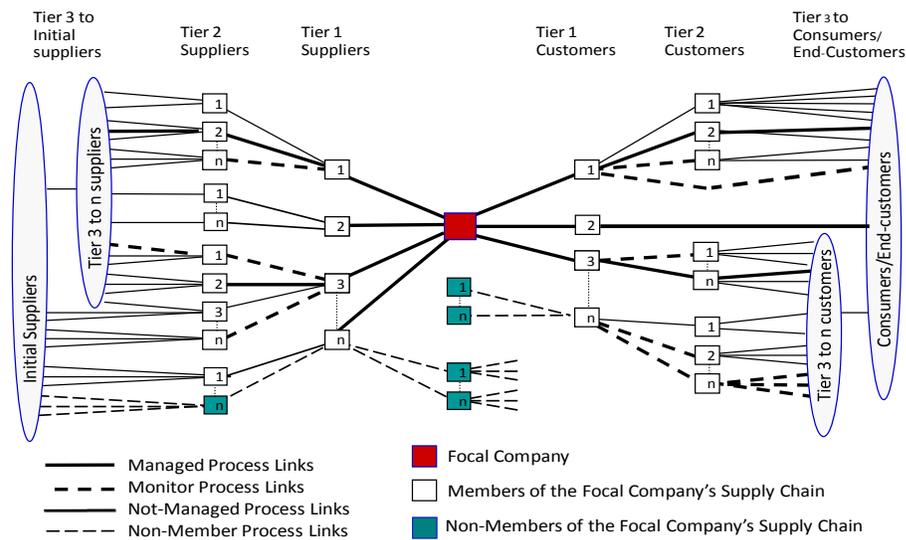
The supply chain management (SCM) literature suggests that firms should integrate all activities across the network in order to increase the efficiency or effectiveness at which it designs, produces, and delivers its products or services to the end user (Ellram and Cooper 1993; Cooper et al. 1997; Chopra and Meindl 2004). SCM has been defined as the integration of business processes, which includes the cooperative and collaborative efforts of the buyers and suppliers located upstream and downstream in the supply chain, that add value for the end customer.

Porter (1985) suggests that coordinating with upstream and downstream partners is not a zero-sum game, as it decreases costs for each firm. Firms have been estimated to control only 40-60% of their overall costs with the remaining costs being driven by the decisions of other supply chain partners (Chizzo 1997).

The following diagram (see Figure 2.1) depicts a three-tiered supply chain and indicates the key processes that may or may not be captured when attempting to cost out the functions of various supply chain partners.

Figure 2.1

### THE SUPPLY CHAIN NETWORK



Source: Adapted from Douglas M. Lambert, Martha C. Cooper, Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2, 1998.

In today's business environment, companies must look beyond their four walls and communicate with their suppliers and buyers to increase profit margins and/or improve the quality of its product or service (Cooper and Slagmulder 1999(a)). To

accomplish this, Seuring (2000) recommends that firms should implement inter-firm supply chain costing systems. While Japanese firms have experienced a great deal of success with inter-organizational costing, Western firms lack the capability to determine the costs of activities across the supply chain (Cooper and Slagmulder 1999(a); Lambert and Pohlen 1996).

Although numerous studies have advanced the SCM concept and its ability to benefit the entire supply chain with increased margins and/or improved customer service, previous research has not addressed the cost and service benefits of managing the supply chain as a network of firms. This research seeks to identify a management accounting technique that spans the entire supply chain and intends to explore the procedures and steps that firms have taken to implement the additional accounting system. The following section discusses management accounting and a myriad of techniques that are most often used when attempting to capture pertinent supply chain cost information.

### Management Accounting

Indeed, the management accounting techniques of activity-based costing (Cooper and Kaplan 1988(a), 1988(b); Cooper and Kaplan 1998; Thomas 1994; Henricks 1999; Brac 2000; Horngren et al. 2000; Lin et al. 2001), target costing (Cooper and Slagmulder 1999(b); Elram 1999, 2000, 2006), total cost of ownership (TCO) (Cavinato 1991; Ellram 1993; Hurkens et al. 2006), and value chain analysis (Dekker 2003) have addressed the costs for a particular firm; however, previous research has not described the process by which the supply chain lead-firm obtains and utilizes inter-enterprise cost information.

Achieving the efficiencies or effectiveness improvements that SCM seeks requires a management accounting system that captures important cost data outside of the firm. Seal et al. (1999) suggest that there are three fundamental roles for management accounting in inter-firm relationships: 1) the make-or-buy decision that could lead to a partnership, 2) the use of a management accounting technique to manage the partnership, and 3) the platform for assessing each supply chain partners' responsibilities and their performance.

Management accounting seeks to provide timely and accurate information to the managers responsible for making short and long-term decisions that affect planning, coordination, control, performance measurement, and motivation (Gupta and Gunasekaran 2005). Management accounting systems provide information that traditional cost accounting was not designed to collect. Traditional cost accounting was designed to capture the operational costs that become the basis for financial statements used by the firm's shareholders and/or auditors of the firm. There are several motivating factors which support a firm seeking another set of cost numbers by using managerial accounting techniques: (1) traditional accounting does not provide adequate value relevant non-financial information; (2) traditional accounting results in inaccurate product costs; (3) traditional accounting does not encourage improvement; and (4) traditional accounting does not recognize the predominance of overhead costs (Gupta and Gunasekaran 2005). Direct labor often represents only a small fraction of a firm's costs, while expenses covering factory support operations, marketing, distribution, engineering, and other indirect or overhead functions is on the rise (Cooper and Kaplan 1988(b)).

From a supply chain perspective, management accounting seeks to capture the supply chain costs that can be used to support strategic decisions. Cavinato (1991) suggests there are six supply chain cost considerations to make: 1) the labor rates of each partner, 2) the partner firm with the most effective process, 3) the partner with the most capital resources available, 4) the partner with the lowest cost of capital, 5) the partner with the highest tax rate, and 6) the partner who benefits the most from depreciation or other tax elements. Once these cost factors and decisions are analyzed, then the firms can decide which supply chain partner should perform a particular function.

### Management Accounting's Supply Chain Costing Techniques

#### *Activity-Based Costing (ABC)*

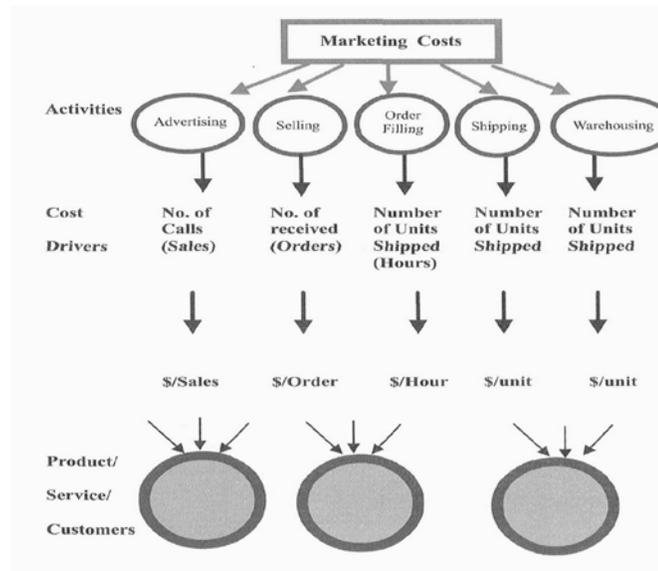
The motivation for using ABC as a management accounting technique is to attempt to capture the true costs of doing business. ABC does not replace traditional account systems, as its objective is to further define cost information so that it is more useful for the decision-maker (Lin et al. 2001). ABC emphasizes that the firm should allocate the costs associated with activities or products that consume resources as a direct cost, rather than allocating indirect costs in a peanut butter spread manner across the various cost centers. Cooper and Kaplan (1988) suggest that all activities exist to support production and delivery, and as a result, should be considered product costs. Furthermore, a thorough analysis of ABC and a firm's activities can be used to identify which customers are more costly to serve, and therefore, not as profitable. Consequently,

these customers can be eliminated, or perhaps, the drivers and activities tied to that customer can be modified or managed in a more lucrative manner.

Another fundamental concept of ABC is that volume does not have a causal relationship with profitability. Firms using ABC as a costing technique can obtain more accurate data pertaining to its products, customers, and service providers in terms of their overall contribution to profits (Lalonde and Pohlen 1996). The following diagram (see Figure 2.2) depicts a model for conducting ABC using the various activities of marketing that drive costs.

Figure 2.2

### ACTIVITY-BASED COSTING



Source: Stapleton et al. 2004, "ABC for Logistics and Marketing", *Business Process Management Journal*

The implementation of ABC consists of seven steps: 1) selecting the team, 2) analyzing the various supply chain functions, 3) breaking processes into activities, 4) identifying the resources being consumed by the activities, 5) determining the costs of the

activities, 6) tracing costs the cost objects, and 7) analyzing final cost information from a total cost perspective (Lin et al. 2001). ABC can be extremely effective if it is not overly complicated. In the researcher's experience, government organizations who have attempted to implement ABC have encountered great difficulty in trying to determine what processes and activities should and should not be managed. In many cases the adage of keeping it simple has not held, and the efforts have ceased. As a result, ABC has been the subject of much criticism.

The two fundamental criticisms of ABC are: 1) it focuses on intra-firm costs only and strives to achieve cost reductions rather than increasing customer service and 2) that the costs used to estimate activities and product costs stem from the traditional cost system that is inadequate for decision making (Johnson 1992). Assuming either criticism is appropriate, ABC as a stand-alone methodology does not appear to meet the philosophy of SCM where reducing costs and increasing quality and/or service are the objectives. The principles of logistics as taught to the undergraduates of most undergraduate SCM curricula speak of the tradeoff implications in providing a level of customer service and the costs associated with that level of service. In that light, ABC falls somewhat short in achieving the effectiveness improvements that a successful supply chain costing effort can evoke.

### *Target Costing*

Target costing aims to reduce costs during the new product development stage (Cooper and Slagmulder 1998). The goal of target costing is to involve the customer, the

suppliers, and the engineers prior to the design stage. Target costing efforts are initiated by intense market research where the supply chain lead-firm gathers intelligence about what the consumer is willing to pay for a given product. Based on the price, the supply chain lead-firm then attempts to reduce the development and production costs proposed by each supplier whom affects the price of the end item. Once the lead-firm has established the target selling price and margin, the allowable cost is calculated by subtracting the target profit margin from the target selling price:

$$\text{Allowable cost} = \text{target selling price} - \text{target profit margin}$$

(From Cooper and Slagmulder 1999(b))

Ellram (2000; 2002) suggests that there are six steps in the target costing process:

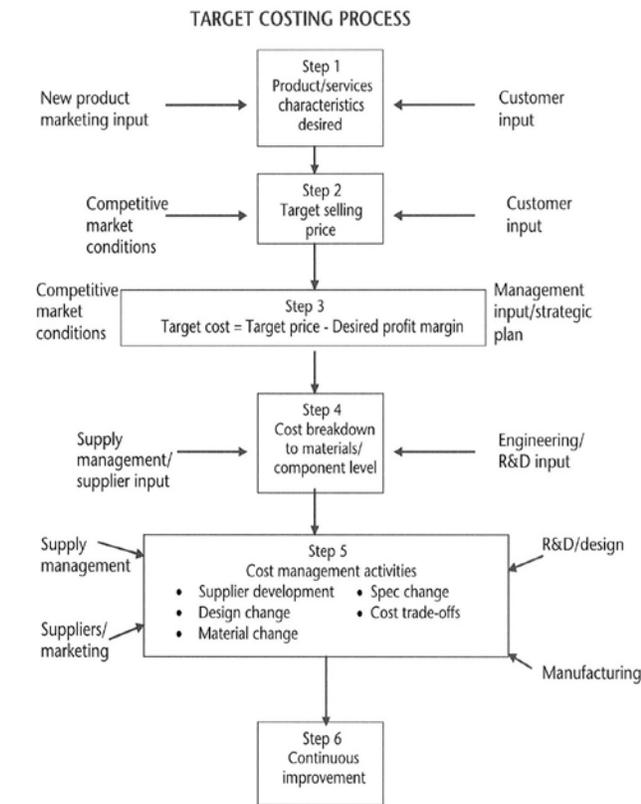
- 1) identify the desired product/service based on customer and the marketing function's input, 2) establish a target selling price based on market conditions and customer inputs, 3) compute the target cost (i.e., allowable cost), 4) breakout out costs to the component level and seek engineering and R&D input for potential design savings, 5) conduct supplier development meeting and change design if necessary, and 6) continuous improvement until target cost is achieved. Figure 2.3 displays a model for target costing that can be used by a firm.

Based on its premises, the target costing technique appears to be ideal for upstream supply chain costing; however, its application is limited for existing products and downstream members of the supply chain. Thomson and Gurowka (2005) suggest that target costing is more appropriate for increasing or managing profit expectations as opposed to being used as a strategic methodology for costing. As depicted in the model, the distributors and retailers do not appear to play an active role in the target costing

process. However, their roles are limited to a new product. Consequently, the target costing methodology is unable to consider a fielded (or current) supply chain product or service.

Figure 2.3

THE TARGET COSTING PROCESS



From Ellram, 1999.

*Total Cost of Ownership (TCO)*

TCO is a methodology that attempts to determine the life-cycle costs of a purchase from a particular supplier (Ellram 1993). TCO includes the procurement costs

and the costs that are associated with quality, transportation, inventory, and sustainment. For example, although a product or service might be offered at a lower initial price, other costs come into play in the long-term. If the end item is of lower quality because the firm purchased the lowest cost component item, then the firm could experience an increase in the number of returns from its end customers. Additionally, if an item requires upgrades or modifications in the out-years, then these modifications will likely increase the TCO. In the computer peripherals (i.e., printers) industry, in particular home and office printers, it is not uncommon to see TCO costs presented in terms of the life-cycle costs which are heavily impacted by the sustainment costs necessitated by the requirements for additional ink, toner, or paper.

TCO can also be used to improve the performance of individual suppliers through TCO measurements or key performance indicators. Ellram and Sifferd (1998) identify three levels of analysis for TCO determinations: operational, tactical, and strategic. Hurkens et al. (2006) conducted a study where TCO was shown to be an effective cost accounting system for strategic decision-making. One of the drawbacks of TCO is that previous research has not addressed how logistics costs across the supply chain are integrated and applied for strategic sourcing decisions. Additionally, TCO has limited application when attempting to make outsourcing decisions (Ellram 1993). In the aerospace industry in particular, TCO assessments often fail to capture sustainment costs that are encountered with the long lifespan of many of today's commercial and military aircraft.

### *Value Chain Analysis (VCA)*

Many in the SCM community have used the “value chain” terminology as a surrogate for supply chain. The VCA terminology stems from Porter (1985) and has been expanded to include the linkages in the supply chain that have important cost and/or differentiation implications for the value chain. Dekker (2003) suggests that VCA is an extension of the TCO model in that it is capable of capturing the costs of both the downstream suppliers and buyers (e.g., retailers). Furthermore, Dekker (2003) and Shank and Govindarajan (1992) suggest that the most appropriate way to conduct a VCA across multiple partner firms is to use an ABC analysis. The Dekker (2003) study identified three ways in which inter-firm cost data can be used in a partnership. First, the costs can be managed cooperatively by partners where the cost data can be used to analyze the overall cost performance of the supply chain. Second, the cost data can be used to evaluate the alternatives and consequences of changing the supply chain operations or structure. Third, the cost data can be used to compare the accrual of supply chain costs over a given time period.

While, the Dekker (2003) study is a good example of how firms can successfully share cost information, the research does not provide a methodology for implementation. Additionally, the use of VCA as a management accounting technique does not appear to offer additional insights not offered previously by ABC, target costing, or TCO.

### *Direct-Product Profitability (DPP) and Efficient Consumer Response (ECR)*

DPP and ECR are cost accounting techniques that were initiated in the grocery

industry. DPP is a methodology for identifying the profit contribution of products according to the cost incurred due to space and handling and all of a product's direct costs. Bookbinder (2001) defines DPP as the input used to identify each item's optimized share of floor space to maximize profits. DPP estimates profitability by subtracting the costs directly attributed to the product from the gross margin (Lalonde and Pohlen 1996). One criticism of DPP is that it fails to consider the overhead and carrying costs associated with a particular product (Kurt Salmon Associated 1993). Borin and Farris (1990) claim that DPP is extremely complex and often too cumbersome for managers to use when analyzing decisions on product pricing, space allotments, and sales promotions.

ECR is a costing technique that attempts to shorten lead-time and decrease costs in the supply chain (Turney 1991). ECR links the individual components of the supply chain via an automated process that can reduce costs by cross-docking inventory or by utilizing space and manufacturing in a more efficient manner (Lalonde and Pohlen 1996). Unfortunately, DPP and ECR do not provide visibility over the supply chain costs outside of the firm. Consequently, if a change is made to the current supply chain operations it is difficult to determine the overall supply chain cost impact. For example, if a task is moved further upstream so that the supply chain lead-firm can realize cost savings, DPP and ECR costing efforts are not intended to determine the cost impact that the change has on the upstream supplier. As a result, the upstream firm that incurred the additional costs may be unwilling to share cost information with this partner in the future.

## Barriers to Supply Chain Costing Implementation

Dekker (2003) suggests that there are three primary issues that collaborating supply chain firms will be faced with when attempting to exchange cost information: 1) the exchange of sensitive or proprietary information, 2) the concern over a fair division of costs and benefits, and 3) the investments that require a particular partner to make towards specific assets. One particular concern that relates to the exchange of sensitive information is that a partner firm may become concerned that cost information provided after the initial contract is signed will be used by the supply chain lead-firm to make comparisons with other competitors (Dekker 2003). Because of the fear of negative reciprocity, many companies are hesitant to present a full and open look at their cost data, as it could be used against them in future negotiations. Many firm policies actually discourage information sharing as a means to maintain an edge with partners (Towill 1997). Overcoming this barrier and others may require a contractual agreement between partners so that the boundaries and rules, addressing how the data and information will be managed and used, are documented and mutually agreed upon in writing. Hence, a legally binding agreement which stipulates a partner's requirement to submit supply chain costing information may be necessary.

Other barriers that might discourage supply chain partners from sharing cost information include: the lack of perfect cost data in determining every activity in an ABC system, the loss of customer focus as management may become preoccupied with the lowering costs, and the effects of internal politics (Lin et al. 2001). Additionally,

some companies are leery of the concept of an inter-firm cost technique that might result in a loss of jobs or additional work associated with supply chain changes.

### Strategic Fit and Supply Chain Processes: Why Firms Use Supply Chain Costing

As mentioned previously, the goal of management accounting is to improve the decision making capability of a firm's managers by providing immediate and pertinent cost information. The cost information generated by management accounting efforts can be used by both operations managers and accountants alike. By collecting this additional information, decision makers are better equipped to assess the "strategic fit" considerations that are instrumental when trying to construct an efficient and effective supply chain. Achieving a strategic fit can be thought of as the bridge that joins the supply chain strategy and the corporate strategy. Consequently, management accounting begins to connect the managers with the accountants so that the cost drivers can be tied to the bottom-line profitability of a firm.

Strategic fit decisions help firms to consider: outsourcing options, product variety determinations (e.g., number of offerings), the costs-to serve particular customers, the impacts of globalization, the means to overcome the impact of shorter product life-cycles, and the costs of facilities, inventory, and transportation (Chopra and Meindl 2004). Each of these decisions helps to optimize the tradeoffs associated with efficiency (i.e., cost) and responsiveness (i.e., customer service). Ultimately, these decisions may affect the firm's selection of a push vs. pull strategy, forecasting determinations, how products or services are priced, whether inventory is centralized or decentralized, and how

information will be shared across the supply chain (Chopra and Meindl 2003; Wanke and Zinn 2004). In order to ensure that the cost impact of supply chain decisions have been accurately analyzed managers must consider the supply chain costs both inside and outside of multiple firms.

Supply chain total costs include the costs of the buying firm and the selling firm. Cost analysis for decision making allows the lead firm to make comparisons that can determine which firm can provide an activity, function, or process for the lowest cost (Cavinato 1991). An accurate assessment of supply chain costs requires an analysis of the cost drivers associated with eight key supply chain processes: customer relationship management, customer service management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization, and returns (Croxtton et al. 2001). Rarely does one firm carry out each of these functions independently. As a result, the costs of partner firms must be assessed in order to achieve overall supply chain improvements.

Furthermore, each of these supply chain functions has a role in establishing a strategy. For example, the order fulfillment function within the supply chain affects the marketing strategy of the firm, the overall supply chain structure, and the customer service goals that the supply chain sets (Croxtton et al. 2001).

### Characteristics of the Firm

The ultimate goal of corporate strategy is to obtain a competitive advantage and to be able to sustain it in the marketplace. Christopher (1992) suggests that firms do not

compete but supply chains do. This research explores the relationship between supply chain costs and firm characteristics, and attempts to determine whether strategic decisions are affected by either, both, or neither. To operationalize firm characteristics, Mintzberg's (1976) classification for organizational decision-making based may be applied. Mintzberg (1976) suggests that decisions are impacted by whether a firm operates in an entrepreneurial mode, an adaptive mode, or a planning mode. Entrepreneurial type firms are willing to take risky and bold decisions. Adaptive firms carry out decision-making in very small disjointed steps, and planning firms use formal analysis before making a decision. It is anticipated that strategic decisions will be impacted by both supply chain costs and whether the firm acts as an entrepreneur, adaptor, or planner.

### Supply Chain Position

Sabbath and Whipple (2004) suggest that it is extremely difficult to integrate the functions within a single firm. This is due to the purchasing focus that seeks to improve support from its upstream partners or suppliers. Conversely, the logistics managers are dedicated towards improving customer service and/or the speed at which the product is delivered to the end consumer. Sabbath and Whipler (2004) and Bowersox, Closs, and Stank (2000) label this competition of interests as the great operating divide. The divide is essentially the information gap where purchasing, marketing, manufacturing, and logistics personnel seldom exchange information, as some are focused on the costs to serve while others are focused on the costs for providing. Even more challenging than

this dilemma is the concept of sharing cost information across the supply chain, and thus, outside of the firm. Ideally, supply chain costing will capture the costs of each key supply chain partner.

Cooper et al. (1997) discuss the meshing of supply chain partners and alliances. They also discuss the importance of the integrated SCM philosophy where supply chains must be managed across a network of firms. Within this seminal research was a description of the levels of information sharing amongst supply chain partners. Cooper et al. (1997) presents a taxonomy of partnerships amongst supply chain firms which is dependent upon the supply chain position or role of an individual firm. For the purposes of this study, this taxonomy has been modified to identify the importance of supply chain position as it affects a firm's ability to engage in supply chain costing efforts. Supply chain position designations include: internal firm partnerships only, dyadic partnerships, and full channel integration partnerships.

