NOTE TO USERS

INFORMATION SYSTEM CAPABILITIES AND EMERGENT COMPETITIVE STRATEGIES:

An Investigation of the Strategic Fit of Supply Chain Management Information Systems

By

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Abstract

This study develops a model for analyzing fit between a firm's competitive strategies and the capabilities of their Supply Chain Management Information Systems (SCM IS). Concepts such as configurational theory, the resource based view of the firm, and emergent strategies and capabilites — all of which are underutilized in current IS literature — ground the study theoretically. A positivist case study of five manufacturers is used to explore the constructs and identify appropriate measures for operationalizing the model.

The developed model enables IS planners to quickly analyze their firm's competitive strategy patterns and determine the ideal level of support required for each SCM IS capability. Firms can improve the effectiveness of their IS and reduce the risk and cost of misfits, by implementing information systems that fit their *emergent* competitive strategies. The developed model is a significant improvement over traditional models that advocate aligning information systems with a firm's intended strategies or their current functional requirements, both of which change more frequently than a firm's emergent competitive strategy patterns.

The case study investigations yielded several important findings. First, Miles and Snow's (1978) competitive strategy typology proved useful for classifying a firm's emergent competitive strategy patterns and reducing the complexity of analysis. However, the qualitative evidence more strongly supported the use of Conant *et al.*'s (1990) multi-dimensional questionnaire measure of competitive strategy type rather than Miles and Snow's (1978) paragraph measure.

Second, existing conceptualizations of IS capabilities were not well suited to analyzing SCM IS specifically. The findings support the conceptualization of SCM IS capabilities as the level of support provided for: operational efficiency, operational flexibility, planning, internal analysis, and external analysis.

Finally, the empirical results strongly supported modeling the strategic fit of a firm's SCM IS as the amount the perceived level of support provided for each SCM IS capability was *less than* the theoretically ideal level, rather than the more common approach of modeling strategic fit as the absolute deviation between perceived and theoretically ideal levels.

Keywords: strategic alignment, competitive strategy patterns, information system capabilities, interorganizational information systems, supply chain management.

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CHAPTER 1: INTRODUCTION

The purpose of this chapter is to provide an overview of the research problem and its importance, as well as the layout of this dissertation.

1.1 Problem Statement

This dissertation addresses the alignment of a firm's competitive strategies[1] with the capabilities enabled by the firm's supply chain management information systems (SCM IS). SCM IS are interorganizational information systems (IOS) that use information and communication technology (ICT) to coordinate information within and between supply chain partners (see Appendix A- Glossary and Acronyms). Specifically, the dissertation explores the concept of the strategic fit of SCM IS and examines its conceptualization, measurement, and usage in information systems (IS) planning and evaluation. The development of a theoretically and empirically supported model of the strategic fit of SCM IS provides researchers and practitioners with an operationalizable model for understanding and assessing the strategic fit of specific SCM IS implementations. Such a model can reduce risks in IS planning and management and further understanding in this important area.

Businesses have recognized the benefits of using SCM IS to synchronize information among customers and suppliers of a supply chain since the early days of Electronic Data Interchange (EDI) (Mukhopadhyay *et al.* 1995; O'Leary 2000). However, the adoption of EDI systems limit trading partner flexibility resulting in benefits often accrued to one partner at the expense of the other (Lee *et al.* 1999). Recent innovations in more flexible Internet-based SCM IS, such as electronic marketplaces or Extended Enterprise Resource Planning (EERP) systems, promise to improve both the efficiency *and* agility of each partner in a supply chain (Green 2001; Reddy 2001a; Subramani 2004). However, deciding on which type of SCM IS to implement is complicated by a lack of a theory for understanding how the various capabilities of an organization's SCM IS should be aligned with their strategies.

This dissertation develops an operationalized theoretical model for assessing the strategic fit of the capabilities of a firm's SCM IS using the firm's emergent competitive strategy patterns, level of supply chain integration[2], and SCM IS capabilities. The study

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[1] Competitive strategies (sometimes termed "business-level strategies") answer questions such as "How should we compete in this business?" as opposed to "corporate-level strategies" that answer questions such as "What business should we be in?" (Snow and Hambrick 1980).