Internal firm partnerships constitute a firm having limited or no cost information sharing with its partner supply chain firms. Dyadic firm partnership consists of cost information sharing between two parties—the internal firm and a buyer or supplier within one tier. A full channel integration partnership consists of a lead firm that is tasked with collecting and distributing supply chain cost information. Full channel integration assists with the shifting of functional responsibilities of supply chain partners so that the product or service delivered is done so in the most effective and cost efficient manner.

## Firm Interaction and Industry Characteristics--Economic Theory

Dyer and Singh (1998) explain that a pair of firms can develop relationships that are capable of sustaining a competitive advantage. Additionally, situations where firms compete one-on-one are the exception rather than the rule (Dyer and Singh 1998). This research equates a pair of firms with the collection of firms that comprise the supply chain. Skjoett-Larsen (1999) posits that inter-organizational processes across the supply chain are best explained by network theory and the resource-based view (RBV) rather than transaction cost economics (TCE). This is not to say that TCE is not important for supply chain decisions, as TCE can be used for make or buy determinations; however, TCE does not explain the inter-organizational processes that exist in short or long-term supply chain relationships. Combs and Ketchen (1999) proclaim that the RBV is ideal when exploring inter-firm cooperation, as the RBV involves multiple firms seeking to capitalize on their capabilities. From a SCM viewpoint, this suggests that higher levels of inter-firm collaboration across the supply chain leads to better service and lower costs as a result of resource optimization.

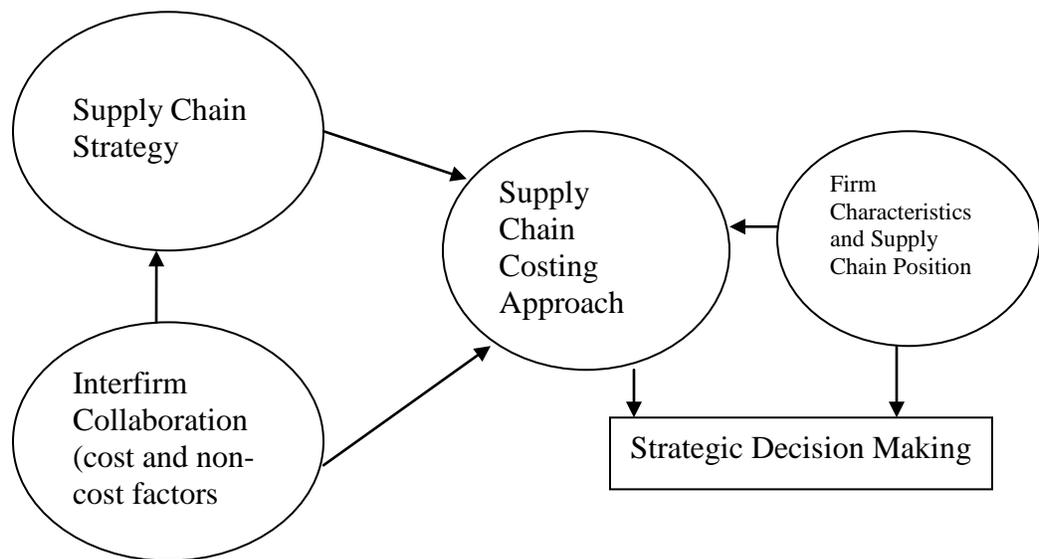
Johanson and Mattsson (1987) suggest that the network approach is more appropriate than TCE for strategy analysis. Johanson and Mattson (1987) suggest that the level of firm interaction with its partners is related to the characteristics of the market (i.e., industry type). Essentially, the market characteristics function as antecedents for strategy formulation. This relationship is further modified by adding the construct of supply chain costing and is reflected in figure 2.4. This research uses network theory and

the resource-based view to explore the complete model examined in the multiple-case study research.

Figure 2.4 represents a notional roadmap, which was developed after a thorough review of the literature. The model is further developed and examined through the use of grounded theory and the multiple-case study method that is discussed in the research design section. This model maps to the initial research propositions and is modified as the research progresses in order to address the research and investigative questions. The data collection and analysis sections purport a theoretical model which is included in Chapters 4 and 5.

Figure 2.4

CONCEPTUAL MODEL FOR SUPPLY CHAIN COSTING



## Research Goals and Initial Propositions

To better understand the phenomena of supply chain costing and how it affects decision making the researcher chose a hybrid methodology using the grounded theory and multiple-case study methods. The outcome sought is to build theory which is generalizable to the theoretical propositions that are modified as the research progresses. Furthermore, the research attempts to identify a methodology for implementing supply chain costing techniques and the resources required for improving cost collection techniques. The propositions suggested can later be operationalized and tested via hypotheses in a more empirical manner.

- 1) Supply chain costing involves the activities and functions directly related to product or service information flows across multiple firms (i.e., the entire supply chain) (see Seuring and Goldbach 2002, Cooper/Slagmulder 1999).
- 2) The level of collaboration between firms is positively related to the amount of supply chain costing data that is collected by supply chain partners (Combs and Ketchen 1999; Handfield and Nichols 1999; Paris and Brassard 2004).
- 3) Firms engaged in a management accounting technique such as activity-based costing, target costing, direct product profitability, or Total Cost of Ownership accounting will demonstrate a greater propensity to engage their suppliers in their costing efforts and derive mutual benefit (Berry et al. 1997; Dekker and Van Goor 2000).
- 4) Senior executives from the lead supply chain firm will be the most likely candidates to initiate a costing initiative (Lambert et. al 1998).

- 5) Supply chain costing will be used to support a wide variety of strategic decisions throughout the supply chain (Lambert and Pohlen 1996).
- 6) Strategic decision making is impacted by supply chain costs and firm characteristics (Mintzberg 1973).
- 7) Activity based costing or an alternative management costing technique should be used in conjunction with traditional cost accounting to formulate financial reports (Cooper and Kaplan 1988, 1998; Lippa 1990)

#### Matrix Summary of Research

The aforementioned propositions were drafted after the construction of a research matrix. The research matrix (see Table 2.1) was constructed for the purposes of identifying the key principles and concepts that relate to the research questions and the relationships associated with supply chain costing. The matrix details the title/author, the year, the publication, and whether the article addressed supply chain costing and/or management accounting. Additionally, the articles were summarized and any relationships between costing techniques and strategic decision-making were identified. This matrix was also used to educate the researcher and to assist with the construction of a questionnaire used to interview the participating firms. Table 2.1 is presented below.

Table 2.1  
MATRIX OF RESEARCH\*

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
Managing for Business Effectiveness	1963 (Drucker)	Harvard Business Review	Precursor for ABC	Companies should not rely on traditional cost accounting information when formulating strategy	Foreshadow for what became ABC—calls for managers to identify cost centers and allocate to the right products
Improving the management of distribution with cost and financial information	1985 (Tyndall and Buser)	Journal of Business Logistics	Generic distribution cost information	Logistics costs and functions are often not equated with strategic level importance. Distribution managers are generally unaware of the value of financial information for improving distribution performance.	Distribution managers continue to lag behind their manufacturing counterparts in applying financial methods to their functions and problems. Financial and acct resources have not kept pace with developments in distribution.
Interorganizational relations in industrial system: a network approach compared with the transaction-cost approach	1987 (Johanson and Mattson)	International Studies of Management and Organizations	N/A	Strategy is an outcome of the interaction processes of exchange and adaptation that are determined by interfirm relationships and intrafirm activities	The network approach, because it accommodates many different types of relationships, is more appropriate for understanding B2B relationships than TCA.
Measures costs right: Make the right decisions	1988 (Cooper and Kaplan)	Harvard Business Review	ABC	ABC helps managers make better decisions about product design, pricing, marketing, and	Early article about ABC—argues that all of a company's activities exist to support the

\*Table 2.1 continues thru page 62.

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
				mix, and encourages continual operating improvements	production and delivery of goods and services; therefore all costs should be considered product (direct) costs—existing cost systems understate profits in some cases and overstate them in others
How cost accounting distorts product costs	1988 (Cooper and Kaplan)	Management Accounting	ABC, fixed vs. variable costing	A comprehensive product costing system is necessary for managerial decisions on pricing, introduction, discontinuance, and reengineering product lines. A cost system could help create a competitive advantage	Product costs are almost all variable. The allocation of costs from cost pools to the products should be achieved using bases that reflect cost drivers. Almost all product decisions are long-term and yet most cost decisions are based on short-term “fixed” costs with disregard for variability.
One cost system isn't enough	1988 (Kaplan)	Harvard Business Review	ABC	Operating costs are reported too late are too aggregated to benefit production supervisors and decision makers.	Highlights the downfall of traditional cost systems: designed to value inventory and not product costs. ABC application will be unique for each individual company.
Making strategy	1988 (Shank and	Sloan Management	Strategic cost analysis (over	The addition of strategic	Managerial accounting

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
explicit in cost analysis: A case study	Govindarajan)	Review	and above managerial and traditional cost accounting)	concerns to cost analysis may product radically different insights	replaced cost accounting as a framework for decision-making. However, it failed to incorporate strategic relevance and "true" cost analysis.
You need a New Cost System When...	1989 (Cooper)	Harvard Business Review	ABC	You need a new cost system when: 1) functional mgrs want to drop seemingly profitable lines, 2) profit margins are hard to explain, 3) hard to make products show big profits, 4) departments have their own cost systems, 5) the acct dept spends a lot of time on special projects, 6) competitors' prices are unrealistically low, 7) customers don't mind price increases, 8) vendor bids are lower than expected, 9) reported costs change because of new financial acct regulations, 10) increased automation, changes in product market	When strategy changes the cost system should adapt to it.

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
				strategy, 11) intensified competition, 12) changes in strategy	
Making fast strategic decisions in high-velocity environments	1989 (b) (Eisenhardt)	Academy of Management Journal	N/A	The greater the use of real-time information and integration amongst key players, the greater the speed of the strategic decision making process.	Conflict resolution and integration among strategic decisions and tactical plans are critical to the pace of decision-making.
Identifying interfirm total cost advantages for supply chain competitiveness	1991 (Cavinato)	International Journal of Purchasing and Materials Management	TCO	SCM includes a comparison with the costs of the buying and selling firm to identify lowest costs. Decision makers should look at costs and not price.	5 total cost factors to examine in SC relationships: 1) lowest labor rate, 2) most effective processes, 3) most capital available, 4) lowest cost of capital, 5) highest tax rate, 6) most depreciation and other tax elements
Are you distorting costs by violating ABC assumptions?	1991 (Roth and Borthick)	Management Accounting	ABC	ABC as a strategy driver can be troublesome if various assumptions are violated.	Two assumptions to ABC are: 1) the costs in each cost pool are driven by homogeneous activities and 2) the costs in each pool are strictly proportional to the activity. If these do not hold then ABC may be inferior to traditional volume-based cost systems.

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
It's time to stop activity-based	1992 (Johnson)	Management Accounting	TOC	ABC cannot tell you if your customers are satisfied or if processes are stable and capable—companies should focus on improving customer-focused processes	Using ABC is good for seeking economies of scale and increasing speed in decoupled process, however it may lead to irrelevance.
Strategic cost management: The value chain perspective	1992 (Shanik and Govindarajan)	Journal of Management Accounting Research	VCA	External focus of VCA and SCM by linking activities from raw material suppliers to end customer by examining multiple cost drivers and discussing cost containment and how it affects strategic decision-making.	Tool of empirical analysis that contrasts conventional cost analysis with VCA. VCA can be used to establish competitive advantage
A framework for total cost of ownership	1993 (Ellram)	The International Journal of Logistics Management	TCO	Implementation and analysis w/ TCO based on inbound (upstream) costs related to quality, delivery, technology, and support.	TCO is fairly simple to grasp conceptually; however, in practice is very complicated to gather all data required to perform analysis.
Implementing activity based costing (ABC) in Logistics	1994 (Pohlen and LaLonde)	Journal of Business Logistics	ABC	ABC is a critical link between corporate performance and logistics costs and performance.	ABC has provided leading firms with a more accurate costing system. Levels of sophistication with regard to ABC vary depending on the firm's objectives,

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
					proportion of indirect costs, diversity of products/services, customers, and their particular channels.
Cost/management accounting—The 21 <sup>st</sup> century paradigm	1995 (Ferrara)	Management Accounting	Traditional cost accounting, target costing ABC, Theory of constraints	Strategy should result from combining several costing methods. Additionally, strategy should be formed with anticipated efficiency improvements after reaching the market.	Cost accounting should accommodate before-the-fact determination of expected actual cost and an after-the-fact actual costs.
Relationship marketing and distribution channels	1995 (Weitz and Jap)	Journal of the Academy of Marketing Sciences	N/A	Activities in corporate relationships are controlled by authoritative, contractual, and normative controls	Vertical integration is often inefficient. However, firms are often unwilling to share sensitive information with suppliers even if it can be used to reduce costs.
A case study of successful partnering implementation	1996 (Ellram and Edis)	International Journal of Purchasing and Materials	Iceberg Costs—similar to total cost of ownership but primarily with NPD—tracks savings relative to pre-agreement with partners	Trust, communication, mutual benefit, long-term perspective, and top-management commitment are prerequisites for success	Case study of Kodak and how their model for relationship building differs from traditional approaches—more collaborative
Issues in supply chain costing	1996 (LaLonde and Pohlen)	The International Journal of Logistics Management	DPP, ABC, TCO, ECR	Supply chain costing enhances strategic management by breaking out costs and tracing them to the product,	Firms have still not moved from traditional channel and traditional costing systems. Supply chain costing's biggest

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
				customers, or channels that consume them Supply Chain costing does not replace traditional cost accounting. It translates existing ledgers into tools that managers can use to evaluate performance and resource consumption. SC costing can have strategic implications when shifting functions.	barrier is being able to allocate the benefits and burdens of each supply chain partner and distributing the gains equitably (not necessarily equally). TCO appears to work for upstream vendors. DPP and ABC are more appropriate for downstream costs. SCM across the entire network provides the firm with the opportunity to increase productivity (e.g., shifting functions). Achieving this requires that costing systems be congruent with its relationships with upstream and downstream vendors.
Meshing multiple alliances	1997 (Cooper et al.)	Journal of Business Logistics	N/A	Value Tree— Meshing relationships means strategies must result in win-win for buyer and supplier	Some relationship are branches, others are stems— information sharing and willingness to manage closely is based on value of the partner firm
Effective interfirm	1997 (Dyer)	Strategic Management	N/A	Strategies to achieve lower	Japanese automakers have

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
collaboration: How firms minimize transaction costs and maximize transaction value		Journal		costs are more effective in Japan than the U.S.	lower transaction costs due to: 1) repeated transactions with a small set of suppliers, 2) economies of scale in transacting with fewer suppliers, 3) extensive interfirm information sharing, 4) use of non-contractual self-enforcing safeguards, and 5) investments in co specialized assets
The effect of strategy and organizational structure on the adoption and implementation of activity-based costing	1997 (Gosselin)	Accounting, Organizations and Society	ABC	Strategy influences the extent to which SBUs adopt an activity management approach. Orgs with high vertical differentiation are positively associated with adopting ABC over other approaches.	Competitive strategy sets the need for cost management information—a prospector strategy is more commonly associated with the adoption of activity management approaches
The effects of partner and relationship characteristics on alliance outcomes	1997 (Saxton)	Academy of Management Journal	N/A	Companies that have a strategic fit with a partner firm (similar culture, similar human resource policies, and similar administrative systems) will achieve greater synergies and greater success.	Positive relationship exists between partner firms' benefits from alliance participation and partner reputation, shared decision-making and strategic similarities

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
The cost-to-serve method	1998 (Braithwaite and Samakh)	International Journal of Logistics Management	Cost-to-serve method	By identifying how much a customer costs-to-serve, a firm can focus on more profitable customers when identifying product line strategy	Integrating business processes is at the heart of SCM and logistics. Cutting delivery times does not reduce costs. Cost and service implications must be balanced.
The relational view: Cooperative strategy and sources of interorganizational competitive advantage	1998 (Dyer and Singh)	Academy of Management Review	N/A	Pairs of firms can create a sustained competitive advantage through relational rents. RBV theory is limited in that it looks at firm strategy only. Relational view is collective with multiple SC partners.	Relational rents are the outcomes of partnerships that emerge from relation-specific assets, knowledge-sharing routines, complementary resource endowments, and effective governance.
“Measuring the unmeasurable”—measuring and improving performance in the supply chain	1998 (van Hoek)	Supply Chain Management	Discuss DPP and TCO	Integration is no longer based on large investments in vertical integration, but rather on interfaces, Not all interfaces deserve the same amount of integration	All suppliers should be measured on cost-effectiveness; however it will depend on whether they are a source of low cost, a market extension, or a market creator
Series of strategic cost management articles (6 total)	1998 to 1999 (Cooper and Slagmulder)	Management Accounting and 1999 Book “Supply Chain Development for the Lean Enterprise:	Target Costing, Kaizen Costing, ABC, TOC	The objective of strategic cost management is to reduce costs while strengthening the strategic position	Target costing is applied to reduce costs during the product design stage, whereas kaizen costing is used to reduce

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
		Interorganizational Cost Management”		of the firm. ABC is used to support “general-purpose” costs to focus managerial attention, not to directly support decisions.	costs during the manufacturing stage. Cost management is not an accounting or finance issue but a managerial one. TOC and ABC are complementary systems not competing systems. Highlight successes of Japanese firms with interorganizational costing.
Activity-based costing applications within logistics, and their effect on logistics decision making	1999 (Caudle)	Dissertation from The Ohio State University	ABC	Firms are motivated to implement ABC to obtain more cost information about products, services, customers, and channels. More complex ABC systems do not increase decision-making capability. Two strategic decisions supported by ABC are logistics decisions based on serving individual customers and costing out key processes. TCO or target costing efforts were not supported by	ABC implementation begins by examining the existing general ledger or income statement. Activities and their costs can then be identified and broken down from the ledger items or categories and allocated to the resources that consume them. Labor is the most commonly tracked ABC activity. Senior finance personnel are the greatest advocates of ABC. 91% of firms queried responded that

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
				ABC. Most decisions supported by ABC appear to be short-term.	ABC is an improvement over their previous logistics costing systems.
Develop profitable new products with target costing	1999 (Cooper and Slagmulder)	Sloan Management Review	Target costing	Target costing can be used as the firm's sole strategy for product development. It allows firm to reduce costs of new products without compromising quality.	Allowable cost = target selling price – target profit margin Given a highly competitive environment, companies must manage costs aggressively if they are going to survive. Target costing is a technique used to strategically manage a firm's future profits.
Supply chain management for lean enterprises: Interorganizational cost management	1999 (Cooper and Slagmulder)	Strategic Finance	Target costing	Decisions are rarely limited to the scope of the four walls of the factory or the boundaries of the firm. Most often than not they span they affect the entire supply and customer chain.	Chained target costing is an important element of interorganizational cost management as it transmits the competitive pressure faced by the firm at the top of the supply chain to other firms within the chain. Western firms lack a fully integrated approach to buyer-supplier cost management.
Supply chain management: A new	1999 (Skjoett-Larsen)	International Journal of Logistics	Channel wide cost efficiencies in SCM	Decision making within SCM is better studied	Network perspective of SCM is based on

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
challenge for researchers and managers in Logistics		Management		with network theory and resource-based view than TCA.	openness and trust between partners as a condition for achieving the best possible results from the cooperation.
Avoid the Pitfalls in Supplier Development	2000 (Handfield et al.)	Sloan Management Review	TCO as a ratio of cost to value	Corporate-level executive steering committee (i.e., mktg, finance, IT, acct, production, SC, design) should assess relative importance of all goods and services in SCM.	Most pitfalls occur during meetings of buyer and supplier management teams—firms gain competitive advantage by improving performance of suppliers and by avoiding the snares of such efforts
On interfirm power, channel climate, and solidarity in industrial distributor-supplier dyads	2000 (Kim)	Journal of the Academy of Marketing Science	N/A	Decisions are affected by power and influence—Trust and relationships affect willingness to share cost data	Trust and relationship continuity moderates the link between power and influence
Target costing for supply chain management: Criteria and selection	2000 (Lockamy and Smith)	Industrial Management and Data Systems	Target Costing, ABC	A sound supply chain strategy is needed that aligns with the target market as well as the firm's competitive and product strategies. Firms should use an ABC-based approach to target costing.	Customer requirements and supply chain relationships are identified as key criteria for selecting the most appropriate method of target costing for supply chains. Target costing cannot be adopted universally for SCM. It should

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
					be introduced into only those supply chains with trading partners ready.
The supply chain management processes	2001 (Croxtton et al.)	International Journal of Logistics Management	N/A	SC strategy is devised by considering all processes and streamlining how these cross-functional processes.	The eight key SCM business processes are: 1) Customer Relationship Mgmt, 2), Customer Service Mgmt, 3) Demand Mgmt, 4) Order Fulfillment, 5) Manufacturing Flow Mgmt, 6) Supplier Relationship Mgmt, 7) Product Dev. and Commercialization, and 8) Returns Mgmt
Supply chain metrics	2001 (Lambert and Pohlen)	International Journal of Logistics Management	PandL Customer and supplier statements, Economic Value Added	Fill-rate, inventory turns, lead-time, on-time performance, damage, and responsiveness are not strategic performance indicators nor are they multi-firm SCM indicators.	There is no evidence that meaningful measurements that span the entire supply chain exists. Present framework for managing interfacing customer relationships and supplier relationships. Current metrics may be self-serving and result in optimizing one firm's performance at the expense of

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
					the other with greater detriment for the entire supply chain.
Supply chain costing: An activity-based perspective	2001 (Lin et al.)	International Journal of Physical Distribution and Logistics	ABC	Every aspect of decision making in SCM requires cost data.	Provides a model for implementing ABC—discusses how to trace cost to cost objects and points out drawbacks of ABC
Cost knowledge: A foundation for improving supply chain relationship	2001 (Norek and Pohlen)	International Journal of Logistics Management	Customer Profitability, ABC, DPP	Strategy is enhanced when functions are shifted in SC to achieve lowest cost or highest quality and rewards are shared.	Many supplier/buyer relationships are counter to the integrated partnerships that SCM purports. Improved cost knowledge may provide a means for firms to negotiate better and determine the profitability of key customers.
Measuring profits and costs across the supply chain for collaboration	2003 (Cokins)	Cost Management	Customer Profitability Analysis, ABC	Better cost data leads to better decisions.	IT is enabling partners along the value-creation chain to coordinate for mutual benefit. Trading partners require cost accounting systems such as ABC that are superior to traditional cost accounting systems. Mgmt accounting is morphing into mgmt economics.
Value chain	2003 (Dekker)	Management	Value Chain	Used to support	VCA requires

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
analysis in interfirm relationships: A field study		Accounting Research	Analysis	make or buy decisions, to manage a partnership, and as a measure of partner performance	open book accounting—insight into a partners planning and budgeting system and provides financial incentives for cost improvement—identifies barriers to VCA implementation: 1) sensitive information, 2) fair division of cost and benefits, and 3) appropriation of investments to be made by each partner
How to do strategic supply-chain planning	2003 (Sodhi)	MIT Sloan Management Review	N/A	Corporate strategy is the entire nature of business. SCM strategy is to open or close plans and distribution centers, modify capacity, change product offerings, make vs. buy decisions	Senior mgrs formulate strategy maximize shareholder value; supply chain planners run optimization models to minimize costs. The two efforts need to be combined.
Do you know your supply chain costs	2004 (Aspinall et al.)	Focus	N/A	Strategies based on faulty information about the product will result in product failure	Increasing the visibility of supply chain costs will result in a competitive advantage—an appropriate costing system will allow managers to make better decisions and

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
Purchasing and supply chain management costing: An air transport perspective derived through commercial air cargo firms	2004 (Ettrich)	Air Force Institute of Technology—Thesis	DPP, Throughput Accounting, ABC, Kaizen Costing, ECR, TCO	Management is constantly forced to focus on costs that are not effectively controlled. Stability is a key factor when estimating costs.	will generate higher profits Firm's are attempting to allocate cost directly or unit variable. Examples of cost categories: Indirect non-unit variable (CEO salary); indirect unit variable (landing fees); direct non-unit variable (mechanic hourly rate), and direct unit variable (fuel cost to fly from point A to B).
Reading between the numbers	2004 (Paris and Brassard)	Strategic Finance	Burden Absorption	Financial statements are written for outsiders (IRS, SEC, shareholders, lenders). They are not for decision makers	Burden absorption takes away a competitive advantage by making underperforming operations look better than they are by loading costs onto large, efficient performers so they look worse.
Strategic logistics decision making	2004 (Wanke and Zinn)	International Journal of Physical Distribution and Logistics Management	ECR and categories such as cost density and cost of goods sold	Discuss the tradeoffs of make to order vs. make to stock, push vs. pull, and centralize vs. decentralize strategies	Strategic decisions are a function of product, operational and demand related variables such as delivery time, obsolescence, coefficient of variation of sales and inventory

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
Applying the strategy-structure-performance paradigm to the supply chain environment	2005 (Defee and Stank)	The International Journal of Logistics Management	N/A	Firms adopting supply chain strategy will have high levels of communication and revenue enhancement for them and their partners	turnover Strategies among partner firms should mesh. Strategic alignment is necessary for supply chain improvements in efficiency/effectiveness
Costing in new enterprise environment	2005 (Gupta and Gunasekaran)	Managerial Auditing Journal	ABC, ABM, and JIT costing	Strategies are affected by distributed operations environment, global outsourcing, alliances based on core competencies, IT for integrated SCM, ERP systems, and e-commerce.	Evolution of manufacturing enterprises together with performance and cost measures—new cost information is needed and it must be aligned with many different strategies within the enterprise
Performance measurement system design	2005 (Neely et al.)	International Journal of Operations and Production Management	ABC, Return on Investment	Performance measurements used for strategy determination are typically: 1) manufacturing cost, 2) value added, 3) selling price, 4) running cost, and 5) service cost	While the business environment has changed dramatically in the last 60 years, management accounting is based on assumptions that are no longer valid (e.g., indirect labor and overhead allocations)—mgmt accounting is distorted by the needs of financial reports and not meaningful product costs
The	2005	International	Inventory	Strategy is	Decision

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
collaboration index: a measure for supply chain collaboration	(Simatupang and Sridharan)	Journal of Physical Distribution and Logistics Management	holding costs, consulting on pricing policies, and sharing inventory cost savings	impacted by information sharing, decision synchronization, and inventive alignment	synchronization and incentive alignment consistently influenced fulfillment, inventory, and responsiveness—significant correlation between collaboration index and operational performance
Three-Questions Accounting	2006 (Corbett)	Management Accounting	Theory of Constrains (aka. Throughput Accounting)	Decision-making is impacted by: 1) if I make this decision how much money is generated?, 2) how much money will we spend?, and 3) how is the amount of money captured by the company impacted?	Throughput per unit: $Tu = P - TVC$ where $Tu =$ throughput per unit of product; $P =$ price per unit of product; $TVC =$ totally variable cost when one more product is sold. Net Profit and ROI: Net Profit = Throughput – Operating Expense ROI = (Throughput – Operating Expense)/Investment
The implementation of target costing in the United States: Theory versus practice	2006 (Ellram)	Journal of Supply Chain Management	Target Costing	Supply management should play a leadership role in managing ongoing supplier cost management—multi-disciplinary teams are needed	Key differences exist in how Japanese and U.S. and Western countries have used target costing

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
Characteristics of target costing: theoretical and field study perspectives	2006 (Everaert et al.)	Qualitative Research in Accounting and Management	Target Costing	for strategy determination New product development affected by companies not willing to compromise quality for lower cost	New product development processes are very unstandardized—differences may be explained by degrees of openness, leadership, time pressures, and position in supply chain
Total cost of ownership in the services sector: A case study	2006 (Hurkens et al.)	Journal of Supply Chain Management	TCO	TCO models developed for the purpose of managing, measuring, and improving individual supplier. TCO can be used to think about cost at the strategic level regarding volume allocation.	Investigates trade-offs in designing a TCO model used to select, manage, and improve processes via SCM.
Supply/demand chain modeling utilizing logistical-based costing	2006 (Kosior and Strong)	Journal of Enterprise Information Management	Logistical-based costing, Operational-based costing (Deo 2001—Maryland dissertation), and ABC	Customer dictates the cost and performance requirements of logistical conduits in the supply chain	Standardized approach for mapping, costing and building supply/demand chain models—merges ABC and Operational based costing
Know the ABCs of retail supply chain costs	2007 (CSCMP)	CSCMP's Supply Chain Quarterly	ABC	Companies may get little help from their acct departments. ABC gives companies a tool for weighting trade-offs, leading to	ABC can be used for profitability of product or product category, adjusting the cost of retail markups, prioritizing opportunities for

Article Title	Year (Author)	Journal/Book	Costing Methodology Identified	Implications for Strategic Decision Making	Summary
				accurate and timely supply chain decisions. (See pages 82-84 for examples)	cost reduction, comparing private for major label brands, offshore versus domestic suppliers, and working with partners to assess new technologies.
Information sharing and supply chain performance: the role of connectivity and willingness	2007 (Fawcett et al.)	Supply Chain Management: An International Journal	Costs=cost of purchased items, inventory cost, overall production cost, transportation costs, cost of NPD	Connectivity exists, but willingness to share information that can actually improve SCM performance is uncommon	Willingness as a key to information sharing is being overlooked. Willingness and connectivity must come together to increase operational and competitive performance.
Bridging organization theory and supply chain management: The case of best value supply chains	2007 (Ketchen and Hult)	Journal of Operations Management	Best Value=cost, speed, quality, and flexibility	Miles and Snow (prospector, defender, and analyzer) Porter (low-cost leader and differentiator)	Supply chains compete on all aspects— organizations must match strategy w/ supply chain

## CHAPTER 3

### METHODOLOGY

#### Selecting the Method

This chapter identifies a methodology capable of addressing the research questions that were previously identified in Chapter 2. What follows is a brief overview of the research objectives, a discussion of quantitative versus qualitative methods, and the rationale for the selecting the grounded theory method, which was integrated with the multiple-case study method (i.e., a hybrid method). Finally, the data collection methods and the systematic steps taken to analyze the data are identified in a manner, which ensures that the research questions were addressed.

#### Research Objectives

The objective of this research effort was to identify the concepts and relationships that emerged when examining supply chain costing in the context of various managerial costing approaches. The study also attempted to identify the relationship between supply chain costing and the strategic decision-making process across a network of partner firms. Furthermore, the research attempted to identify the barriers to implementation that may be preventing or delaying firms in their attempts to use supply chain costing as a means to reduce costs or achieve quality improvements upstream and downstream in the supply chain.

## Method

This research used a hybrid approach that combined the grounded theory methodology proposed by Strauss and Corbin (1990) with the multiple-case study method proposed by Yin (2003). These two research methods are designed to help depict or explain a phenomenon when very little is known with regard to the antecedents and the outcomes. Both the grounded theory and case study methods are ideal for studying a phenomenon in its natural setting (i.e., the firm and the supply chain) in order to learn more about the state of the art and to generate theories from practice. By conducting interviews in an open-ended manner with supply chain executives and managers alike, the current practices and processes of supply chain costing were captured, identified, and analyzed to construct a model depicting the relationships which comprise supply chain costing and its relationship with decision-making.

The grounded theory and multiple-case study methodologies typically begin with a cursory review of the literature. This study included documentation and a construction of a research matrix, which was presented in Chapter 2. While Glaser and Strauss (1967) suggest that grounded theory can be restrained by reviewing the literature, Charmaz (2001) suggests that a review of the subject matter is preferred. This research followed the Charmaz (2001) approach and included a review of the literature, which had previously addressed supply chain costing in a direct or indirect manner. A review of the literature revealed that a theoretical model of supply chain costing does not exist, nor are there identifiable variables and/or constructs that can be tested empirically. While previous research has discussed supply chain costing in a conceptual manner, attempts

have not been made to identify constructs and relationships that can be measured and reported in a quantitative manner. In summary, most of the supply chain costing research is based on management accounting techniques that focus on reducing an individual firm's costs and not those of costs incurred by multiple firms across the network. Consequently, the grounded theory (Strauss and Corbin 1990; Charmaz 2001) and the multiple-case study approach (Yin 2003) were used as a means to develop theory as it emerged during data analysis.

The following section discusses the approach used in selecting the most appropriate method (i.e., quantitative vs. qualitative) for addressing the research questions.

#### Quantitative vs. Qualitative

Quantitative research typically includes experiments or surveys and is typically applied when the researcher has identified a priori hypotheses. As such, the research is most often conducted in a deductive manner by identifying specific variables that represent a construct capable of being measured. While the primary objective of most research is generalization and repetition, quantitative research also seeks to predict and explain a phenomenon in a causal manner and to develop knowledge using a post-positivist approach. When carrying out quantitative research, the research questions and hypotheses are identified up-front after having been formulated from theories found in the literature. These theories can then be tested via an instrument and analyzed with the use of statistics. The research questions and hypotheses that are addressed with

quantitative methods are typically unchanged throughout the study. The following table is a summary of the basic research designs found in SCM research.

Table 3.1  
BASIC RESEARCH DESIGNS

		Types of Analysis*	
		Primarily Quantitative	Primarily Qualitative
Type of Data	Empirical	Survey data, secondary data, in conjunction with statistical analysis such as: factor analysis cluster analysis discriminant analysis	Case studies, participant observation, ethnography. Characterized by: limited statistical analysis, often non-parametric
	Modeling	<ul style="list-style-type: none"> <li>• simulation</li> <li>• linear programming</li> <li>• mathematical programming</li> <li>• decision analysis</li> </ul>	<ul style="list-style-type: none"> <li>• simulation</li> <li>• role playing</li> </ul>

(Source: Ellram, 1996)

The absence of constructs or even relationships that could be linked to supply chain costing which might be measured with a survey or experimental method resulted in the selection of a qualitative method. Additionally, and more importantly, the selection of the qualitative method was driven by the research and investigative questions, which asked the “hows” and “whys” with regard to supply chain costing. Yin (2003) suggests that qualitative methods are more appropriate for addressing “how” and “why” type questions. The majority of the research questions in this study begin with “how.” Consequently, the research questions were the primary factor in selecting the qualitative method. Yin (2003) also suggests that qualitative methods are more apropos when

examining a process. This is also the case in this research in that the research objective is to examine and explore supply chain costing as a process. The next section explains several of the variants used in qualitative research.

### The Qualitative Methods

Creswell (2003) identifies five qualitative methods: ethnography, grounded theory, case study/multiple-case study, phenomenological, and narrative. Each of these methods uses an inductive approach and most often focuses on a process. Qualitative research is usually carried out as fieldwork where data is captured in a natural setting (e.g., observation and/or interviews). Qualitative methods are commonly used for applied policy research and used for detecting, defining, categorizing, theorizing, explaining, exploring and mapping concepts (Ritchie and Spencer 1994). Additionally, qualitative research is ideal when variables are complex and difficult to measure, and when the findings will be based on patterns uncovered in the data and reported in a descriptive manner. What follows below is a discussion of each of the five qualitative methods. Finally, the rationale for selecting a hybrid of grounded theory and the multiple-case study method is presented.

The ethnography method is often used to study a cultural group by observing them and uncovering the behaviors that the group exhibits. This research focuses on multiple businesses and the relationships between supply chain costing and decision making within the firm. As such, the ethnography method was not chosen.

Grounded theory is used to study a process by conducting several data collections at multiple stages throughout the process. Grounded theory attempts to identify the interrelationships of categories of information (Strauss and Corbin 1990). It consists of a constant comparison of the categories that emerge from the data and includes sampling numerous groups to maximize similarities and differences. This research did apply the characteristics of grounded theory.

The case study method is most commonly used to conduct an in-depth study of one-event, several activities, or a process. A variety of data collection procedures can be used in a case study and is usually over a sustained period of time. The case study approach addresses questions such as how and why, while traditional secondary data or survey methods address the who and how many (Yin 2003). Selecting a case for study often seeks out a unique case, a representative case, a revelatory case, or a longitudinal case. The multiple-case study method, which is an extension of the case study method, allows the researcher to develop a deeper understanding of processes and outcomes and can be used to develop and test hypotheses as the research progresses. Multiple-case studies are more robust than a single case study and can address multiple selection criteria goals. Multiple-case studies are also a means to replicate, or perhaps rule out findings across numerous cases. The multiple case study approach was used in this research.

The phenomenological method is used to learn about the human experience. It is typically directed at a small number of subjects to develop patterns and relationships. Lastly, narrative methods are used as a means to collaborate with participants in order to

generate stories that depict their lives. Based on the human emphasis and the life story focus of the phenomenological and narrative methods, these methods were ruled out in favor of the grounded theory and multiple case study methods.

### Rationale for Hybrid Approach

Eisenhardt (1989 (a)) suggests that integrating grounded theory with the case study approach produces novel theory. The hybrid approach, using the multiple case study method and the grounded theory methods together, has previously been tested and detailed by Eisenhardt (1989 (a)), Ellram (1996), and Carter and Dresner (2001). According to Eisenhardt (1989 (a)) using case study data to build grounded theory has three strengths: 1) It produces novel theory because of the flexibility of the constant comparison method, 2) the close connection of theory and data allows for further testing of the theory in subsequent studies, and 3) the theory is more likely to be empirically valid because of the constant comparison and questioning of the data.

Ellram (1996) suggests that grounded theory used in conjunction with case study research can be used to build theory that can be tested using additional case studies, surveys, or other method. A further discussion of the key facets and procedures of both methods are listed below.

### Grounded Theory

The benefits of grounded theory are that it: 1) builds theory rather than simply tests it, 2) gives the research process the rigor necessary to make “good” science, 3) helps

the researcher break through the biases and assumptions they might previously possess, and 4) provides the grounding, density, and integration necessary to generate a rich, tightly woven, explanatory theory that approximates reality (Strauss and Corbin 1990). Strauss and Corbin's (1990) grounded theory methodology calls for constant comparison, thus allowing the researcher to state their assumptions and constantly reflect back to the data.

The grounded theory method seeks theory emersion as more and more is learned about supply chain costing. As stated previously, prior research has not identified the relationships or constructs associated with supply chain costing. Grounded theory is also ideal as it allows the researcher to change and refine research questions as more and more is learned about the phenomenon (Eisenhardt 1989). When conducting grounded theory, the theory is constantly being questioned and refined until theoretical saturation is achieved (Eisenhardt 1989; Glaser and Strauss 1967). For example, in interviewing the eight firms the same patterns or themes associated with barriers to implementation were identified from the textual analysis of the interview data. Once this occurs, the sampling for that relationship can cease. Conversely, if one firm has unique barriers, the grounded theory method calls for the researcher to continue sampling to seek out understanding to explain anomalies within the sample (Strauss and Corbin 1990).

### Multiple-Case Study

The multiple-case was chosen over the single case study approach because it is typically more robust. Simply put, multiple cases are better than one when attempting to

generalize towards the theoretical propositions (Yin 2003). The application of this method allows for the validation, modification, or rejection of observations. Yin's (2003) multiple case study method was also determined to be appropriate for this study, as supply chain costing did not have a clear set of outcomes previously identified. Multiple-case study is also ideal when the research focus is on contemporary as opposed to historical events (Yin 2003). Moreover, supply chain costing is a new phenomenon and with the exception of management accounting techniques presented in the literature, practitioners and academia understand very little about it. The procedures for carrying out a multiple-case study are presented below.

Yin's (2003) multiple-case study method first suggests a cursory review of the supply chain costing literature. This is necessary in developing a thorough understanding of the subject area and the gaps within the literature. This exercise helped to develop three research questions and a series of investigative questions. Second, the theoretical propositions are then constructed from prior literature and personal experience in the SCM field. The propositions can then be tested and modified with multiple-case analysis. These first two steps were carried out in the course of this research. Finally, the interview protocol was constructed and, reviewed by a panel of supply chain and costing experts for content validity. The interview questions were vetted and modified by supply chain costing authors with multiple peer-reviewed publications and by management accountants with numerous publications as well.

The objective of both grounded theory research and multiple-case study research is not to test relationships among variables but rather to discover relevant categories and

the relationships among them (Strauss and Corbin 1990; Yin 2003). Consequently, this study sought to uncover the relationships and the categories that emerged while examining supply chain costing and its role in strategic decision-making. Additionally, both the grounded theory and the case study methodology were appropriate, as very little was known about the subject area. Furthermore, both methods were used to control the risk of introducing bias to the study because the researcher had prior experience in the field of SCM.

Applying grounded theory to a case study can result in a prolific and rich understanding of data. Both methods are also applicable when hypotheses are not known a priori. In using the hybrid approach the propositions were modified as the research progressed (Eisenhardt 1989; Strauss and Corbin 1990; Miles and Huberman 1994). The hypotheses representing the operationalization of the propositions were the initial outcomes of the research. Any generalizations made later are made towards the theoretical propositions that were tested via data analyses (Yin 2003). The next section addresses the method applied to collect data in the course of the research. Finally, a conceptual model that depicts the theory and the relationships between of supply chain costing and strategic decision making is proposed.

### Data Collection and Analysis

Data was collected from multiple sources. Corbin and Strauss (1990) and Yin (2003) suggest that a triangulation approach helps to ensure the reliability of the findings. The sample and unit of analysis must also represent both a purposeful and a convenience

sample. The grounded theory and multiple-case study sample in this research consisted of 8 supply chain lead-firms from two different industries (i.e., the transportation and aerospace industries). Efforts were made to include firms that comprise both the upstream and downstream roles in the supply chain. Initially, the top 25 firms in the field of SCM (2007) as recognized annually by AMR Research and *the Journal of Supply Chain Management* were contacted and attempts were made to coordinate participation via interviews with senior executives listed in the Council of Supply Chain Management's (CSCMP) membership directory. Three of these top 25 firms agreed to participate in the research. The remaining five companies were contacted by the researcher based on previous participation in logistics research with the University of North Texas. Seven of the 8 firms are located in the Dallas Fort-Worth metro area, while the other was located outside the state of Texas. It is important to note that the names and any information that could be tied to individual firms and/or the individuals participating in the interviews were withheld to ensure confidentiality and anonymity. In many cases, the researcher signed a non-disclosure agreement so that both parties were protected and to ensure that proprietary information was not compromised.

The data collected consists largely of in-depth personal interviews, which were recorded, as well as additional documentation provided by the participating firms (e.g., briefings, memos, etc). Personal interviews were initiated at the firm locations, and conducted face-to-face with participants from the business divisions of SCM, sales and marketing, accounting/finance, and operations. Follow-on interviews with the same team members and/or additional company personnel were required in some instances later as

additional information or clarification was needed. Additionally, the firms were asked to provide interview access to upstream and downstream partners for questions related to the cost benefits or cost burdens encountered across multiple supply chain firms. This was not possible in all but one instance as many companies opted not to discuss costs with their supply chain partners.

The interviews and supporting documents that were collected were later transcribed and converted to text documents and for coding within MaxQDA. MaxQDA is a software application that assists in the largely manual process of coding and analyzing qualitative data. The coding within MaxQDA was used to analyze and examine themes, patterns, and categories that emerged within and across industries. Miles and Huberman (1994) suggest that researchers should begin with general themes that are identified from reading the literature and to add more and more themes realized as the research progresses. The coding concluded with qualitative data analysis, which consisted of the detection, definition, categorization, theory identification, explanation, and mapping of the categories and relationships that emerged during the coding process (Ritchie and Spencer 1994).

The coding schema followed the procedures laid out by Corbin and Strauss (1990) and Miles and Huberman (1994). The process used for coding consisted of a three-step method of open coding, axial coding, and selective coding (Corbin and Strauss 1990). During open coding the many different categories within the data were identified, broken down, compared, and conceptualized. Additionally, during the open coding phase, the categories were explored in an in-depth manner to uncover the properties and dimensions

of the categories emerging. Second, and during axial coding, the data were put back together and the connections between categories were made. This sequence investigated the relationships by context, action/interaction strategies, and consequences (Strauss and Corbin 1990).

The final step of the process is selective coding. During this phase, the conceptual model of the depicted relationships was constructed, and relationships were validated or invalidated in accordance with the data. In cases where more data was needed to substantiate a relationship, then theoretical sampling (i.e., identifying additional cases of a relationship that support or refute) was initiated. This process was concluded when theoretical saturation was reached. Theoretical saturation is reached when no new data are emerging from the categories. At this point, the relationships between categories were well established and validated by the existing data (Strauss and Corbin 1990). An example of the coding procedure is presented below.

#### Example of Coding the Research

After inputting the textual data into MaxQDA the open coding phase began. Initially, the textual information was coded with categories emerging and each assigned a letter coding. The open coding schema was based on Miles and Huberman (1994), which suggests a two letter code for the category (e.g., price sensitivity = PS) and a hyphenated letter code that identifies the particular properties of the category. Miles and Huberman (1994) recommend that a provisional coding list be constructed prior to the analysis by identifying categories present in the literature. In this manner, the research might identify

five main categories that emerge from the textual data: costing methodologies (CM), strategic decision-making factors (SD), barriers to costing implementation (BI), price competitiveness (PC), and industry unique information (UI). During open coding the category of price competitiveness would be explored in-depth to uncover the dimensions and properties that various firms have experienced. The properties would receive a multi-hyphenated coding schema based on classifications of setting/context, process, events, strategies, or relationships (Miles and Huberman 1994; Bodgan and Biklen 1992).

Note: The following coding examples are strictly notional and are not the actual codes that emerged from the textual data.

Price competitiveness in the aerospace industry (AI) where adequate competition (AC) exists would be coded as PC-AI-AC. Additionally, the coding of the category and properties of barriers to implementation and price sensitivity would be compared across the various firms and the four industries contained in the sample. Finally, the dimensions would also be coded in a two letter coding schema to depict the dimensions of price competitiveness in the aerospace industry. To further demonstrate, the coding might consist of three dimensions of price sensitivity (e.g., low, medium, high) that indicate a firm's likelihood for implementing supply chain costing. In the instance where an aerospace firm is extremely price competitive in the commercial aerospace market, the case would be coded as PC-AI-AC-HI, where HI represents a high level of price sensitivity.