[2] Supply chain integration is the coordination of a firm's strategies, processes, systems, and performance measures with those of its partners. Another common term is "supply chain maturity," although this study avoids its usage as it may incorrectly imply that tighter integration is better in all cases.

reports progress in refining and validating the model using feedback from researchers, industry practitioners, and an exploratory multiple case study.

1.1.1 Why Study Supply Chain Management Information Systems (SCM IS)?

Supply chain management[3] (SCM) involves the coordination of material, information, financial transactions, and decisions among a firm's suppliers, customers, distributors, and their partners. Christopher (1998) describes SCM as "planning and coordinating the materials flow from source to user as an integrated system rather than ... as a series of independent activities." The desire to share information and promote collaborative management of the supply chain causes firms to turn increasingly to IOS for supply chain management and coordination (van Hoek 2001).

SCM IS are enterprise or interorganizational ICTs used to coordinate information in a supply chain. Since SCM IS vary widely in sophistication and functionality, there is often little agreement in the terminology used to describe the various types. Some examples of SCM IS include: EDI- or web services-connected IOS; electronic marketplaces; EERPs; and collaborative customer or supplier portals. The different types of SCM IS are explored in more detail in the following chapter. Successive chapters investigate the high-level organizational capabilities enabled by SCM IS in general, rather than focusing on the technical and functional differences between them.

As described in the following chapter, SCM IS can enable more accurate and timely information coordination, which reduces inventory and administrative costs and increases responsiveness to market demands (Horvath 2001; Lee *et al.* 1997; van Hoek 2001). Effective use of SCM IS can reduce buffer inventory stocks, reduce lead times, increase sales, and improve customer service (Anderson and Lee 1999; Mentzer *et al.* 2000). Despite the importance of SCM IS to the competitiveness of many firms, numerous gaps in the theoretical and empirical literature hinder the effective usage and selection of SCM IS (Subramani 2004).

1.1.2 Why Study the Strategic Fit of SCM IS?

Over the years, research on the evaluation of IS has increased in abstraction from aligning IS capabilities with functional requirements (Lucas 1981), to desired architecture (Allen and Boynton 1991), to competitive strategies (Henderson *et al.* 1996). Although theories of strategic alignment or fit have been examined at the level of overall IS strategy (Kearns and Lederer 2001; Peppard and Breu 2003; Reich and Benbasat 2000; Sabherwal and Chan 2001), operationalized models have not yet been developed to a sufficiently detailed level to measure the strategic fit of specific types of IS, such as SCM IS.

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[3] Synonyms and variations of supply chain management include: *supply chain coordination, -integration, -collaboration, and value chain management;* however, this study does not distinguish between these concepts and prefers the more encompassing and widely used term *supply chain management* (SCM).

IS studies have explored different dimensions of the concept, resulting in terms used interchangeably such as alignment, fit, linkage, or coordination. This study uses the term "strategic fit" since it focuses on the degree to which the capabilities of a firm's IS match the requirements for supporting a firm's competitive strategies (Venkatraman 1989a). The term "alignment" is avoided since it is often unclear whether it refers to the "process" or "outcome" of alignment (Reich and Benbasat 1996). This study focuses on the latter (the degree of fit achieved or desired), rather than the question of how to align the systems and strategies to improve the degree of fit. In addition, this study focuses specifically on fit between competitive strategy and IS used specifically for supply chain management and coordination, rather than the other aspects of fit proposed by Henderson *et al.* (1996), such as fit between competitive strategy and business processes. The strategic fit of SCM IS is defined in this study as *how well the organizational capabilities enabled by a firm's SCM IS support the firm's competitive strategies.* Table 1.1 lists the initial research constructs for this study, their definitions, and related previous studies (which are discussed in more detail in the following chapter).