Upon completion of the dimensions and properties of the categories identified during open coding, the data can then be axial coded. During axial coding great attention is directed towards establishing the relationships between the categories. For example,

the data may indicate that the category of “price competitiveness” is related to the category of “industry unique information.” Coded intersections within MaxQDA are examined and tallied in order to identify relationships between proposed categories. Additionally, the properties coded during open coding (e.g., setting/context, process, events, or relationships) are used by the researcher to assist in formulating categorical relationships. For example, the analysis may indicate, that in the transportation industry, price competitiveness is less important (i.e., setting/context) when insufficient competition exists among common carriers (i.e., trucking service providers). Additionally, the data may indicate that the costing methodology used by a firm is dependent upon the position occupied (i.e., supply chain position) of the firm (e.g., upstream or downstream role in the supply chain). As such, the axial coding calls for investigating the conditions, the context, the action/interaction, and consequences for each industry to see if each of the propositions can be validated for each or all the industries (Strauss and Corbin 1990). If there are not enough examples with the interviews collected, then follow-on sampling and interviewing of additional firms may be necessary. Information is then collected until each category and its associative properties and dimensions are theoretically saturated.

Finally, the data within MaxQDA will be selectively coded. During this phase, the categories are integrated to form a conceptual model depicting a theory. Effectively, the coding schema of letters will be related in a conceptual model and each of the category codes and the dimension and properties codes will be coded according to the research question or investigative question that it pertains to. A numerical coding of 1.3

suggests that a category or dimension will help to address research question one and investigative question three. Additionally, during this phase discriminate sampling may be required. Here, the researcher gathers more information, but only where the categories require additional development. For example, if the properties and dimensions of price sensitivity were not uncovered via the interviews with transportation firms, then additional interviews with personnel from transportation firms may be required.

Upon completing the analysis of the data, hypotheses are then proposed. These hypotheses can then be tested in future studies in a more empirical manner. To facilitate later research, the hypotheses are structured so that they represent the operationalizations of the propositions that are modified as the research progresses. As with any research, validity must be addressed. In qualitative research, the researcher must go to great lengths to examine validity and provide support for the findings so that it is both trustworthy and believable. The following section identifies several methods used to address types of validity and/or key concepts of validity when using a qualitative research method.

### Validity of the Research

To ensure the trustworthiness and authenticity of the qualitative research, Lincoln's and Guba's (1990) criteria were examined at the conclusion of the research. The four classes of criteria are resonance, rhetorical, empowerment, and applicability. Resonance is the degree of fit between the case study report and the overall believability. Rhetorical consists of the unity in terms of the writing. Empowerment suggests that the

research should not merely suggest areas for future research, but also evoke the reader to act. Finally, applicability allows the reader to make inferences about the case study to their own context.

Additionally, Maxwell (1992) identifies five types of validity that should be examined or questioned in qualitative research. First, descriptive validity should be examined by checking the factual accuracy of the interviews. Second, interpretive validity is checked by investigating whether the phenomenon is being explained based on the participant's perspective rather than the researchers. Third, theoretical validity is checked to see if the relationship and constructs identified in the conceptual model closely mirrors construct validity of similar studies. Additionally, theoretical validity is enhanced when multiple measures are used (e.g., interviews and documentation). Fourth, generalizability and external validity will be determined by the amount of theoretical as opposed to purposeful sampling that is required during selective coding. Finally, evaluative validity is determined by the means (i.e., Strauss and Corbin 1990; Miles and Huberman 1994—coding process) the researcher used to evaluate the data and how the conclusions were arrived versus an alternative method (e.g., Yin 2003—pattern matching). At each step in the collection of data and coding of the data, the researcher must address these five types of validity.

### Research Design--Mapping the Questions

As discussed previously, the interview questions were vetted to a panel of SCM and management accounting experts who were well versed in the supply chain costing

literature. After modifications and final approval of the questions, the questions were used as an informal protocol for guiding the sequence of the interviews. As such, the interviews were open-ended and allowed for each case to present and discuss their own experiences in using supply chain costing for decision making purposes without an agenda. To that end, Grounded theory research is intended to be flexible (Strauss and Corbin 1990).

The following section identifies the research and investigative questions as well as their mapping to the questions of the interview protocol. The mapping of the questions allows the researcher to address the questions as well as the propositions that are being tested during the data analysis.

### Research Questions

The following questions were addressed through a series of interview questions pertaining to supply chain costing and its affect on strategic decision-making. Second, the research questions attempted to address the problem statement and the objectives outlined for this research effort. The research questions for this study were:

- 1) How do managers cost out supply chain processes?
- 2) How is the information used for strategic decision making?
- 3) What costing techniques provide the greatest insight into the factors driving supply chain costs and best support decision-making?

## Investigative Questions

Additional questions were used in a tertiary manner to further address the three main questions above. These investigative questions can be examined and supported with information collected during the interviews or from the supply chain costing literature. These questions were:

- 1) How can the financial rewards associated with supply chain costing efforts be distributed equitably (not necessarily equally) with supply chain partners?  
(supports research question 2)
- 2) What does a taxonomy of existing costing techniques look like? (supports research questions 1 and 3)
- 3) What type(s) of supply chain costing information is being collected by firms?  
(supports research question 1)
- 4) Who (i.e., which decision makers) generates supply chain costing information and who are the recipients (i.e., users) of the data within the firm? (supports research questions 2 and 3)
- 5) What are the barriers to implementation for supply chain costing? (supports research question 3)
- 6) What techniques can be used to overcome the barriers associated with supply chain costing? (supports research question 3)

## Propositions

The following propositions were modified and developed as the research progressed. These propositions were initially formulated from previous literature. However, because of the limited research directed at supply chain costing these propositions had to be updated as more information was obtained from the interviews. In the end, the resulting propositions were tested via the multiple-case study approach.

- 1) Supply chain costing involves the activities and functions directly related to product or service information flows across multiple firms (i.e., the entire supply chain) (see Seuring and Goldbach 2002, Cooper/Slagmulder 1999).
- 2) The level of collaboration between firms is positively related to the amount of supply chain costing data that is collected by supply chain partners (Combs and Ketchen 1999; Handfield and Nichols 1999; Paris and Brassard 2004).
- 3) Firms engaged in a management accounting technique such as activity-based costing, target costing, direct product profitability, or Total Cost of Ownership accounting will demonstrate a greater propensity to engage their suppliers in their costing efforts and derive mutual benefit (Berry et al. 1997; Dekker and Van Goor 2000).
- 4) Senior executives from the lead supply chain firm will be the most likely candidates to initiate a costing initiative (Lambert et. al 1998).
- 5) Supply chain costing will be used to support a wide variety of strategic decisions throughout the supply chain (Lambert and Pohlen 1996).

- 6) Strategic decision making is impacted by supply chain costs and firm characteristics (Mintzberg 1973).
- 7) Activity based costing or an alternative management costing technique should be used in conjunction with traditional cost accounting to formulate financial reports (Cooper and Kaplan 1988(a)1988(b), 1998; Lippa 1990)

### The Interview Questions

The interview questions listed were approved by the University's Institutional Review Board prior to initiating the on-site interviews. Each question listed was used as a tool to address an individual or series of research question(s), investigative question(s), and/or research proposition(s). The mapping of these questions indicates which research question, investigative question, or proposition that the item attempts to answer.

Interview Protocol (research question (RQ), investigative question (IQ), or Proposition the item maps to):

1. How do you define supply chain costing? (RQ 3 and Proposition 1)
2. What costs are identified as supply chain costs in your organization? (RQ 1 and 3, IQs , 3 and 4, and Proposition 1)
3. Does your firm have a comprehensive philosophy/approach for supply chain costing that you know of? Please explain. (RQ 2, IQs 3 and 4, and Proposition 3)

4. Do you use a particular costing approach for each type of buy or do you use different approaches depending on the item or service? (RQ 2, IQs 2 and 4 and Proposition 3)
5. If you don't use the same costing approach for all buys, what determines when you use alternative approaches? (RQ 2, IQs 2 and 4 and Proposition 7)
6. Is supply chain costing a tool or a philosophy? (RQs 1 and 3 and Propositions 1 and 2)
7. What activities are part of the supply chain within or outside of your firm? (RQ 1 and 2, and Proposition 1 and 2)
8. What cost data do you receive from suppliers? Customers? (RQ 1, IQs 1 and 3, Propositions 1 and 3)
9. Was there any top management involvement in the early levels of supply chain costing development? What levels/functions were involved? (RQ 1 and 2, IQ 4 and 6 and Propositions 4, 5 and 6)
10. What functional areas are involved supply chain costing, and how? (IQ 4)
11. How would you describe the relationship, if there is one, between supply chain costing data and traditional financial accounting data? (Proposition 3 and 7)
12. Do you believe that the linkage of supply chain costing to other initiatives has helped the acceptance of these programs, or vice versa? How/why; address both internally and externally (with supplier/customer). (Proposition 3)
13. What resources have you used to identify and manage supply chain costs? (IQ 4)

14. What problems relative to developing supply chain costs have you encountered?  
How were these challenges resolved? (IQ 5)
15. Provide examples of how you have reduced or more effectively managed supply chain costs. (General Question)
16. What impact does supply chain costing on decision making? Please give specific examples. (RQ 2 and 3, IQ 6 and Propositions 5 and 6)
17. What decisions are based on supply chain cost data? What decisions are based on traditional cost accounting data? (RQ 2 and 3, IQ 6 and Propositions 5 and 6).
18. Who makes these decisions? How often are these supply chain decisions reviewed (revised)? (RQ 2 and 3, IQ 6 and Propositions 5 and 6)
19. Are supply chain costs separated for internal decision making or are they aggregated with other costs? (RQ 2 and 3, IQ 6 and Proposition 6)
20. How is supply cost data collected and disseminated within or across organizations? (RQ 2 and IQ 4)
21. Whom, or what function "owns" the supply chain costing process? (RQ 1, IQ 4, and Propositions 4 and 7)
22. Who is responsible for gathering/maintaining data related to supply chain costs — individual, team? (RQ 1 and 2, IQ 4, and Proposition 1)
23. Do you see your firm doing more or less inter-firm costing in the future? Which area will be affected, and why? (IQ 5 and Proposition 5)

24. Is there anything else significant about your use of a supply chain costing approach or your implementation of a costing approach that you think I should know about? (Generic Question)
25. If you could capture cost information from the supply chain that you currently do not have visibility of, what would it be? (IQ 3 and Proposition 2)

### Summary

This chapter identified the research methodology that was used to address both the problem statement and the research objectives. The methodology used was a hybrid approach that integrated the grounded theory method proposed by Strauss and Corbin (1990) with the multiple-case study method suggested by Yin (2003). The data collection methods and the analysis approach (Miles and Huberman 1994; Strauss and Corbin 1990) were also outlined. Finally, the research design was detailed so that the interview questions could be traced to the research questions, investigative questions, and/or propositions. The analysis and findings based on the research are presented in Chapter 4.

CHAPTER 4  
ANALYSIS AND FINDINGS  
Identifying Firms to Participate

A total of eighteen companies representing the aerospace and transportation industries were contacted and asked to participate in the interviews for this research. Unfortunately, only eight companies agreed to participate. During the initial phases of the research, a concerted attempt was made to construct a supply chain in its entirety within one of the eight firms. Ideally, it would be preferable to map a complete supply chain and to examine the roles and costing methodologies displayed by individual participants to gain an understanding for how firms begin to cost out certain supply chain functions, and how strategic decisions are impacted by the position of the firm in the supply chain. However, this was not entirely possible. Although a supply chain network within the aerospace industry was mapped; each of its individual supply chain partners would not agree to discuss their costing processes. As such, a piecemeal approach for identifying the roles or functions across the supply chain network was applied.

The individual roles (i.e., positions) of the supply chain, which were mapped prior to this study for the aerospace industry, were classified as supplier, manufacturer, 3PLs, distributor, and the end user. Based on information received during the course of the

interviews, the additional role of integrator was added, as two of the aerospace firms managed multiple functions within the supply chain and were receiving revenues based on their role as the overall supply chain integrator.

The piecemeal supply chain roles within the transportation industry were modified and expanded to include the functions and roles of brokers, trucking and freight transportation providers. As such, the supply chain of the transportation industry included suppliers, manufacturers, trucking and freight providers, distributors, 3PLs, and the end user. One of the key differences between the aerospace and transportation industry was the transportation industry's predominance of supply chain partners who operate in a services environment rather than the more product-focused environment encountered in the aerospace firm interviews.

In total, eight companies and numerous individual interviewees within each firm agreed to participate in the one to two hour interview sessions. Across the eight companies there were 23 total interviews that took place during the data collection phase of the research. Of the 23 interviews, 19 were recorded for coding and analysis purposes. Three of the interviews were not recorded because of a recorder malfunction and one participant asked that their interview not be recorded. 21 of the 23 interviews were conducted on-site at the participating firms, while two of the interviews were conducted via a conference call, which was also recorded. Copious notes were taken during each of the 23 interviews. These notes were later used to augment the coding of the interviews along with additional supporting documentation (e.g., presentations or spreadsheet information) provided by the interviewees. As such, the recorded interviews, the notes,

and documentation were used to triangulate the data in support of the findings, propositions, and conclusions that are discussed later in the research paper.

In total, there were 234 pages of recorded and transcribed data, 47 pages of documentation submitted by the interviewees, and 65 pages of handwritten notes used in conducting the case study. The 234 pages were transcribed into Microsoft word by three undergraduate students who were compensated for their services. The students employed for this effort signed confidentiality agreements as to not disclose information that could be tied to participating firms which agreed to participate in this research effort. The 47 pages of supporting documentation, which consisted of Microsoft Powerpoint presentations and Microsoft Excel spreadsheets were not coded; however, they were analyzed to determine key process steps in obtaining supply chain costing information and/or methods for collecting supply chain costs for decision making purposes. Several documents that were provided by the interviewees were not used for analysis purposes, as the documents contained information that if revealed could jeopardize the pertinent non-disclosure agreements that were signed prior to the interviews. The remaining documentation was used for research purposes but in a manner that firm names or personnel could not be identified or traced back to the owner. Finally, the handwritten notes were transcribed by the author and compared to the interviews to ensure the reliability of the transcriptions performed by the undergraduate students. No significant inconsistencies were found when comparing the transcriptions and the interview notes. In all cases, the errors consisted of spelling mistakes and/or the use of acronyms where no further explanation was required.

In many cases there was more than one company representative participating in the interview. In those instances, the interview protocol was followed, and the individuals participating were allowed to select and address the specific questions for which each felt they had the most experience or relevant expertise in answering. The participating firms from both the transportation and aerospace industries represent both product and service providers. The sample of firms selected represents a stratified, yet largely convenient (or convenience) sample. The sample is stratified based on a focused attempt to include firms that are well known for their accomplishments in the field of supply chain management. For example, three of the participating firms were recognized as being one of the top 25 firms based on their supply chain management practices by the *Journal of Supply Chain Management* in 2007. The remaining firms, while not only relatively large in size (i.e., classified as medium or large firms with revenues over \$100 million annually), have demonstrated attempts to increase the effectiveness of their supply chain management practices. In this sense, the sample could be considered theoretical as well. All participating supply chain firms were involved in supporting a professional supply chain management organization. Many are actively involved in the Council of Supply Chain Management Professionals (CSCMP), while others are actively involved in the Institute of Supply Management (ISM).

Moreover, the participating firms or organizations also represent a convenience sample, as seven of the eight companies were located within 120 miles of the Dallas/Fort Worth (DFW) metropolitan area and within driving distance of the researcher. Fortunately, there are many large corporations headquartered in the DFW area making

data collection somewhat accessible. In several instances a return trip to the firm’s location to retrieve additional documentation supporting some of the discussion in the interviews, or to address the responses in need of clarification, was required.

As mentioned previously, participating firms represent both product and service providers. However, in some cases the participating firms could be considered both a product and a service provider. For example, two of the firms manufactured or distributed a particular product line in the aerospace industry. Additionally, they also provide logistics support for the end-user after the item is delivered. The following table provides demographic information as to the firms and the participants. Note: Each interview conducted with one or more participants was counted as one interview.

Table 4.1

FIRM DEMOGRAPHICS AND REPRESENTATION

Companies or Organizations Represented In the Study								
Industry	Role within Supply Chain	Firm Size <sup>a</sup>	Product vs. Service	Number of Participants From				Total Interviews
				Accounting	Logistics	Sales & Marketing	Purchasing	
Aerospace	Manufacturer	Large	Product	1	3	0	2	5
Aerospace	Distributor	Large	Product	1	1	1	1	2
Aerospace	Supplier	Medium	Product	1	1	0	1	2
Aerospace	Warehousing	Medium	Service	0	1	0	0	1
Transportation	Manufacturer	Large	Product	1	4	1	1	8
Transportation	Transportation Broker	Medium	Service	0	1	0	0	1
Transportation	Trucking Company	Large	Service	0	2	0	1	1
Transportation	Manufacturer	Large	Product	1	1	1	0	3

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<sup>a</sup>Large, annual revenues greater than \$1B; medium, revenues between \$100M and \$1B; small less than \$100M

Uncovering Supply Chain Cost Practices via the Interview Protocol

The interview protocol, which was vetted to experts within the supply chain management community, was designed to allow for the qualitative analysis of the

participants firms' usage of supply chain costing. Initially though, the protocol was used to assess a firm's cost philosophy and general practices in management of their supply chain(s). In two of the cases, the firms were managing their supply chain using a more evolutionary approach to SCM where SCM constitutes a dirt-to-dirt management philosophy with SCM used at the strategic management level. Conversely, the six remaining firms could be classified as supply chain proponents. Suffice to say that these six firms approached SCM from a more traditional perspective, in which they viewed SCM as an umbrella for logistics functions (i.e., materials management and physical distribution) of the firm. In these instances, material management and physical distribution would encompass the sourcing and procurement, supply and inventory tasks, and the transportation functions. In today's literature, SCM consists a cross functional application of management where front-end design, sales, operations, and accounting all come into play.

Second, the interview protocol was directed to allow for the examination of the underlying costing processes and practices of the participating firms. Questions were asked in a manner used to gather an overview of the firm's cost accounting systems, and whether or not the firm used management accounting to assist with decision making. The interview questions did not ask for specific cost information in the form of numbers, but did seek to identify the firm's costing processes and barriers. Additionally, the research attempted to identify the resources (e.g., personnel, software programs, departments, etc) required to collect cost information for the supply chain, and how cost information was disseminated within the firm. Additionally, the interview was directed at the instances

where firm's may have shared or collected cost information with its suppliers, partners, or customers in order to achieve cost reductions or improve the quality of the product or service. Finally, the protocol was utilized to identify the strategic decisions that a firm makes based on their use of the supply chain cost information collected within and outside of the firm's four walls. Once the interview information was collected, the data was coded for analysis purposes. The following section identifies the methodology used for classification.

#### Coding the Interviews/Documents/Field Notes

The data collected was coded using a modified version of the grounded theory approach suggested by Glaser and Strauss (1967) and Strauss and Corbin (1990), and the qualitative data analysis techniques suggested by Miles and Huberman (1994). Glaser and Strauss suggest that coding should be done based on the data rather than establishing a coding schema prior to the analysis. For purposes of analysis, the codes in this study are a hybrid of both, the previous terms in the literature and the documentation collected during the actual interviews.

Initially, a literature review of the supply chain costing and cost/management accounting was performed to identify key concepts that would most likely be discussed during the open-ended interviews. Many key terms were identified, and were determined to be too large in number to tackle for coding purposes. At first count, there were 64 key terms and/or categories identified in the literature that might be mentioned in the interviews. To streamline the approach, the categories were reduced by using the

handwritten notes from the first 12 interviews. For example, the concepts which did not appear in the interviews were deleted or merged with another category. As such, the interview notes facilitated the consolidation and merging of key concepts into a more manageable framework. After this exercise, there were 21 categories remaining. By final count and after following the guidance provided by Strauss (1987), where categories of conceptualizations are grouped and collapsed for analysis, there remained 15 categories of key terms. At final count, the 15 categories represent the broad and common concepts of supply chain costing. Furthermore, each of the categories remained consistent with what was discussed in the concepts discussion identified in the literature review (Chapter 2). The next step in the research design was to define a coding schema for the 15 categories, which could be used for interpreting the interview and documentation data collected.

Strauss and Corbin (1990) identify a three step approach to coding qualitative data. Steps one through three include: 1) open coding, 2) axial coding, and 3) selective coding. The method used to carry out each step is discussed in the sections that follow.

### Open Coding

During the open coding phase, a two-letter a priori coding schema was constructed based on the procedures suggested by Miles and Huberman (1994). As mentioned earlier, there were 21 broad categories prior after the first iteration of data synthesis. Miles and Huberman (1994) suggest streamlining the categories even further, so as to simplify analysis of the data. This provided further assistance in whittling the

categories down from 21 to 15. What remained was the two-letter coding schema. That schema is presented below.

Categories emerging (Open Coding):

Fifteen 2-letter categories

1. IC: Inter-organizational and Intra-organizational costing
2. CA: Cost Accounting (e.g., traditional IRS, SEC, and auditing roles)
3. SD: Strategic Decisions (i.e., decisions influenced by supply chain costing)
4. AC: Antecedents of supply chain costing (i.e., drivers to supply chain costing)
5. CP: Cost to Price implications (how do supply chain costs affect market price?)
6. RP: Role of upstream and downstream Partners (how do distributors and customer impact end-to-end costs?)
7. CF: Cross-Functional (i.e., organizing a supply chain costing effort across multiple departments).
8. SB: Shifting of Benefits/burdens of the supply chain based on costs (e.g., roles and allocations)
9. MA: Management Accounting (e.g., target costing, activity-based management, should cost)
10. WI: Why it's difficult (Barriers to supply chain costing)
11. IT: Information Technology's role in supply chain costing (e.g., ERP)
12. CC: Capturing Cost information (who collects supply chain cost information)



facilitated by the use of the MaxQDA software where each coding category could be queried so that only the text associated with a particular category could be printed out and analyzed. Each textual segment for a given category was then compared and contrasted to identify key differences, key characteristics, and dimensions. To supplement this largely manual effort, the various dimensions were examined in MaxQDA to identify the frequency at which they appeared across all coded text segments. In many cases, the dimension labels were then merged to reduce the number of dimensions without compromising the key characteristics of each category. The dimensions for each category are discussed in the following section.

Interorganizational and intraorganizational costing (IC) included three primary dimensions. They include: full and open accounting with supply chain partners, limited cost disclosure with partners, and intraorganizational visibility. Based on a frequency count of all 15 coding categories, this category was the most heavily discussed in the interviews. During several occasions throughout the interviews, participating firms expressed an interest in having full and open accounting disclosure between supply chain partners. However, the research could not identify examples where the entire network of firms in the supply chain was sharing cost data. And while it was the goal or “panacea” of many firms, most viewed this as a distant reality.

Seven of the eight firms also presented evidence where their suppliers and/or customers had shared cost data with them and vice versa. However, the sharing did not span the supply chain network. As such, these instances within the textual data were coded as having limited information sharing with partner firms. Finally, most of the

firms engaged in what has been called intraorganizational costing. This occurs when costs are only being captured by one firm and are based on their individual role in the supply chain only. Unfortunately, most firms could not describe or provide a process by which these costs were collected. In some instances, firms were extremely challenged when attempting to capture their internal supply chain costs. These findings are discussed later.

The category of cost accounting (CA) included two dimensions. These dimensions are “costs can be traced to the supply chain cost drivers” and “costs not traceable to cost drivers”. In all but two of the firms, supply chain costs could not be traced to the drivers. In the two instances where the costs were traceable, the firms were dedicating significant resources (i.e., money and manpower) towards implementing a new cost collection methodology. The two firms that seemed to have visibility of its cost drivers were either, required to have it because it was required by cost and accounting (CAS) standards or the Truth In Negotiations Act (TINA) (i.e., mandatory for government contracts over \$650K) or because the firm had produced the same product for many years and had established sufficient cost knowledge of their direct labor hours and other indirect cost drivers.

The “strategic decisions” category (SD) included three dimensions. They were strategic decisions impacted by a firm’s internal cost drivers, strategic decisions which are affected by the cost drivers of one supply chain partner, and decisions that are impacted by the interorganizational cost drivers of multiple key partners across the supply chain network. This category was fifth in terms of frequency based on coding and

data analysis of the transcriptions. Examples of strategic decisions that were the outcome of coordinated cost analysis across the network of firms or impacts to one other partner included: inventory and facility location decision, capital investments (e.g., special equipment or tooling) decisions, risk management decisions, and pricing/margin decisions. Decisions that were being made based on the costs captured within the single firm (i.e., individual supply chain role or function) included: outsourcing determinations, purchasing and contract strategy decisions, and freight and transportation decisions. While some of these decisions overlapped into the three dimensions, an attempt was made to assign them to a single category. In summary, seven of the eight firms interviewed were not making strategic decisions based on full visibility of costs across the supply chain, but rather, most analyzed decisions based solely on what the firms had direct control over. This will be discussed further in the findings section.

The “antecedents” or drivers (AC) to supply chain costing included three categories. There were multiple dimensions identified for each. The categories consisted of: 1) marketplace competition (dimensions--low cost or differentiation strategies), 2) supply chain position (dimensions—internal cooperation, dyadic cooperation, vertical cooperation, and full channel integration), and 3) level of SCM integration (dimensions—low, medium, and high). Achieving and optimizing the outcomes of a supply chain costing effort requires full SCM integration across the network. Unfortunately, this was not demonstrated in any of the interviews within the aerospace and transportation industries. Anklesaria (2008) suggests that the drivers to supply chain cost management are the strategic vision or business plans of partner firms, the procurement or marketing

strategy of a product or service, the identification of costs and the team members who participating in cost collection, and to identifying the goals for supply chain performance. Unfortunately, these drivers assume that the decision to carry out supply chain efforts has been made. In a sense, this is putting the cart before the horse. Firms must first determine whether supply chain costing can be carried out. In doing so, the dimensions of marketplace competition, supply chain position, and the level of SCM integration must first be analyzed. These categories will be discussed further in the research.

Many companies seem to espouse the objectives of supply chain costing; however, the interview data suggests that these efforts may outweigh the return on investment for implementing a supply chain costing across the supply chain. In one of the interviews, the interviewee stated “why should I spend five cents to save three cents”? Alternatively, engaging only those critical supply chain partners and capturing only the relevant cost information necessary to identify partners that need additional cost or quality attention seems to be a more realistic means for obtaining or sustaining a competitive advantage in the marketplace. On that note, one interviewee reported that during a recent professional trade consortium, which addressed the topic of capturing of supply chain costs, that many firms were almost 100% sure that supply chain costs were in many instances being reflected as a double cost on the books. Hence, before they could begin to share cost data with partner firms they must get a better grasp of their own cost allocations first.

The category of “cost to price implications” (CP) included two dimensions. The dimensions were highly connected and moderately connected. Many of the firms

interviewed had not considered the full impact that supply chain costs have when managing the product or service with a dirt-to-dirt perspective. Only two of the firms were able to explain how cost impacted price down to the lowest levels. Moreover, only one of the firms interviewed (from the transportation industry) could provide a description of the process where price could be managed in a backward fashion (i.e., a technique similar to target costing). As such, only one firm was actively managing costs in a manner to ensure projected profit margins were achieved. This case was noteworthy; however, a documented methodology for supply chain costing could not be provided by that firm. On the surface and based solely on the description, this costing process could be viewed as similar to the target costing process proposed by Cooper and Slagmulder (1999) and Ellram (2000; 2002).

The category of “role of upstream and downstream partners” (RP) included three dimensions. The dimensions identified in the interview data were: highly cooperative, moderately cooperative, and low cooperation. Each of the eight firms interviewed expressed a desire to include or at least share cost information with other network members in the supply chain. Four of the interviews provided evidence where firms were actively engaging in supplier development, either through supplier development conferences where costs were discussed, or in certifying key suppliers and rewarding them when cost reduction goals were met. Unfortunately, while many of the supplier development conferences do identify potential areas for cost savings or quality improvements, they fail to achieve the overall goal of mutual benefit and/or gain as they often end up identifying cost reduction goals. These goals for suppliers were typically

stated in terms of a desired percentage reduction in the supplier's cost. In one interview, the interviewee stated that their supply chain customer (a larger aerospace firm) had demanded a 2% reduction per year in their component pricing. No rationale was provided, as this was the cost of doing business with that partner. As a result, the downstream supplier must engage its component suppliers or look for alternative ways to reduce their costs if they want to remain a supplier.

The category "cross-functional" (CF) includes three dimensions. The dimensions are: fully integrated, limited cooperation, and functionally independent. During the course of the interviews, the companies appearing to be the most knowledgeable with regard to their collecting and using cost information were managing their supply chain in a cross-functional manner. Overall, only two companies featured a fully integrated supply chain which was managed across the firm. The remaining six firms were structurally organized to manage the supply chain in a stove-piped manner where there were functional departments. When management of the firm was by function, the ability to discuss cost processes was extremely limited. However, the expressed desire of the interviewees was to abandon this practice. Interviewees explained that they were beginning to coordinate with other firms and other supply chain partners. However, full supply chain integration of cost information was not demonstrated. As such, cross-functional management across the supply chain appears to a lucrative means by which to identify the potential for cost savings or increased effectiveness gains. This is discussed later in the findings section.

The category of “shifting of benefits/burdens” (SB) contained two dimensions. These two dimensions were labeled as major and minor. The major dimension requires a significant realignment or investment between partners. The minor dimension requires an administrative adjudication of what each partner must modify to increase efficiency or effectiveness. One of the most common complaints expressed by the interviewees was that profits, as the key motivator for a firm, might prevent them from sharing cost information or even cost savings rewards with its partners. The concern most often expressed was that the 800-lb gorilla of the supply chain often decides who gets what when the savings are disbursed. With that in mind, the belief is that the 800-lb gorilla would often take the biggest banana. In two other cases, the lead supply chain firm being interviewed was so engrained towards achieving profit margin gains for itself, that it could not envision the supply chain as a myriad of partners that could increase efficiency or effectiveness by shifting responsibilities or functions within the supply chain.

In one interview, the interviewee explained “that we do it better than anyone else, we just need more cost visibility upstream.” This sentiment somewhat defeats the ideals of supply chain costing, and can be construed as, “you give me lower prices and I’ll maximize my margins via procurement savings with little regard for you as a supplier/partner.” All the while, the supplier must figure out how to maintain its current margin with the customer. Some interviewees did express reciprocity in sharing, however, the win-win philosophy in supply chain management was not as prevalent as one might anticipate based on the SCM literature.

The “management accounting” (MA) category included three dimensions. They were: those used to greatly enhance decision-making capability, those with limited decision-making capability, and those without the cost knowledge to assist with decision-making. In chapter 2, the literature review presented information suggesting that traditional cost accounting was not designed for the purposes of managing supply chain costs. The interview data collected in this research supports this assumption. The interviews did however, offer additional insight to the management accounting practices contained in the literature, as well as additional management accounting practices capable of assisting decision-makers. Examples of some of the management accounting techniques encountered were: target costing, life-cycle costing, landed cost models, should cost models, and kaizen costing techniques. Unfortunately, only three of the eight firms interviewed had what could be called extensive knowledge of these techniques.

The category of “why it’s difficult” (WI) included three dimensions. This category includes major obstacles to implementation, minor obstacles to implementation, and obstacles easily overcome. Essentially, this category represents the barriers to implementation that a company or the entire supply chain may encounter when attempting to gain visibility of the supply chain network. In many instances, the interviewees discussed a transactional view (i.e., arms-length approach) as the overriding philosophy of the firm. While, there was some mention of a relationship-based management approach, most firms explained that relationship-management did not extend in a downward fashion to the customer, but in a transactional manner to the upstream supplier. Secondly, many companies explained their dependence on traditional

cost accounting systems as a method for measuring performance in a post-hoc manner. Finally, firms expressed concern over sharing cost data with its suppliers in fear that this information could be used against them in future negotiations. Because of the ubiquitous nature of this concern, the category was broken down further and risk of disclosure was added. The dimensions of risk of disclosure are low, medium, and high. Finally, firms expressed that before they could begin to share cost data with their suppliers, they first needed to get their arms around what their own costs were. Either they were not organized functionally to facilitate cost collection, or their current cost collection techniques were incapable of breaking out the costs associated with individual functions or roles. In many instances, firms stated that all they see are cost roll-ups.

The category of “information technology” (IT) included three dimensions. They were: fully integrated across the supply chain, limited integration across the supply chain, and intraorganizational capability only. All of the companies interviewed stated that they had enterprise resource planning (ERP) or some type of data warehousing type system currently in place. However, it was not apparent whether the architectural design for the ERP type systems were capable of capturing supply chain costs and used to make decisions based on those costs. In one case, the interviewee expressed that the ERP was capable of collecting massive amounts of data; however, it was almost information overload. No participating firms were able to demonstrate how ERP systems could be used to assist in analyzing supply chain cost data with the exception of labor hours required for production purposes.

The category of “capturing cost information” (CC) included three dimensions. These dimensions included: upper-level management, mid-level management, and lower level management. This category identified who the users of supply chain cost data are and how the various levels of management use that information. Because the interviews targeted supply chain executives and upper level managers, the analysis of the data may be biased towards higher-level employees. However, when a company granted additional access in the form of multiple interviews, as was in the case of three of the firms (where more than two interviews were conducted), lower level managers did discuss their methods for collecting pertinent supply chain cost information. In one interview, a mid-level logistics manager was able to provide cost information pertinent to specific freight options based on various partner firm configurations through the firm’s transportation management system. This was the first example where a manager could navigate through a data warehouse and compile cost information used for supply chain decision making in a just a matter of minutes. This represented one of the best examples of supply chain costing being used for decision making purposes.

The category of “unique industry characteristics” (UI) did not include dimensions for purposes of analysis. The findings that are discussed for this category will be discussed in a separate section of the research paper, so as to discuss to compare and contrast the individual firms that comprise the aerospace and transportation industries, and how the industries differ when viewed on the aggregate. Furthermore, this category will be further established with the case study portion of the hybrid method rather than the grounded theory.

The category of “methods for improving supply chain quality” (CQ) included two dimensions: best practice and noteworthy concepts. This category represents instances where cost tradeoff decisions were necessitated by the customers’ demand for more differentiation in the marketplace. Essentially, firms undergo these endeavors when attempting to improve the effectiveness at which the supply chain can meet the needs of the customer. Firms displaying a method to increase quality that could be traced to involving multiple supply chain partners rather than their own firm was labeled a best practice. Those interviews that discussed a firm enhancing supply chain quality by examining cost tradeoffs within their own firm only were assigned to the noteworthy dimension.

Finally, the category of “metrics for supply chain performance” (MS) included two dimensions. The dimensions were: performance indicators measuring the performance of the aggregate supply chain or multiple partner firms and metrics tied to performance of the individual firm only. Only one interview revealed metrics that could be tied to multiple firms. In that particular case, the metrics identified were limited in that they covered only a portion of the supply chain network. All of the interviews included numerous metrics that would be helpful for individual firms. However, they were limited by not touching the rest of the supply chain. In one of the cases, the interviewee explained that it is not uncommon for the engineering function to claim a cost savings on the product design and packaging, while at the same time, creating an even greater cost increase for warehouse personnel in terms of handling costs. In this

instance, the metrics for one function will degrade overall performance, yet another function or division may be rewarded for it.

Effectively, these dimensions may assist in the quantitative analysis of supply chain costing studies in the future. These dimensions will serve as the framework for the propositions that can be operationalized for hypothesis testing in future research and by using statistical analysis. The next step of the grounded theory process is the axial coding of the categories. Effectively, the relationships between the categories are established prior to the final step of selective coding.

### Axial Coding

The axial coding step was performed using a feature found in the MaxQDA software package. One of the functions of MaxQDA is the capability of identifying intersections of codes within the texts of the interviews. Initially, the frequencies of the coded intersections were examined in order to determine the most commonly found relationships. MaxQDA enabled the researcher to manipulate the textual segments so as only to retrieve those that were dual coded during the open coding. The dual coding, therefore, represents an intersection or relationship between two or more categories. If a category contained more than three instances of intersecting with other categories, it was examined further, in the context of the interview, to identify potential causal conditions between the categories.

Seven of the fifteen categories included more than three intersections. Each of the seven categories is discussed in accordance with the intersecting or causal relationship

exhibited with other categories. As stated previously, the most commonly coded category was the “interorganizational and intraorganizational costing” (IC) category. This category featured a total of 21 intersections with seven other categories. The intersections included “shifting of benefits/burdens of supply chain” (SB), “strategic decisions” (SD), “role of upstream and downstream partners” (RP), “unique industry characteristics” (UI), “capturing cost information” (CC), “why it is difficult” (WI), and “metrics for supply chain performance” (MS). In examining the context via the themes and patterns of the textual intersections, it was found that RP, UI, CC, and MS preceded the decision to attempt interorganizational or intraorganizational costing efforts. It was also noted that the “SD” coding most often followed an “IC” coded segment. Consequently, RP, UI, and CC represented the drivers or antecedents of interorganizational or intraorganizational supply chain costing. SB and WI acted as a determinant for the firm’s ability to conduct supply chain costing, and ultimately to make strategic decisions based on supply chain costing. Finally, SD was depicted as an outcome of IC.

The “antecedents of supply chain costing” (AC) or the drivers intersected with 4 other categories in the coding schema. Textual segments that were coded as AC were featured with segments of the RP, CP (cost to price implications), CC, and MS. This established these categories as four of the six drivers of supply chain costing. The role of upstream and downstream suppliers (RP) is extremely similar to the level of SCM integration across multiple firms. As such, RP was determined to be redundant as a driver and does not appear in the conceptual model presented later.

UI also acted as a driver, though it did not intersect with the AC category. The UI characteristics are discussed later in the analysis of the differences within both industries and across both industries. Finally, the drivers mentioned previously (i.e., marketplace competition, supply chain position, and level of SCM integration) were also added due to their prevalence throughout the interview transcripts.

The “capturing cost information” (CC) intersected with four other categories a total of 10 times. Within these segments, discussions addressing how companies collected supply chain costs typically involved a relationship with either “strategic decisions” (SD), “management accounting” (MA), “information technology” (IT), or “interorganizational or intraorganizational costing” (IC). SDs typically followed the codings of CC in the text. Conversely, MA and IT preceded CC sequence.

The “strategic decisions” category intersected on 12 occasions with four other categories. These categories included both IC and CC (mentioned previously), and “shifting of benefits/burdens of the supply chain” (SB), and “why it’s difficult” (WI). In each occurrence, SD was always the outcome of the relationship between the categories. The causal condition of these relationships suggests that SD follows the other core categories identified by the intersections. The goal of the study was to determine how strategic decisions were impacted by supply chain costing. Decisions that were identified in the transcripts and from the notes taken during the interviews suggest that these decisions are related to: outsourcing, overall pricing strategies, identifying the particular roles that individual suppliers should perform, and finally, the overall decision to

implement fully integrated supply chain costing or to revert back to traditional cost accounting approaches.

The “management accounting” (MA) category was another core category that revealed intersections with other key categories. It intersected with CC coded segments on six occasions. It also intersected with IT and CP (“cost to price implications) on three occasions in the text segments. After examining the relationships between these categories, it was commonplace for MA to link with segments coded as CC and CP. In the context of a model, MA acts as the primary technique for overcoming some of the barriers to supply chain costing. Furthermore, MA would act as an antecedent to CC and CP and also demonstrates a relationship with the IT category. Several interviewees expressed that their current IT systems did not provide for the type of visibility necessary to capture external, or in many cases, internal cost drivers.

Finally, the “why it’s difficult” (WI) category coded data consistently intersected the IC and SD coded segments. The WI category represents the barriers to implementation for IC and greatly impacts a firm’s strategic decision making capability unless techniques are used to overcome barriers. Visually, and in the context of a model it would mimic the supply chain costing drivers and precede IC or SC costing in its ability to affect supply chain costing efforts. Further examination of the barriers to implementation also brought about various methods for overcoming the barriers. The conceptual model and the discussion that appears later will present some strategies that can be used to overcome these challenges.

The categories of IC, CC, RP, SD, MA, and WI represent the emerging categories of the conceptual model based on the grounded theory to this point. The next step is to selectively code the data, so that a conceptual model depicting the grounded theory of supply chain costing and its relationship with strategic decision making can be constructed.

### Selective Coding

The third and final step is selective coding. During this step, the conceptual model depicting supply chain costing and its impact on decision making is presented. Strauss and Corbin (p. 116: 1990) define selective coding as “the process of selecting a core category and systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development”. Much of the validating of the relationships in this effort was conducted during the axial coding step where the intersections and relationships of the coding categories were identified previously. Construction of the conceptual model was the outcome of the selective coding, and was performed simultaneously with the case study analysis. During this effort, the characteristics of the individual firms and the two industries were identified as well.

Initially, and identified previously in the axial coding step, there were five categories that could possibly function as a core category (i.e., IC, CC, SD, MA, and WI). Based largely on the focus of this research effort, and because IC was coded more frequently than the other 14 categories, it is hereby identified as the core category.

Additionally, from this point forward in the research paper, IC can be used interchangeably with supply chain (SC) costing. As such, the conceptual model will use SC costing rather than IC.

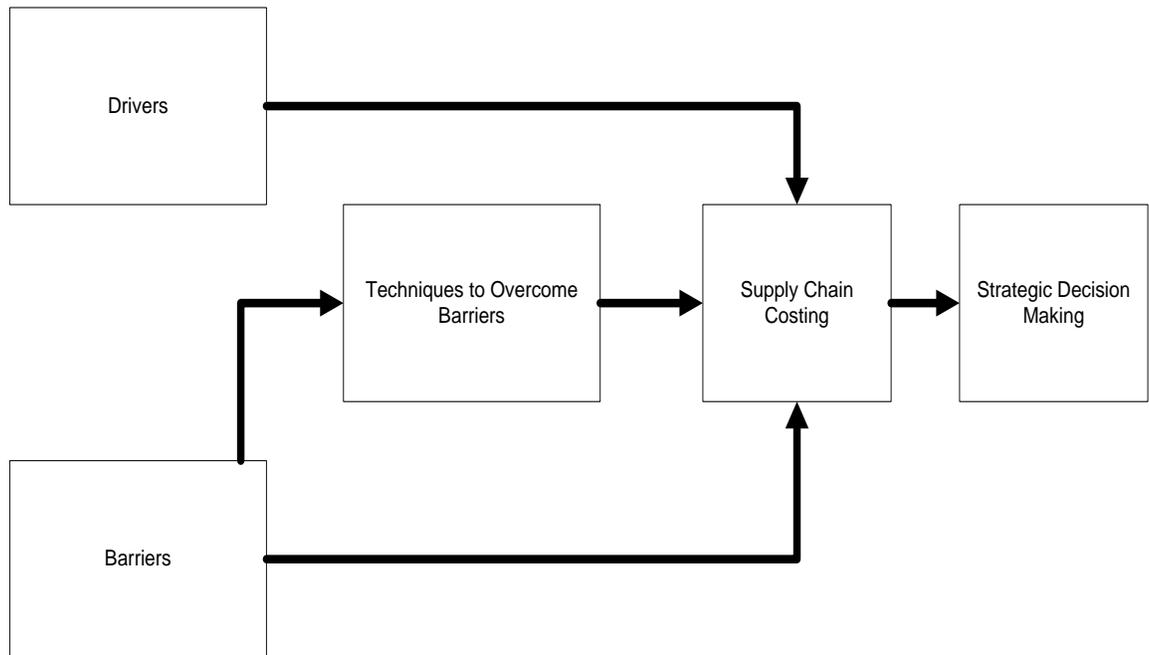
Essentially, the selective coding from this point forward represents the merging of the grounded theory method (Strauss and Corbin 1990) and the case study method proposed by Yin (2003). In summary, the conditions and differences encountered in the main categories are the impetus for building theory and generating the research propositions.

#### A Model for Supply Chain Costing and Strategic Decision Making

The conceptual model features the core category of SC costing, the drivers or antecedents, the barriers to implementation, techniques for overcoming barriers, and the impact of SC costing on strategic decision making. The model is the outcome of selective coding established after comparing and contrasting the unique conditions and differences within and across industries that are discussed in the findings that helped to formulate the research propositions.

Figure 4.1

THEORETICAL MODEL FOR SUPPLY CHAIN COSTING



The Case Study and Resulting Propositions

The following is a case study presentation of the drivers, the barriers, and the techniques used to overcome barriers, SC costing, and the strategic decisions impacted by SC costing. Additionally, immersed within this section is a presentation of the propositions emerging from the research, as well as a further discussion of supply chain costing, and the relationships of supply chain costing with the other categories identified in the conceptual model. Ideally, the conceptual model will be the framework for supply chain costing research conducted in the future.

## The Drivers and Barriers of Supply Chain Costing

A review of the interviews indicated a prevailing dependence on the level of price and/or quality competitiveness found in a particular industry. As such, this was established as a driver for supply chain costing. Additionally, both industries expressed a desire for more supply chain cost visibility to assist strategic decision makers. Ideally, the strategic decision makers could use additional cost visibility to establish target profit margins. This information would also assist decision makers who manage the quality implications of suppliers and providers. Two of the firms from the aerospace and one from the transportation industry were functioning as a manufacturer within the supply chain. Both manufacturers were recently recognized within their industry as having the highest quality of any manufacturer. Additionally, one third-party-logistics provider (3PL) within the aerospace industry was recognized as having the best on-time delivery of replacement aircraft parts throughout the industry. As such, achieving low cost leadership status (such as the position held by Wal-Mart's within the retail industry) was not the driving force behind the firm's supply chain costing efforts.

More attention within these firms was being directed towards what the end-user expected from the product and/or service and how effectively the consumer's requirement could be met. These two firms were using a reverse costing approach similar to the target costing practice suggested by Ellram (2002). In these instances a particular feature or option could be offered to the consumer at a reasonable price, while still ensuring the anticipated margin for the manufacturer. Overall, the aerospace industry was less price competitive. One aerospace firm stated that its industry was

unique in that an airplane on the ground sometimes renders cost meaningless, as the commercial or military customer will pay almost whatever takes to get the airplane flying again. Consequently, a firm in the aerospace industry may choose a strategy that is centered on production and delivery rather than total supply chain costs.

Moreover, the focus of the remaining firms who were suppliers or providers in the aerospace or transportation industry was directed largely at managing and achieving cost reductions. In one particular case, the firm interviewed within the aerospace industry was supplying a common part for OEM aircraft manufacturers and was in a do-loop towards reducing the cost of a component part. In fact, the upstream OEM partner had told them they were expected to achieve a 3% price reduction per year in order to maintain their contractual arrangement. While this cost reduction was not substantiated by the OEM, the message was loud and clear. As a result, the supplier firm chose to appoint a former internal accountant to work alongside supply chain management personnel to assist in identifying cost drivers and additional opportunities for cost improvement. Another firm within the transportation industry, who was a manufacturer operating with a low-cost strategy, had appointed a supply chain analyst to identify potential cost reduction areas that could be achieved. In one particular instance, this company had gone to a consignment or vendor managed inventory (VMI) strategy to help achieve lower inventory costs throughout the supply chain. Both of these were considered best practices, as just having a supply chain manager who understands the intricacies and complexity of accounting and costs may increase the level of SCM integration within a firm. In other interviews, the SCM functions of the firm had little to no relationship with

the firm's finance and accounting function. As such the following propositions are suggested.

Proposition 1: Firms operating with a low cost strategy are more likely to conduct supply chain costing efforts than those using a strategy of differentiation.

Proposition 2: Firms who have SCM personnel with a background in finance or accounting will be more successful in achieving supply chain cost efficiencies or effectiveness improvements than those without.

The second category emerging as a driver to SC costing was identified as supply chain position. The position that a firm occupies within the supply chain could largely impact the potential or even the possibility to carry out supply chain costing. Within both industries, it was extremely important in determining what type of control a firm has within supply chain. Previous research in the Asian auto industry has suggested that supply chain costing is responsible for many of the efficiencies and effectiveness improvements (Cooper and Slagmulder 1999). However, before supply chain costing can be studied and assessed, the conditions must be determined. For one, many Asian manufacturers are vertically aligned and the ownership at the top of the supply chain extends to the smallest component supplier. Additionally, the government provides directives that mandate cooperation among firms that are partially backed and supported by government entities. In the United States, these conditions are seldom found. In years past, U.S. automakers did own much of its supply chain; however, much of this has now been dissolved due to bankruptcy and efforts to reduce manufacturing costs by using overseas suppliers.

Based on the firms interviewed in this research, supply chain position appears to be extremely important. One of the firms within the transportation industry had

numerous upstream subsidiaries, and as a result was able to mandate specific costs for component items. Conversely, there were other firms that had ownership of some suppliers or partner firms; however, they did not require cost disclosure. To successfully do this, a firm will have to determine what portion that the supplier or customer comprises in its business base to determine whether they are a candidate for exchanging cost information.

Additionally firms within both industries expressed that their willingness to exchange cost information with other partners was not based on the trust it has in another partner, but rather the cost disclosure requirements that the supplier or buyer has levied as a condition for doing business with. In one particular firm it was suggested that if the expectation going in to the business arrangement is that cost disclosure will be required then cost information is provided. If the supplier has that expectation up front, then it's the "cost" of doing business. However, if the lead supply chain firm has not required cost disclosure information in the past, then levying the new requirement in future business deals may discourage cooperation from an existing partner. As such, the following propositions are suggested:

Proposition 3: Firms who are vertically integrated with other supply chain members are more likely to engage in supply chain costing.

Proposition 4: Asian firms are more likely to engage in interorganizational supply chain costing efforts than Western firms.

Proposition 5: The willingness to share cost information with a partner firm is based on the expectation of gaining additional revenue rather than trust.

The third and perhaps the most important driver for SC costing is the level of SCM integration exhibited by a firm or network of firms. Quite honestly, much of what academia professes in the textbooks today is not being practiced in the workplace. In all but one case, SCM was limited to the logistics functions found within the firm. The four firms interviewed within the aerospace industry could not demonstrate an integrated SCM philosophy or a shared management approach that spanned the multiple functions within the company. In most cases the costs captured, that could be identified as supply chain related costs were rolled up at the highest levels. For example, the costs were limited to labor and transportation. Additionally, during the course of the interviews it was extremely rare to see evidence of cost visibility outside of more than one functional area. One firm within the transportation industry, a broker, had visibility of all its internal costs and was continuously looking at areas for cost improvement. However, that particular firm reported that it would be almost impossible in today's transportation industry for a supply chain to have complete visibility of all its costs. In effect, it was expressed as a distant dream. Furthermore, the transportation industry manufacturer, who displayed the most highly integrated SCM approach, did have some level of communication among functional divisions within the firm; however, the costs were not broken out to that level of detail.

Along with this finding, was the need for cross-functional approach in collecting and utilizing cost data. Most of the firms interviewed explained that accounting was responsible for capturing cost data, and as such, the data could not be effectively used by SCM personnel for decision making purposes. The reliance on traditional cost

accounting rather than managerial accounting degraded that firm's ability to monitor supply chain costs and to improve performance real-time. The following propositions are suggested:

Proposition 6: SC costing efforts where SCM consists of full channel integration will achieve greater efficiency or effectiveness improvements than dyadic or internal costing efforts.

Proposition 7: Cross-functional management of supply chain costing efforts will be more successful at achieving efficiency or effectiveness improvements than a functionally independent approach.

The fourth driver for SC costing was the cost-to-price implications category.

With this category the dimensions were high correlation between cost and price and moderate correlation between cost and price. In each and every interview, the firm's participants discussed cost and how it affects the price of the end-item or service. Within the transportation industry, several of the firms mentioned landed cost models to determine the total cost of delivering the item or service to the consumer. Within the aerospace industry, there were mentions of total life-cycle costing being used to establish the market price. However, no documentation was provided that could be used to present as a methodology for supply chain costing. One generalization that could be made about both industries was that costs associated with direct labor were most often monitored when estimating price. Within both industries, the research encountered headcount models, moving average costing, and labor hour estimation. Additionally, most cost models were reactionary and collected after the fact. Most were not used to impact supply chain management decisions in a real-time manner.

In summary, the reliance on traditional cost accounting was viewed as a detractor when trying to implement cost collecting activities seeking to identify supply chain cost drivers that managers could use for decision making purposes. Because firms are typically evaluated by senior executives who focus on numbers at the end of the reporting period, it was difficult to identify costs which costs were allocated for day-to-day supply chain activities or functions.

The best example of a more in-depth management accounting estimation system was presented by a firm in the transportation industry. This particular firm had a cost system similar to activity-based costing where time and motion studies were conducted on the factory floor and were used as estimators for future workload. Furthermore, five of the eight firms interviewed expressed a desire to establish a more robust should costing system that would give the firm a higher level of confidence that the price charged to the consumer was sufficient to recap all indirect costs and produce healthy margins. The findings with this driver suggest a call for some form of management accounting that would give cost managers more visibility into the true cost drivers. Whether the management accounting method used is a target costing approach or an activity-based costing approach is irrelevant at this juncture. However, some type of management accounting approach would go a long way in improving the decision making capabilities of a supply chain manager. The following proposition is suggested:

**Proposition 8:** Firms utilizing management accounting methods will be better equipped to identify areas for efficiency or effectiveness improvements than those using traditional cost accounting methods alone.

The fifth cost driver for SC costing involves the firm's ability to capture cost information. The transportation industry displayed a better knowledge of its cost drivers than the aerospace industry. The drivers most often identified were: fuel, labor, and equipment charges. In particular the transportation freight broker and a large trucking firm displayed an excellent grasp of their cost drivers; however, no formalized procedure was presented.

Within the aerospace industry, those companies engaged in government contracts did exhibit a rigorous method for collecting contractually required cost data. However, one of the conditions or concerns with government contracts was that the requirements for cost disclosure do not roll completely down to the subcontractor level. In these agreements, the government has no privity with subcontractors, and as such, seldom audits the costs of subcontractors unless there is a problem identified. In many government contracts costs often exceed budget estimates under a cost-type contract, and the cost escalation is due to a subcontractor's portion of the effort. One of the interviewees from an aerospace manufacturing company stated that obtaining additional cost data from its subcontractors might help to relieve some of the auditing challenges faced by the Defense Contract Audit Agency (DCAA). The DCAA is often charged with validating the costs for a given program, but only has insight to the prime contractor's effort. Hence, the following proposition is suggested:

**Proposition 9:** Full and open supply chain costing for prime and subcontractors in government contracts would help to decrease cost overruns on cost-type contracts.

The final driver for SC costing was the firm's ability to measure the performance of itself and/or its ability to measure the performance of its supply chain partner firms.

The concerns related to this category were that there are too many metrics being tracked in both the aerospace and transportation industries. One of the interviewees in the aerospace industry who had worked on many different programs within the company, stated, that everything was being tracked. In many cases, there was so much information that performance improvement was being hampered by information overload. In one case the firm was tracking over 100 performance metrics. Consequently, this firm had instituted a goal to reduce the number of metrics for each major program to five performance measures. At the time of the interview, the goal had not yet been achieved but the indicators were looking good. Within both industries, the most commonly identified metrics were traced back to the cost, schedule, and performance of intraorganizational business units. In summary, most of the metrics were reactive in nature.

Within the transportation industry, many of the metrics involved cost per truck or cost per vehicle, cost for overtime, and number of hours. Trucking companies within the transportation industry suggested that supply chain costing would be extremely difficult as many partner firms are using performance metrics that are counterproductive. Some transportation partners measure performance based on cost per case, while others measure cost per pound. Additionally, some transportation companies establish their freight rates using less than truckload (LTL) rates, as opposed to the cheaper, full truckload (TL) rate. All of these characteristics have a great impact on how the supply chain costs are analyzed for an individual industry.

One transportation firm reported having over 200 metrics that were being discussed each week at a staff meeting. To overcome this, the manufacturing firm had sought out on-site Six Sigma personnel to assist with the reduction of corporate metrics to 12 performance improvement areas. The process and tracking of the metrics appeared to be a huge success and still capable of reporting feedback on key performance indicators. Few firms had metrics that spanned all business areas, and only two of the firms interviewed tracked metrics for multiple supply chain partners. Both of these firms were within the transportation industry and the metrics were being used as a means to evaluate the performance of transportation costs and the timeliness of delivery for critical shipments. One of the best practices noted was a transportation firm having real-time visibility of shipment data through a transportation management system (TMS) where shipments could be analyzed and consolidated to achieve full truckload shipments with other subsidiaries within the corporate structure. All companies expressed a desire to devise a performance improvement system that spanned multiple supply chain members. Unfortunately, most of what was detected was limited to a single firm. As a result, the following proposition is suggested:

Proposition 10: Performance metrics spanning the entire supply chain generate greater efficiencies or improvements than the individual metrics of supply chain partners.

The barriers to supply chain costing included four categories that were repeatedly identified throughout the series of interviews. These categories included: functional alignment and organization, the risk of disclosing cost data information, the difficulty in shifting the benefits and burdens across the supply chain, and the inability of current IT

systems to communicate and capture cost data of the single firm as well as the costs of multiple firms. The comparison within industry and across industries is discussed below.

In many cases, the companies were not aligned to support SCM. All but one of the companies were structurally organized by functional areas and were still operating in a stove-piped fashion. As suggested previously, an integrated SCM philosophy has not been fully embraced by practitioners. Within the transportation industry, those interviewed stated that their firms' were attempting to manage by supply chain, but were not yet doing so. Overall, the transportation industry viewed the supply chain as a collection of functional divisions that were already in place. In large part, most transportation firms had structural and organizational functions aligned by operations, marketing, logistics, procurement, and inventory personnel. In most cases, these personnel were used to carry out specific roles for the supply chain and were being managed in a functional manner rather than an integrated supply chain management approach. Most frequently, the procurement division was responsible for coordinating the efforts of external supply chain partners with the end objective of acquiring and obtaining components and services at reduced prices.

Through the course of the interviews that were conducted with the four transportation firms, it was discovered that only interviewee and their firm had made a concerted effort to push or stress the importance of cross-functional management across the supply chain. Particularly, the company was engaging the accounting and finance function to break out costs so that managers could use them. Hence, the firm was applying a managerial accounting approach rather than a traditional cost accounting

approach. The same firm had also loaned engineering support to a downstream partner to help it reduce its packaging and handling costs, as well as its transportation costs. The arrangement was working quite well; however, the cross-functional arrangement was in the infancy stages, and thus, still being evaluated to determine the true savings.

Within the aerospace industry, there was one firm aligned to support cross-functional support of the supply chain. The particular firm competes as a 3PL provider and a distributor for numerous aircraft parts in both the commercial and military sector. The firm had recently established a supply chain division responsible for conducting analysis for the operations and logistics sectors within the firm. The SCM director was a former procurement director and was hired to build momentum for change management. The firm expressed a focused intent to align its divisions by supply chain as opposed to function within the next two years.

Overall, both industries were familiar with the supply chain management concept and its definition; however, the integration of multiple firms, multiple functions, and supply chain cost collection had not yet fully occurred. This finding and its associative proposition was also suggested earlier in Proposition 7.

The next barrier for SC costing involved the risk of disclosure for cost information. Many companies still fear that disclosing cost information to external partner firms may result in a reduction of their profit margins. Within the transportation industry, there was a greater fear that information could be used against them later during future negotiations. Two of the transportation firms believed that because of the competitive level of the industry, that exchanging cost information could be a tremendous

risk. Many of the interviewees expressed that the accounting and finance staff would attempt to roadblock the exchange of cost information. Several concerns regarding the requirements of Sarbanes-Oxley and maintaining an arm's length between transactions was suggested during the interviews.

Another aspect of the risk concern was embedded in the contract type utilized between the two partners. Firms expressed that when using a fixed-priced type contract, there was a pre-existing confidence for ensuring a lower price if competition for the supplies or services could be obtained during the request for proposal stage. Conversely, companies that were operating in cost-plus type contract arrangements explained that supply chain costing could further assist as a means to monitor the cost performance of its upstream and downstream partners. One particular aerospace firm reported hiring external subcontractors and/or consultants to manage its external suppliers at their on-site location by analyzing and reporting back the cost, schedule, and performance indicators. Additionally, these reports were comprised of data that was kept in strict confidence between the prime and subcontractor. For the purposes of this study, access could not be obtained to discuss this scenario with the subcontractor or the supplier; however, this presents itself as a technique that could be used to avert fear of disclosure.

Finally, the concern of reduced margins was discussed by both transportation and aerospace firms. Two of the medium sized firms that were not the lead supply chain firm felt that the larger supply chain member might use cost data as leverage for reducing the margins of its suppliers and/or buyers by assuming only the most profitable functions, and outsourcing the more costly and less desirable supply chain functions. Additionally,

many of the firms suggested that exposing cost data could compromise a competitive advantage and be compromising during negotiations. As such, the following proposition is suggested:

Proposition 11: A partner's fear of the SC lead using SC costing as a means to reduce profit margins represents the most significant barrier to implementing supply chain costing.

### Techniques for Overcoming SC Costing Barriers

As discussed previously during axial coding of the data, interorganizational costing (IC) is impacted by considerations pertaining to the shifting of the benefits and the burden of the supply chain. This concern acts as a barrier, or probably more suitably described as a challenge for supply chain costing proponents. During interviews with the aerospace and transportation industries, it became apparent that supply chain members need to identify who owns what (i.e., who is invested) and who controls the various key processes in the supply chain. Important consideration and management attention is required in order to consider alternatives associated with the dispersion of burdens and benefits within the supply chain.

Suppliers must be in agreement that to lower the total costs of the supply chain that roles and functions may need to be shifted in order to lower the overall price or improve the quality of the item for the end consumer. Additionally, the larger supply chain firm, or supply chain lead, may have to make significant capital investments in a smaller supplier to ensure that the supplier can deliver a required product or service. This was encountered quite frequently by transportation manufacturers. One particular 3PL

within the transportation industry suggested that while they see the hard savings they are creating for the manufacturer by taking over their inventory and distribution functions, none of these savings are being handed back to the 3PL firm. As a result, there is difficulty in figuring out how to disburse real cost savings back to partner firms, if and when efficiencies are realized. Determining, the value that each partner contributed towards achieving the savings, will help to ensure that savings are distributed in a fair and equitable manner, and thus prevent the need to resolve disputes via further mediation.

Both industries suggested that the only way to get around this challenge was to establish metrics that reward lower cost performance or increased quality output. Interviewees from aerospace firms suggested that contract mechanisms could outline the incentives to be disbursed if improvements are achieved. One particular transportation firm suggested that without a true win-win approach, that supply chain costing would die a short death.

Attempting to achieve cost reductions or achieve higher performance (i.e., improved quality) hinges on the notion that partner firms are willing to accept alternative roles along the chain in order to achieve efficiencies of effectiveness improvements. The role of upstream and downstream suppliers may be on-site support in the form of manpower at a partner firm's manufacturing plants (i.e., aerospace) or terminals (i.e., trucking companies). One example included placing an engineering representative from a transportation manufacturing firm on a supplier's production line. This helped to lower design costs and the cost for rework that was often identified during quality inspections. As such, the following proposition is suggested:

Proposition 12: Contractual agreements between partner firms represent the best means to obtain full and open cost disclosure required for cost or quality improvements.

An additional barrier to supply chain costing was identified by firms in discussing the limitations of their current IT systems. The interviews suggest that many of the data and ERP systems were not designed to capture cost information, nor were they designed to exchange information with other partner firms. A particular manufacturing firm in the aerospace industry suggested that they would like to have visibility of the operational data of each and every partner in the supply chain. Essentially, this would give all supply chain members a more accurate depiction of demand data. This would assist in improving forecasts and act as an aid for lowering overall costs. Additionally, the same firm complained that they lack the ability to track and monitor total freight and transportation costs throughout the supply chain when evaluating new suppliers. One of the procurement executives from an aerospace firm presented an example of parts being bought with little or no analysis done. The part was slightly more expensive from a local supplier, but when transportation costs were factored in the local supplier was cheaper. A transportation firm also presented a case where a supplier was charging a lower price for a component part sourced from China, yet the manufacturer was paying a higher total cost due to the additional shipping charges.

Currently, very few IT systems are capable of communicating supply chain information across the firm. The best example of an IT system was found at one of the aerospace firms. This firm was using a modified ERP system to capture direct cost information via card swiping by technicians on the production floor. While this system

was ideal for production operations, it was not capable of collecting other supply chain costs being consumed by the firm. Within and across both industries, there was no trend to indicate that firms with more extensive IT systems were more successful in collecting cost data with and outside of the firm. As such, the following proposition is suggested:

Proposition 13: Firms with extensive information technology system are no more inclined to engage in supply chain costing efforts than those without.

### SC Costing's Impact on Strategic Decision Making

The final propositions suggested in this research involve strategic decision making at the executive level of the lead supply chain firm. Three of the firm's interviews included the CEO or a senior level executive. The other five firm's interviewed included vice-president or division managers involved in strategic decision making. In summary, only two of the executives at the eight firms were familiar with the supply chain costing concept. The two particular executives explained that a supply chain costing effort across multiple firms would require significant resources and a large financial investment. Many seemed to fear the full bore implementation of an activity-based costing scenario due to the time and effort required to identify all of the cost drivers. In large part, the frustration of executives hinged on the preconceived level of detail often required by management accounting techniques. Additionally, a few of the executives stated concern over the willingness of other partners to share cost information with their firm. These concerns echoed the barriers that were discussed previously.

At each of the firms interviewed, the findings suggest a strict reliance on traditional cost accounting where cost information is centered on production and

operations. In the two industries participating in the study, it was most common for senior leadership to be apprised of budgeting information based on cost projections tied to production or operations, transportation, inventory, and procurement costs at the beginning of the accounting period (e.g., quarterly). Unfortunately, supply chain decisions can't always wait the end of the reporting period where decisions or efforts to investigate cost overruns have already occurred. Here lies the fundamental difference between management accounting and traditional cost accounting. Management accounting is used for decision making purposes at both the highest and lowest levels of management.

In most cases a fully integrated supply chain management philosophy was not being practiced. While many of the firms espoused an integrated approach, most were still functionally aligned with traditional cost pools (e.g., labor, direct/indirect, overhead, etc.). As a result, costs were seldom used by supply chain managers for decision making purposes. Near the end of the interviews, and once the concept of supply chain costing had been explained to the executives, all recognized a potential return on a supply chain costing effort.

Within both industries executives recognized supply chain costing as an almost revolutionary concept that might result in their firm being more competitive in the marketplace. Based on the findings, it is with little doubt, that the go or no-go decision lies in the hands of senior leadership. Getting their sponsorship, support, and buy-in initially will greatly impact the decision on whether to embark on such an effort. The best practice in this area was exhibited by an aerospace manufacturer who had reassigned

an accounting executive and placed them in charge of supply chain operations. This allowed for a pseudo integration traditional cost accounting and management accounting. Cooper and Kaplan (1988, 1998) and Lippa (1990) suggest that management accounting and traditional cost accounting should be used in conjunction to populate financial reports. If cost information is not shared internally, the ability to capture external cost data will remain a distant reality.

All in all, the senior leader must decide on whether to invest and/or implement supply chain costing methods across the firm. In large part, it is a decision on whether to implement a management accounting method to supplement the traditional cost accounting being performed by firms in both the transportation and aerospace industry. While, the executives understood the need for accounting experts that could assist managers with day-to-day decision making, most were cognizant of the importance of the bottom line, and what the shareholders or board members would evaluate firm performance on.

Because extensive supply chain costing across integrated firms was not found in this research, it could be assumed that leadership views supply chain costing as too large of an investment. However, based on scenarios given to the executives regarding cost information that supply chain managers could obtain and use, leadership welcomed the concept and discussed numerous alternatives for using such information for very critical decisions. The types of strategic decisions identified where supply chain costing would have significant impact included, but was not limited to: overall strategy (i.e., low-cost or differentiation), critical outsourcing decisions, inventory and warehousing decisions,

transportation and packing decisions, and process reengineering decisions. The findings pertinent to the strategic decision making impact led to the following propositions.

Proposition 14: The senior executives of a firm will express greater confidence in the decisions supported by interorganizational cost collection and sharing than decisions based on intraorganizational cost information.

Proposition 15: Supply chain costing will impact decisions related to the overall strategy of a firm, key sourcing decisions, logistics decisions, and the shifting of resources across the supply chain.

Proposition 16: Supply chain costing used in conjunction with traditional cost accounting will improve a firm's performance in the marketplace.

The 16 aforementioned propositions listed in this chapter represent the emergent theoretical propositions based on the findings of this research. In line with the methodology suggested by the case study and grounded theory methods, the researcher identified initial propositions based on the pre-existing literature. The guiding propositions were then later modified according to the findings of the qualitative research effort. The following section addresses how each of the seven guiding propositions was either extended or removed due to the findings of the research, or modified to reflect the findings. Each of the 7 guiding propositions is discussed separately in the following paragraphs.

#### Addressing the 7 Guiding Propositions

1. Supply chain costing involves the activities and functions directly related to product or service information flows across multiple firms (i.e., the entire supply chain) (see Seuring and Goldbach 2002, Cooper/Slagmulder 1999).

Effectively, this proposition was modified to formulate a definition for supply chain costing. Because the proposition would be difficult to operationalize for future

hypothesis testing and research, it was removed as a proposition. However, a few of the propositions (e.g., P7 and P10) include critical components of the supply chain costing concept. The critical components of management accounting and a fully integrated approach were added to the definition of supply chain costing. In addition, the definition for supply chain costing was modified to include the cost collecting methods (i.e., management accounting), which seek to identify cost drivers across the supply chain. The definition of supply chain costing is hereby suggested as, a management accounting technique used to identify cost information pertinent to the internal and external supply chain cost drivers of integrated firms carrying out the supply chain activities and functions associated with product and/or service flows. Furthermore, supply chain costing can be used by supply chain managers for both tactical and strategic decision making.

2. The level of collaboration between firms is positively related to the amount of supply chain costing data that is collected by supply chain partners (Combs and Ketchen 1999; Handfield and Nichols 1999; Paris and Brassard 2004).

This initial proposition was modified based on a lack of support from the firms interviewed in the transportation and aerospace industries. Previous literature had suggested that trust and collaboration would facilitate supply chain costing and the requirement for the disclosure and exchange of relevant supply chain cost data between partner firms. However, in the course of the research, several of the firms interviewed stated that an expectation clearly stated from the outset of the supply chain effort would be more effective in obtaining buy-in from partner firms when dealing with disclosure of

cost information. This was further explained in the analysis which led to the formulation of P5. In fact, it was expressed that if this were not a requirement in the past, that there would be an enormous change management shock if the lead supply chain firm levied this requirement on suppliers or service providers, enough so, that the business relationship might be jeopardized. As such, trust was not further analyzed.

3. Firms engaged in a management accounting technique such as activity-based costing, target costing, direct product profitability, or Total Cost of Ownership accounting will demonstrate a greater propensity to engage their suppliers in their costing efforts and derive mutual benefit (Berry et al. 1997; Dekker and Van Goor 2000).

This proposition was modified and addressed in P8. In terms of the conceptual model this category was coded under management accounting and represents a technique that can be used to overcome barriers to supply chain costing implementation. While the firms interviewed in this study were not applying management accounting in its truest sense, there were several best practices identified where firms were using total landed cost models or cost estimations based on time and motion studies. These costs could then be used effectively by the managers to further assist sales and marketing personnel when pricing an item or service. However, when discussing cost and cost allocation with supply chain managers it was difficult to identify cross-functional communication between supply chain managers and accounting personnel. The supply chain managers explained that the typical cost accountants employed by the firm were not collecting costs based on supply chain costs, but rather roll-ups of labor, direct material, and overhead by function rather than the true cost of the activity. The risk of using this approach when

managing the supply chain may result in some items or services being inaccurately priced. Much like the theory behind activity-based costing, each supply chain must be assessed to determine which costs should be allocated and to whom. When allocating cost at the aggregate level it is possible that one product or service line may be unfairly levied costs that are not tied to its particular supply chain activity, thus making it difficult for a given supply chain to compete with similar offerings in the marketplace.

4. Senior executives from the lead supply chain firm will be the most likely candidates to initiate a costing initiative (Lambert et. al 1998).

This proposition was not coded as a major category in the model. While there was a category established for strategic decision making, the interviews and documentation did not suggest that senior leadership was more likely to initiate supply chain costing. The reason for this is largely because of the non-existence of supply chain costing methodologies across the 8 firms interviewed. As a result, it was difficult to determine who would lead such an initiative. Conversely, without senior leadership support and a strong push for supply chain costing it is unlikely that it will gain momentum as a means for decision making in these two industries as potentially others. More information regarding this initial proposition is addressed in the following paragraph which identifies the strategic decisions supported or affected by supply chain costing.

5. Supply chain costing will be used to support a wide variety of strategic decisions throughout the supply chain (Lambert and Pohlen 1996).

One of the motivations for supply chain costing is to assist in identifying efficiencies prior to or during supply chain operations. This initial proposition and initial proposition 6 were combined and are represented in the model by the construct for strategic decision making. Initial propositions five and six were also addressed previously by Proposition 15 which depicts the decision outcomes affected by increased information made possible by supply chain costing. Finally, while there was little evidence to suggest that supply chain costing exists as a mature phenomenon, the interviews did identify decisions and decision making capabilities that would be enhanced with a working methodology for supply chain costing. Unfortunately, with the exception of limited target costing being applied at a manufacturer in the trucking industry, firms were unable to identify instances internally or externally where the supply chain had been fully costed in an end-to-end manner.

Most firms indicated that they rely most often on traditional cost accounting as well as cost, schedule, and performance metrics for evaluating business performance. While the impact of supply chain costing on strategic decisions was recognized, it can't be stated that supply chain costing is impacting strategic decisions for firms at this time. This was somewhat surprising in the aerospace industry, where great emphasis is being placed on aircraft sustainment due to longer aircraft lifecycles and efforts to lower capital investment costs. Moreover, supply chain costing represents great potential in identifying cost reductions for sustainment parts and/or logistics support as well as a

mechanism for improving aircraft availability by achieving reliability and maintainability enhancements.

6. Strategic decision making is impacted by supply chain costs and firm characteristics (Mintzberg 1973).

This initial proposition was extended by propositions 14 and 15 and addressed in the conceptual model by the strategic decision making capability (i.e., the outcome construct) and as a driver to supply chain costing. As stated before, a firm that is in a price competitive market is more likely to engage in supply chain costing. If the firm uses a strategy of differentiation, the firm may elect to use supply chain costing. However, the findings in this study suggest these firms are less likely to so.

7. Activity based costing or an alternative management costing technique should be used in conjunction with traditional cost accounting to formulate financial reports (Cooper and Kaplan 1988 (a), 1988(b), 1998; Lippa 1990).

This initial proposition was captured by propositions 1, 2, 8, and 16. Both management accounting and traditional cost accounting appear on the conceptual model. While a reliance on traditional cost accounting alone is featured as a barrier, management accounting is both a driver and a technique to overcome barriers. This study does not propose that either should be ignored. Traditional financial accounting is still required for financial reporting. However, financial reporting that includes information based on supply chain activities and functions would give shareholders and directors the pertinent information to properly assess a firm's financial viability.

## Summary

The findings and analysis presented in this chapter were based on the interviews and the data submitted by the 8 firms from the transportation and aerospace industries. A model which depicts the antecedents and barriers to supply chain costing, as well as supply chain costing's impact to strategic decision making has been defined. The findings that helped to establish the resulting propositions highlight the impacts of a given firm's marketplace competition, supply chain position, cost to price implications, performance measurement (i.e., metrics), a firm's accounting practices, integrated SCM approach, and current IT systems on the firm's ability to improve its strategic decision making capability. The next chapter discusses the results and conclusions based on these findings and closes with a discussion of the limitations of the research and suggestions for future research.

## CHAPTER 5

### RESULTS AND CONCLUSIONS

#### Overview

This chapter summarizes the theoretical contributions of the research and presents conclusions that can be drawn based on the findings from the interviews and data collected from the case studies of the eight firms sampled from the transportation and aerospace industries. The chapter is structured based on the research objectives that were suggested previously and the investigative questions which helped to further explain the phenomena of supply chain costing and its impact on strategic decision making. Due to the use of the qualitative method, a section has been included to address the inherent biases of the research and the limitations associated with the scope of the effort.

The section is structured in an outline form where the research and investigative questions are identified and addressed using the findings from the data collection effort. The findings pertaining to each question are followed by the conclusions and generalizations that stem from the research. It is important to note, and as is common in the application of the qualitative research method, some of the research or investigative questions were answered through an analysis of the extant literature. The remaining questions were addressed via the use of a hybrid approach which merged the case study method with the grounded theory method.

## Research Summary

This chapter addresses the research objectives and identifies a theoretical model proposed as a prescriptive model for further exploration and understanding of the supply chain costing phenomena. While the current state and use of supply chain costing as a managerial accounting tool to augment or drive strategic decisions is still in the developmental phase, the conclusions from this study suggest that many firms have adopted the concepts and ideas of supply chain costing as they strive to achieve a competitive advantage in the marketplace.

## The Research Questions

1. How Do Managers Cost Out Supply Chain Processes?

### *Findings*

This research question was addressed by analyzing the transcribed interviews and coded data as well as analysis of the accounting methods that the eight firms used to collect supply chain costs. Several of the firms mentioned the use of landed cost models, most probable cost models, and target costing models. The theory and application of target costing was briefly discussed in the literature review found in Chapter Two. The case studies suggest that only two of the firms, and their respective supply chain managers out of the eight participating firms (one in the transportation industry--a manufacturer; and one in the aerospace industry--a manufacturer), were able to demonstrate a cost collection methodology used to accurately compute supply chain

costs. Of the firms interviewed in the aerospace industry, cost collection was limited to the internal firm alone, and not other supply chain partners. However, in this instance, costing approaches were obtained from upstream and downstream trading partners. In summary, the research found that firms were able to provide limited evidence of an integrated approach to SCM or supply chain costing. The case study firm labeled as a best practice had just recently restructured the organization by supply chains, and were still evaluating the overall effectiveness of the integrated SCM approach. Overall, evidence of interorganizational cost sharing across partner firms was limited to one firm. However, there is movement in this direction and the feedback from senior leadership was that they perceive value in adopting this practice.

One manufacturing firm within the transportation industry had established a formalized methodology for suppliers and partner firms to submit cost data and suggestions for cost or process improvements. An executive in this firm stressed the importance of defining an expectation up-front to a potential partner when requiring cost information disclosure, as it was a requirement when doing business with them. The identified process for managing supply chain costs was not being used in each and every supplier relationship, but was available for suppliers looking to find ways to reduce overall supply chain cost. This supplier relationship management practice was identified as the best practice for capturing supply chain costs in this study. Essentially, the methodology was presented to suppliers and labeled as a cost management program. The program allows suppliers to submit cost reduction proposals which can be evaluated by the supply chain manager. The typical proposal consists of cost reduction suggestions

directed at: process improvement, methods to reduce warranty costs, alternative materials, alternative product design, weight and transportation savings, cost savings realized through supplier on-site engineering assistance, supplier furnished tools, assembly time reduction, packaging and handling savings, and potential part consolidations. A model for managing suppliers in this method could be easily establishing by any firm and would allow for partner firms to share in the gains realized by cost reduction.

The process used by this particular firm was reactive in nature and most often used to manage current suppliers. It is feasible however, that this supply chain costing methodology could be used to break out the costs of future or current partnerships. At the other seven firms, the interviews suggest that the process for collecting supply chain costs consists of a roll-up at the each functional level within a single firm only. Additionally, the cost components of each firm are seldom disclosed, thus limiting the ability to shift resources and functions across the supply chain. Examples of the cost components collected within a firm typically consisted of labor costs, inventory and warehousing costs, procurement costs, and overall freight/transportation costs. Moreover, in both industries the remaining seven firms were capturing cost information from production and operations headcount models where costs were arrived at using a functional approach to cost collection. A recurring finding was the absence of the SCM approach, which is often featured in the textbooks which are used to educate future supply chain managers.

### *Conclusions*

During the course of the interviews, several of the interviewees suggested that it is extremely difficult to obtain visibility of the costs across an entire supply chain. Many explained an unwillingness to implement an approach that would require extensive resources to achieve the level of detail required for ABC. It was apparent though, that executives from both industries understood the potential benefits which could be realized by using an ABC type approach or a similar management accounting method (e.g., target costing); however, most firms were reluctant to make such an investment. Furthermore, many of the interviewees suggested that they understood their supply chain costs and how they impacted margins at the end of the reporting period, but that there was no formalized procedure for doing so. In several firms it was commonplace for the logistics department to aggregate warehousing and transportation costs and for the procurement department to roll-up their costs for everything purchased that quarter. At the end of the quarter the firm would report a lump sum for supply chain costs.

The barriers to implementation for most firms involved an unwillingness to exchange cost information with other suppliers as well as a strict reliance on traditional cost accounting methods which don't capture supply chain costs. With the exception of the best practice identified by the transportation manufacturer, it was difficult to establish a supply chain costing methodology capable of generating efficiency or effectiveness improvements in an end-to-end manner across the supply chain. The findings suggest that organizational management is conducted in a functional manner and often features an aversion to management accounting. Some conclusions that could be from this might be

too large of an initial investment or the sheer difficulty of mapping out a supply chain for costing purposes.

The conceptual model presented earlier and the resulting propositions were partially supported by prior literature and the use of a normative (i.e., how it should be) approach throughout the case studies and grounded theory application rather than the positive (i.e., how it is) approach for data collection.

A well-established procedure or methodology for collecting supply chain cost information was encountered at one firm. This practice however, was not an integrated process for managing suppliers but rather a method used to achieve cost reductions. This method could be expanded to allow for supply chain management costing by implementing a cross-functional and interorganizational SCM approach where all partner firms would require supply chain participants to identify and evaluate proposed and alternative costs associated with the following cost drivers: 1) process improvement, 2) materials, 3) design, 4) weight and transportation, 5) engineering support, 6) supplier furnished tools or equipment, 7) assembly time, 8) packaging and handling, 9) inventory and warehousing, and 10) overhead. Each of these analysts would be responsible for identifying and collecting the costs consumed by each partner firm across the supply chain. Subsequently, they would make recommendations to the lead SC firm thus allowing decision makers to identify the ideal suppliers and or service providers to perform each of the various tasks or functions. In this manner the costs of a supply chain could be efficiently managed.

## 2) How is the Information Used for Strategic Decision Making?

### *Findings*

All of the interviews featured a CEO, top-level executive, or a vice-president or comparable involved in strategic decision making at the firm. Of the executives only two were familiar with the supply chain costing concept. After the concept was explained, several of the interviewees disclosed an almost complete reliance on traditional cost accounting for strategic decision making. As a result, the interviewees were asked about management accounting and if they used any other type of accounting for decision making purposes.

Within and across both industries, the findings indicate a reliance on traditional cost accounting where cost information is centered on production and operations. In most cases, these functions most often drive decision making. If the costs at the end of the quarter are close to what was estimated during the budgeting process, then the status quo is maintained. Consequently, costs were seldom used by supply chain managers and/or executives for decision making purposes. Near the end of the interviews, and once the concept of supply chain costing had been explained, each interviewee was able to identify the added value of the information that could allow for improved decision making capability.

First, and foremost, the firms which were currently applying the differentiation strategy rather than a low-cost strategy, recognized that supply chain costing efforts, could allow them to compete on cost as well as the dimensions of quality or delivery. Other decisions that could be improved by supply chain costing models included: critical

outsourcing decisions, inventory and warehousing decisions, transportation and packing decisions, and process reengineering decisions.

### *Conclusions*

The current impetus for strategic decision making for firms in the transportation and aerospace industries is based on production and operations implications and the return on investment that shareholders and board members expect from the firm. Supply chain costing as it stands today in the aerospace and transportation industries does not directly impact strategic decisions in the manner that direct labor hours and traditional cost accounting measures do. However, the ability to capture the cost drivers that comprise an interorganizational SCM approach would assist in identifying potential efficiencies and improvements in the areas of procurement, transportation, warehousing and inventory, marketing, business development, and overhead costs. A more discrete identification of the drivers for each of these allocations would allow management to more clearly identify which product or service lines are more profitable and more lucrative than others.

- 3) What Costing Techniques Provide the Greatest Insight into the Factors Driving Supply Chain Costs and Best Support Decision-Making?

### *Findings*

As stated previously, the reliance on traditional cost accounting was seen as a barrier when attempting to identify supply chain costs. Traditional cost accounting is directed at capturing production and operations costs in the case study firms. Based on

the interviews, the two companies that had applied a management accounting approach had a better understanding of their supply chain costs and how those costs impacted decision making within the firm. A best practice associated with this research question was found in a manufacturer within the aerospace industry. This firm had established a supply chain accountant position. This individual had spent many years in the accounting department and recently transitioned to the role of a supply chain accountant. This designation presented significant potential for linking management accounting and traditional cost accounting. Additionally, at three of the other firms interviewed, managers expressed that operational accounting experience was a valuable, but rare asset.

Other findings that arose throughout the interviews dealt with the level of vertical integration that a lead firm had with the rest of the supply chain. In situations where the firm was dealing with other corporate entities or other business units, the ability to capture pertinent cost data which could be used for decision making acted as an enabler when identifying which business units would perform which supply chain functions based on who could provide the item or service at the lowest cost.

### *Conclusions*

With the exception of the one cost management program presented within the transportation industry, no one technique existed which provided the greatest insight into supply chain cost drivers. However, the role or potential role that a supply chain or operational accountant could play in synthesizing the traditional cost accounting role as

well as the management accounting role was brought to bear. The need for both accounting systems was established during the analysis of the transcribed interviews. The findings of this study do not suggest an ideal supply chain costing approach for either industry. However, the use of management accounting type models for identifying cost drivers represents a step in the right direction.

Information from recent literature suggests that a firm would benefit from the implementation of a target costing system where the target price is identified at the outset, and then the costs are minimized so that the ideal margin is realized. One particular firm within the transportation industry identified some applications of target costing when attempting to provide a product or service based on what the consumer was willing to pay for it. The research did not identify new management accounting techniques that would surpass the objectives of Cooper and Kaplan's (1988) article on ABC which assists managers in making better decisions about product design, pricing, marketing, and encourages continual operating improvements. However, movement towards supply chain costing was detected during the research. Executives appear to be embracing some of the theory suggested by Eisenhardt (1989), which explained that the ability to make faster decision at the strategic-level is enhanced when more information is shared within and outside of the organization. The participants in this research were beginning to see the value in supply chain costing. Most understood what the barriers to implementation were and were beginning to bridge the arm's length approach to managing key partners and suppliers as limited efforts were underway to collect upstream cost information.

The following section identifies the investigative questions that were used to further understand the phenomena of supply chain costing and its relationship with strategic decision making. Additionally, these questions were used to motivate questions that sought to draw out information from the participants with regard to the barriers to implementation as well as the techniques used to overcome the barriers. This section follows a similar format as that of the research question section previously (i.e., findings and conclusions).

#### Addressing the Investigative Questions

The following section lists the findings and conclusions associated with each investigative question.

- 1) How Can the Financial Rewards Associated with Supply Chain Costing Efforts be Distributed Equitably (Not Necessarily Equally) with Supply Chain Partners?

This investigative question supports research question 2.

#### *Findings*

Executives participating in this study found the question very difficult to answer. In fact, the distribution of financial rewards became one of the barriers to implementing supply chain costing as firms might fear that the larger firm would keep any and all efficiencies realized. Several of the firms suggested, that the lead firm would seldom share cost savings with partners that had assisted in reducing costs or achieving an increased margin in the past. However, one particular firm within the transportation industry was using the transportation function of the supply chain as a means to provide

incentive for an external freight provider. This observation indicates that firms are recognizing the perceived value of supply chain costing. In this case, the downstream transportation firm had agreed to pay a partner carrier less-than-truckload (LTL) rates for various trucking routes featured in their contract. The partner carrier could then identify if possible, a means to consolidate truckloads allowing it to pay truckload (TL) rates. If achieved, the partner carrier would lower its freight costs. When doing so the external carrier would increase its profit margin and the receiver would reduce its costs because the number of deliveries and the handling associated with multiple deliveries was reduced.

In another instance within the transportation industry, a firm placed engineering support personnel on-site at a supplier's production facility. This practice helped to lower design costs and the cost for rework often incurred.

One potential method for re-distributing profits was uncovered in the case study where an aerospace government contract was under discussion. This same approach could be used for supply chain costing in commercial industries as well. With this method, the lead supply chain firm and a supplier agree to a fixed priced incentive contract (FPI) where the contract provides for an adjustment to profits based on a formula comparing the final negotiated cost to total target cost. FPI firm target contracts are used when the partners can negotiate a firm target cost, a target profit, a profit adjustment formula, and a ceiling price at the outset (Federal Acquisition Regulation 16.403-1(a)) where the supplier or service provider is allowed a fair and reasonable incentive where both parties assume an appropriate share of the risk.

The key elements of the FPI contract are:

Target Cost = Projected Cost

Target Profit = Estimated profit for Target Cost

Target Price = Target Cost + Target Profit

Price Ceiling = Maximum Price where the supplier or service provider would assume all costs thereafter (equals the pessimistic total price)

#### Profit Adjustment Formulas

The following formulas can be used to compute a redistribution of the benefits (e.g., underrun) or burdens (e.g., overrun) for individual supply chain partners. The variables listed below are used when calculating under or over target share ratios.

$S_{CU}$  = Supplier or Service provider's share of cost underrun

$S_{CO}$  = Contractor percentage share of cost overrun

$S_{LU}$  = Lead Supply Chain firm's share of cost underrun

$S_{LO}$  = Lead Supply Chain firm's share of cost overrun

$P_T$  = Target Profit

$P_O$  = Profit at optimistic cost

$P_P$  = Profit at pessimistic cost

$C_T$  = Target Cost

$C_O$  = Optimistic cost estimate

$C_P$  = Pessimistic cost estimate

Underrun share for supplier

$$S_{CU} = \frac{P_T - P_O}{C_T - C_O} \times (-100)$$

Overrun share for supplier

$$S_{CO} = \frac{P_T - P_P}{C_T - C_P} \times (-100)$$

Underrun share for lead supply chain firm

$$S_{LU} = 100\% - S_{CU}$$

Overrun share for lead supply chain firm

$$S_{LO} = 100\% - S_{CU}$$

An underrun example is presented in Table 5.1.

Table 5.1

PRE-NEGOTIATION TARGETS FOR CONTRACT INCENTIVES

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FPIF CONTRACT PRENEGOTIATION ESTIMATES			
Element	Optimistic	Most Likely (Target)	Pessimistic
Direct Material Cost	\$250,000	\$300,000	\$350,000
Direct Labor Cost	\$320,000	\$400,000	\$500,000
Indirect Cost	\$230,000	\$300,000	\$450,000
Total Cost	\$800,000	\$1,000,000	\$1,300,000
Profit	\$150,000	\$100,000	\$25,000
Total Price	\$950,000	\$1,100,000	\$1,325,000

Supplier's share of additional profit:

$$\begin{aligned} S_{CU} &= \frac{P_T - P_O}{C_T - C_O} \times (-100) \\ &= \frac{\$100,000 - \$150,000}{\$1,000,000 - \$800,000} \times (-100) \\ &= \frac{-\$50,000}{\$200,000} \times (-100) \\ &= 25\% \end{aligned}$$

Lead supply chain firm's share of additional profit

$$\begin{aligned} S_{LU} &= 100\% - S_{CU} \\ &= 100\% - 25\% \\ &= 75\% \end{aligned}$$

With this example, both parties have a vested interest to achieve efficiencies.

More importantly, the parties have a method for distributing the benefits and the burdens based on the performance of a given supplier. This method could be used for each supplier or service provider across the supply chain.

### *Conclusion*

The consideration and difficulty of shifting the benefits and burdens of the supply chain based on integrated cost information can act a barrier in the implementation of supply chain costing. One of the considerations is that benefits are not always monetary and that often it is the optimal utilization of core competencies of particular partners.

First, it is necessary that key supply chain members pre-determine who owns what and

who has a vested interest in what processes. Suppliers must be in agreement up-front on the objectives of lowering of supply chain costs, which may require the shifting of various functions and tasks. As determined in the study, the lead supply chain firm (often the largest firm in the supply chain), found it less expensive in the long run to make capital improvements or investments in a key supplier to effectively lower the overall price of the final product or service. On several occasions, executives in aerospace firms suggested that contractual mechanisms would be necessary to outline the incentives and disbursements if future efficiencies are realized. In summary, there is movement in the direction towards implementing supply chain costing. However, it is important that techniques such as this be applied in order to allow for a fair and equitable allocation of the burdens and benefits when successes or setbacks occur.

## 2) What Does a Taxonomy of Existing Costing Techniques Look Like?

This investigative question supports research questions 1 and 3.

### *Findings*

This investigative question was answered via the literature review and the research matrix featured in table 1. The taxonomy includes methods such as ABC, strategic cost analysis, total cost of ownership, VCA (value chain analysis), DPP (direct-product profitability), cost-to-serve method, kaizen costing, and target costing. Each can provide great benefit in assisting in strategic decision making for the firm. To generalize, most methods (with the exception of the cost-to-serve method which focuses on the

downstream customer) can be directed towards upstream suppliers to assist with identifying efficiency or effectiveness gains in the supply chain. Throughout the research, there were two examples of target costing and several examples of using a total cost of ownership approach. Additionally, there were several mentions of landed cost models. Landed cost models deal primarily with the purchasing aspect of the supply chain, and were used to determine which suppliers were the least expensive based on final destination shipping and handling costs. The landed cost models were not formalized and documentation was not provided by the interviewees.

### *Conclusions*

The taxonomy of supply chain costing methodologies stems largely from management accounting techniques which are meant to supplement traditional cost accounting so that decision making capabilities is enhanced. Ferrera (1995) suggests that firm strategies come from the combination of multiple accounting methods. One method should not be used alone. This suggests that supply chain costing is an overall concept with many tools within it to attack specific problems or decisions. One particular manufacturing firm in the transportation industry espoused this principle and identified numerous techniques for identifying pertinent cost information across the supply chain.

### 3) What Type(s) of Supply Chain Costing Information is being Collected by Firms?

This investigative question supports research question 1.

#### *Findings*

Throughout the interviews, multiple supply chain cost categories were collected. The most common cost categories consisted of direct labor, indirect labor, packaging and handling, reverse logistics, warehousing, inventory, transportation and fuel, networking costs, materials, utilities, facilities, travel, marketing, and invoice processing costs. Procurement costs were often allocated as an indirect cost or an overhead expense at most locations. Two particular aerospace firms did allocate the purchasing costs on a direct basis; however, the cost was spread evenly across all product lines. Each of these categories could be broken down further to identify costs at a lower level to include first and second tier suppliers. One particular spreadsheet example from the transportation industry featured a landed cost breakout of the charges associated with the freight expenses when dealing with a foreign supplier (e.g., China). Thus, the firm could compare the proposals of a domestic versus foreign partner. The cost breakdown included two major components: origin outbound and destination inbound costs. The first category of cost was operation and handling, consisting of receiving costs, put away and inventory replenishment, picking/packing/kitting, and dispatch. An additional category captured was origin outbound administration and maintenance cost. It included the subcategories of inbound management, inventory control, and outbound management. The remaining origin outbound cost categories included site management fees and cross

docking costs. On the destination inbound side there were the same operation and handling costs as well as inventory control and on-site management fees. This methodology suggests that this firm was attempting to understand how their supply chain relationship drive their costs, and one of many examples where costs information was being collected before the end of the reporting period.

### *Conclusions*

This investigative question has been addressed in prior literature. Anklesaria (2008) suggest that supply chain costs include: direct material, direct labor, machine and process costs, material handling, quality cost, tooling costs, facility cost, management costs, engineering overhead, general and administrative, selling and distribution costs, and financing costs. Anklesaria (2008) suggest that firms should map out their processes using a very simple activity-based costing approach. The most savvy cost approaches found in the case studies were instances where the methods of collection were relatively simple. Most did not require a complicated IT system, but rather an accountant who understand the various cost categories with a basic understanding of the supply chain functions. Whether a firm chooses an ABC, target costing, kaizen costing, or a customer profit and loss (P&L) approach is of little importance. However, the potential rewards of doing so and possibly gaining a competitive advantage in the marketplace are of significant importance to most firms.

#### 4) Who (i.e., Which Decision Makers) Generates Supply Chain Costing Information and Who are the Recipients (i.e., Users) of the Data within the Firm?

This investigative question supports research questions 2 and 3.

#### *Findings*

Supply chain cost information was generated primarily by the logistics functional within each firm interviewed. Within the logistics management division, data was rolled up and presented to the vice-president of logistics. In both the transportation and the aerospace industries, the logistics and purchasing departments were often viewed as the supply chain of the firm. One of the aerospace executives stated that their supply chain consisted of freight, inventory, and warehousing. Consequently, this viewpoint can undermine what integration, cross-functional management, and information sharing across a chain of partner firms purports to achieve. SCM must focus on the whole organization, and not just production, and on processes rather than organizational units or functions.

Overall, the interviewees expressed a desire to have more visibility and transparency of supply chain cost information. The key finding was that management needs accountants to help them identify what information needs to be collected and how to analyze the data. A broader vision of cost information is needed in most firms as many executives haven't made the leap to managing costs at the supply chain level. It was still somewhat unclear as to who would receive cost data when it was collected. In two of the interviews, it was envisioned that supply chain costs would be presented to multiple personnel in the firm. One particular CEO explained that supply chain costing would

link the decisions made by the CEO or top executives, with that of the business development and marketing department, the program managers, production or operations, finance and accounting division, logistics, and procurement personnel.

### *Conclusions*

All divisions within the firm require cost visibility of the supply chain. With the exception of senior executives, where a roll-up of these costs will suffice, other managers reported that it would increase their ability to make well-informed decisions related to the products and services delivered to the end user.

#### 5) What are the Barriers to Implementation for Supply Chain Costing?

This investigative question supports research question 3.

### *Findings*

The interviews suggest that there are numerous barriers to the implementation of supply chain costing. During the course of the interviews, it was discovered that no firm was able to demonstrate evidence suggesting complete visibility of the supply chain or evidence of sharing cost information with more than a few key partners. Several firms expressed that a transactional view (i.e., arms-length approach) was a longstanding strategy that would be hard to overcome given many of the stipulations of the Sarbanes-Oxley requirements. While, there were discussions suggesting a relationship-based management approach, most firms viewed relationships from a downward perspective

which extended primarily to the customer. In most instances, the upstream suppliers were being managed in a transactional manner.

Another barrier identified was the firms' dependence on traditional cost accounting systems. Once again, few applications existed where management accounting techniques were being used to drive strategic decisions. There was interest at all levels within the firm including mid-level and executive-level managers; however, the anticipated costs for additional resources or IT systems seemed to stifle any movement. An additional barrier to supply chain costing stems from the firms' repeated concerns with the risk of sharing cost data with its suppliers in fear that this information may be used against them in future negotiations. Finally, firms expressed that before they could begin to share cost data with their suppliers, they first needed to understand their costs. Either they were not organized functionally to facilitate cost collection, or their current cost collection techniques were incapable of breaking out the costs associated with individual functions or roles. In many instances, firms stated that all they see are cost roll-ups.

### *Conclusions*

In summary, the barriers presented above were encountered in almost every interview. Table 5.2 identifies some of the barriers to implementation and techniques that could be used to overcome these barriers. A discussion of the techniques to overcome the barriers follows.

Table 5.2

BARRIERS TO IMPLEMENTATION AND TECHNIQUES USED TO OVERCOME

<u>Barriers</u>	<u>Techniques to Overcome</u>
Unwillingness to share cost data	Expectation of cost disclosure up-front Incentives provided for efficiency gains
Reliance on Traditional Cost Accounting Methods	Augment with Management Accounting Designating a supply chain accountant
Functional approach to Management	Integrated SCM approach to management Mapping out key supply chain processes Supply chain analyst assigned to manage partner firms

During the discussions there were several suggestions by the interviewees that would help to minimize some of the barriers presented. A transportation firm suggested that requiring supply chain cost disclosure could be set forth at the beginning of the partnership. If the partner supplier expects that disclosure will be a requirement from the outset, then it will be of little issue throughout the relationship. An aerospace firm stated that they could expand their supplier development conferences and present the benefits of sharing cost data in order to obtain a supplier's buy-in. Another technique for overcoming the barriers to supply chain costing, would be to assign a supply chain lead accountant who communicates with each partner firm to identify the key cost drivers across the supply chain. Finally, the findings suggest that the absence of some method of managerial accounting is perhaps the biggest barrier to implementation. The findings indicate that traditional cost accounting is ill-equipped, nor was ever intended to, be used for SCM and/or supply chain costing approaches.

An additional technique for overcoming barriers involves mapping out the supply chain process. Without a map, it is premature to decide where costs information should be disclosed and by what partner supply chain firms. As stated previously, ABC can be extremely detailed. However, if the effort is kept fairly simple and only the key processes are identified, then ABC can still work.

In much the same way, supply chain costing can succeed as well. By mapping out only the key processes, the effort can be broken down into smaller and actionable parts. For example, if a commodity supplier represents a huge contributor to a given supply chain and the supplier's industry is extremely competitive, then perhaps the price paid for the competitive item is fair enough. If so, full disclosure and a fully integrated SCM approach may not be necessary. During the course of the interviews, it became clear that the managers have a good understanding of the supply chain cost drivers. In one instance in the aerospace industry, a firm explained that rework and quality deficiency costs were spiraling out of control. In the course of the interview, the supply chain recognized that they could appoint a rework and deficiency cost analysis team to determine which suppliers are responsible for the largest percentage of the defects. This technique may not represent a full-blown supply chain costing approach; however, this practice represents a major step in this direction.

#### 6) What Types of Strategic Decisions are Supported with Supply Chain Costing Information?

This investigative questions supports research question 2.

### *Findings*

The interviews revealed that several decisions could benefit from information collected from supply chain costing efforts. Leadership welcomed the concept and discussed numerous alternatives for using such information for strategic decisions. The most common types of decisions discussed involved overall strategy (i.e., low-cost or differentiation), critical outsourcing decisions, inventory and warehousing decisions, transportation and packing decisions, and process reengineering decisions.

### *Conclusions*

Executives expressed a need for more cost information from the functions that span the supply chain. Supply chain costing represents an overall technique that can be used to collect information, which can be used to enhance the decision making capabilities at the highest level of the firm. The gap that exists today is driven largely by the reliance on traditional cost accounting, which is ill-equipped to address many of the decisions required to improve the bottom line. By utilizing management accounting techniques capable of capturing supply chain costs and the true cost of doing business, these executives will be better informed and, therefore better equipped to appease shareholders.

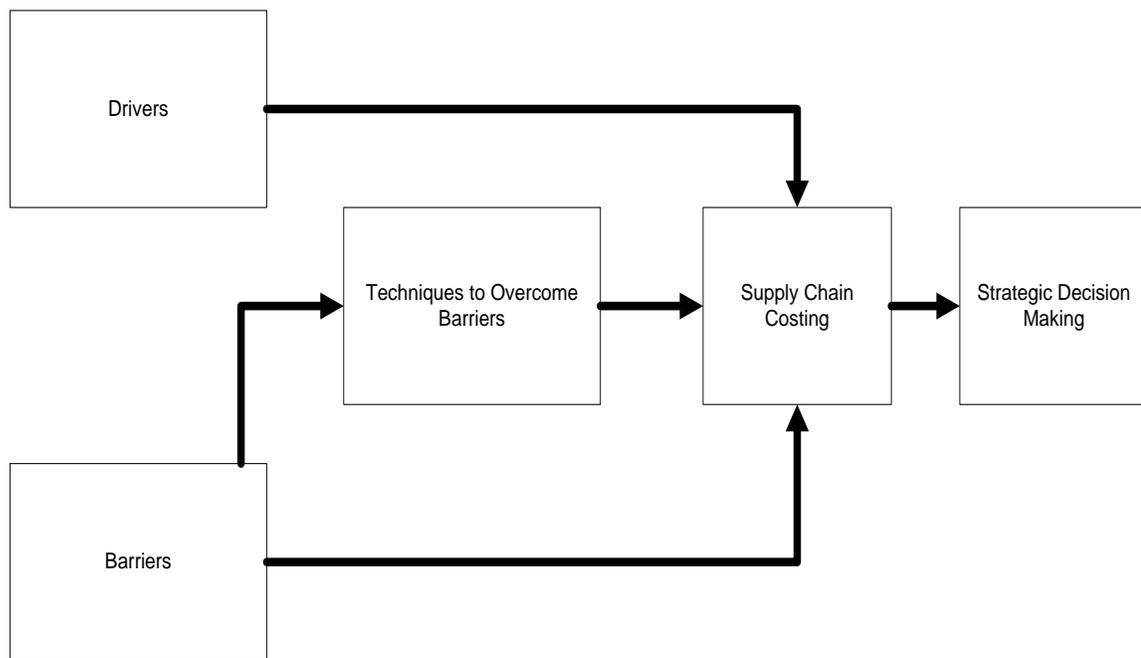
### Theoretical and Practitioner Contributions

At the outset of this research there were three primary objectives. The first was to understand the phenomena of supply chain costing. The second objective was to gain an

understanding of the impact that supply chain costing had on strategic decision making within the firm. The final objective was to identify the barriers to implementing supply chain costing methods and techniques that could be used to overcome these challenges. The model presented in Figure 5.1 is intended to motivate future prescriptive research that will allow for the empirical testing of the propositions identified previously.

Figure 5.1

THEORETICAL MODEL FOR SUPPLY CHAIN COSTING



This model represents the theoretical contribution of the research effort and a depiction of supply chain costing from both a normative and positive viewpoint. This research also provides a general understanding of supply chain costing as an overall technique that can be applied across numerous firms to identify cost saving measures or quality enhancements. The allocation of benefits and burdens represents a paradigm shift for many as companies begin to compete as supply chains rather than individual firms. The

following section of this chapter addresses the validity of the research and the believability of the findings and conclusions presented.

### Trustworthiness and Validity of the Research

The trustworthiness or authenticity of the research was addressed using Lincoln and Guba's (1990) criteria, which calls for resonance, rhetoric, empowerment, and applicability. The degree of resonance for the research is assessed by determining the degree of fit between the case study and reliability. The reliability of the case study analysis was maintained by having multiple graduate students transcribe the interview data. Additionally, a second interviewer was available for all but six of the 23 total interviews. Finally, the results and findings of the study were based on interviews, documentation, and prior literature. In this manner the researcher used a triangulation approach to ensure reliability of the findings. The rhetoric of the research is assessed on the research's unity in terms of the writing. In large part, the research document is organized by the research questions and the investigative questions. The theory building approach using both prior literature and the hybrid methodology (grounded theory and case study) were then applied as a means to identify the relationships and the unique characteristics of the constructs of supply chain costing and its impact on strategic decision making. Finally, while qualitative methods make it difficult to totally eliminate researcher bias, the triangulated approach of prior literature, face-to-face interviews, and supporting documentation, helped to minimize bias.

Empowerment of the research attempts to force the reader to act rather than simply suggest areas for future research. In this light, and because supply chain costing is a relatively new phenomenon, sufficient evidence exists to suggest that a methodology of interorganizational costing would greatly enhance a lead supply chain firm's ability to manage multiple partners and to improve decision making capability. Additionally, supply chain costing can be used to identify areas where cost or quality improvements can be achieved. Lastly, the applicability of the research is based on the reader being about to make inferences based on the cases studied and applying it to their own context. While the research was directed at only two industries, the results and conclusions are generalizable to numerous industries. The demand for more management accounting expertise to assist decision makers is not unique to these two industries alone.

The validity of the research was assessed using Maxwell's (1992) criteria, which calls for an evaluation of validity based on the research's descriptive, interpretive, theoretical, generalizability, and evaluative validity. The descriptive validity is assessment by an assessment of the factual accuracy of the interviews. As stated previously, the interviews were recorded and later transcribed for analysis purposes. In all cases, the interviewees were forthright and honest in their responses to the questions asked. If there were questions or confusion related to the responses, the interviewer sought further clarification. Additionally, the 23 transcriptions were analyzed and compared with hand-written notes for their factual accuracy and consistency. Second, the interpretive validity was assessed by comparing the participant's responses with that of the researcher's perspective on supply chain costing. While the researcher had some

previous exposure to supply chain costing, it was the interviewees' open-ended responses which were used for coding and analysis purposes. The researcher did not participate in the dialogue or encourage the interviewees to respond in any particular manner. As such, the theoretical model for supply chain costing was built in a conceptual manner using the interviewees' perspectives on supply chain costing.

The theoretical validity of the research was assessed by comparing how the model constructed in this research compares with similar studies. Two similar studies using exploratory approaches to building conceptual models were applied by Ellram (1998) and Ferring and Plank (2002) in their research for building Total Cost of Ownership (TCO) models. Both research efforts, investigated the drivers and barriers to TCO implementation. In summary, this methodology and the emerging theory are consistent with similar efforts. Third, the generalizability of the research was further ensured by conducting multiple visits to several of the firms participating in the interviews. In other instances interviewees were asked follow-up questions to ensure their interview data was correct or when further clarification was required. Additionally, the follow-up questions assisted with theoretical saturation. Per Strauss and Corbin (1990) the conditions and relationships between the categories are supported by consistent responses from the interviews. Additionally, if there are anomalies uncovered in the interview dialogue, questions can be asked that delve further in order to determine why inconsistencies exist. Finally, evaluative validity was assessed by examining the coding process during the data analysis portion. By using Miles and Huberman's (1994) process for coding interview it is very likely that other research would have led to similar conclusions based on the

patterns. Additionally, because MAXQDA was used to assist with the coding of the categories, the themes and patterns found in the data were standardized, as opposed to relying on a manual processes.

The following section includes suggestions for future research and is followed by the theoretical contributions of the research and the contributions to the practitioner.

### Suggestions for Future Research

Part of the research effort included a discussion of each firm's IT capability (e.g., ERP system) and whether their IT system could facilitate the collection of key supply chain cost information. Future research could investigate whether firms with extensive IT systems are more successful at communicating and sharing supply chain information with partner firms. For example, are the partners communicating forecast and demand data up and down the supply chain?

The research effort attempted to identify metrics that could be used for gauging performance of the supply chain in terms of cost. Unfortunately, the measures identified were being used primarily by individual firms only. Future research could be directed at identifying the metrics which are more suited for managing multiple firm partnerships across the supply chain.

Many of the interviewees felt that the supply chain was too complex to map out when attempting to identify the upstream and downstream suppliers and service providers whom comprise the supply chain. Future research could identify which tiers or levels

across the supply chain are more likely to consume the key cost drivers and processes which should be collected.

Another key driver for supply chain costing may be the position occupied by a particular supply chain member. Essentially, who owns what and where in the supply chain should the lead supply chain firm be positioned. Future research is needed to determine what level of ownership or position a firm needs to have to be able to manage the pertinent cost of the supply chain.

The findings of this research effort suggest that firms within the aerospace and transportation industry are not fully embracing the principles of SCM. Only one firm of the eight interviewed viewed SCM as more than logistics and transportation. While academia has taught the principles of SCM for some 20 years, the adoption of the key tenets of SCM has been slow to take hold. Future research is needed to identify the barriers to SCM and to identify the techniques that firms could use to effectively implement SCM.

### Summary

Supply chain costing represents a new chapter for management accounting. Ramos (2004) purports that until recently supply chain management had very little impact on management accounting. However, with the introduction of supply chain costing the cooperation amongst firms in partnerships can be vastly improved. By expanding communication and disclosing cost information the supply chain can become more efficient, and decision makers will possess the necessary information to improve

decision making at the strategic level. While the research did not uncover or detect mature methodologies for firms seeking to implement supply chain costing the potential financial benefits were apparent.

One possible analogy for the normative importance of supply chain costing exists with the classic Texas Hold'em poker game. Each year, thousands of the world's best poker players gather in Las Vegas for the World Series of Poker. Prior to the event, each individual participant forks over \$10,000 in hopes of becoming the world champion and collecting millions of dollars in prize money. Typically, the payouts include the top 100 finishers but only the last standing receives the ultimate prize which is often as high as \$5,000,000. While poker is a game of individual skill, the supply chain as a collection of partner firms doesn't have to be.

Imagine if the World Series of Poker featured an individual using a team approach rather than his or her cards alone. What if each player at an 8-man table was able to share cards with other players to achieve the highest possible hand? These eight players would undoubtedly win when going against a thousand individual players. While it sounds unfair and is not allowed at the World Series of Poker, sharing information in the marketplace is perfectly legal. With a supply chain costing approach, cost information being shared across multiple firms can be extremely beneficial. Supply chains are found in almost every industry in today's competitive marketplace, as there are numerous business partners who each contribute to the end product or service being delivered to the consumer. Moreover, the supply chain has the ability to collectively manage each partner's competitive advantages by shifting the functions and tasks of each partner to

come up with the best set of “cards”. Consequently, supply chain costing in the marketplace would serve to optimize the contributions of each supply chain partner to deliver a more efficient and effective product or service.

In a game of Texas Hold'em each player is attempting to grow a larger stack of chips. In the business world, the chips are profits and continued growth. In the supply chains of large firms where the stakes are often higher than a \$10,000 entry fee, a result of having to split \$5,000,000 amongst eight is much better than finishing 101<sup>st</sup> out of 3000 in the World Series of Poker. The integration and cooperation of firms is critical in today's marketplace. However, as long as the focus of the supply chain remains directed at individual firms, it is unlikely that efficiencies will ever be realized by the firm or the end consumer. Supply chain costing represents the next frontier for multiple firms attempting to institutionalize a SCM approach where firms don't compete, but rather supply chains.

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