Existing studies of strategic fit in IS deal primarily with high-level IS strategy in general (e.g., Reich and Benbasat 2000; Sabherwal and Chan 2001) and are not detailed enough to model the strategic fit of capabilities of specific types of IS. This dissertation addresses this gap in the literature by developing an operationalizable theoretical model of the strategic fit of supply chain management information systems. SCM IS were chosen as the focus because they are critically important to the success of many firms, but have not received sufficient attention in empirical information systems research (Subramani 2004). Although the strategic fit model developed is operationalized specifically for SCM IS, the underlying theories and methodology could be adopted in future studies for analyzing other types of information systems.

The concept of strategic fit of IS in general, and strategic fit of SCM IS specifically, clearly requires further study. Improving the strategic fit of IS has been repeatedly mentioned as among the top priorities of IS executives (Brancheau *et al.* 1996; Luftman 2001; Niederman *et al.* 1991). Numerous studies indicate that the alignment between a firm's information systems and its competitive strategy is critically important for the success of many businesses today (Camillus and Lederer 1985; Chan *et al.* 1997; Cragg *et al.* 2002; Gupta *et al.* 1997; Henderson and Venkatraman 1992; Kearns and Lederer 2001; King and Teo 1997; Sabherwal and Chan 2001). However, there is a need for operationalized models that enable firms to understand and measure the strategic fit of organizational capabilities enabled by specific types of IS, such as SCM IS. As outlined in Table 1.2, the predominant conceptualizations in the current literature have several limitations that have prevented them from being used to develop a holistic empirically grounded model of the strategic fit of SCM IS.

Traditionally, IS implementation researchers have recommended matching IS capabilities with a firm's functional requirements (Lucas 1981), critical success factors (Holland and Light 1999), or desired architecture (Allen and Boynton 1991). However, with the complexity of enterprise systems packages such as SCM IS, it has become increasingly infeasible to select a system that will meet all of a firm's requirements or

even to understand what those requirements are (Holland and Light 1999). As a result, firms may choose SCM IS based on their previous successes in other supply chains, without a detailed analysis of whether it truly fits the requirements for supporting the firm's specific competitive strategies. The fit between SCM IS and the competitive strategies they support remains a critical yet often overlooked factor in the success of SCM IS implementations (Chopra and Meindl 2001; Reddy and Reddy 2001).

Table 1.1 - Initial Research Construct Definitions and Related Studies

Construct	Definition	Related Studies
Supply Chain Management Information System	An information system that supports the exchange and coordination of information between various participants of a supply or demand chain.	(Chopra and Meindl 2001; Kalakota and Robinson 2001; Kaplan and Sawhney 2000; Konsynski 1996; McLaren *et al.* 2002)
Strategic Fit of SCM IS	How well the organizational capabilities enabled by a firm's SCM IS support the firm's competitive strategies.	(Chan *et al.* 1997; Henderson *et al.* 1996; Sabherwal and Chan 2001; Singh *et al.* 2001; Venkatraman 1989a)
Supply Chain Integration	The coordination of a firm's strategies, processes, systems, and performance measures with those of its partners.	(Moncrieff and Stonich 2001; Poirier and Bauer 2001; Riggins and Mukhopadhyay 1994; Roloff *et al.* 2001; Shah *et al.* 2002)
Competitive Strategy Patterns	The recurring strategic activities and postures undertaken by a firm in response to their perceived competitive environment.	(Ansoff 1965; Clarke 2001; Doty *et al.* 1993; Miles and Snow 1978; Mintzberg 1978; Porter 1985)
Competitive Strategy Archetype	An ideal configuration of internally consistent emergent competitive strategy patterns. Examples include Defenders, Prospectors, and Analyzers, which are ideal configurations of competitive strategy patterns.	(Doty *et al.* 1993; Gimenez 1999; Gupta *et al.* 1997; Hambrick 1983; Meyer *et al.* 1993; Miles and Snow 1978; Mintzberg 1978; Shortell and Zajac 1990; Tavakolian 1989; Venkatraman 1989a; Zahra and Pierce 1990)
SCM IS Capabilities	High-level organizational capabilities that are enabled by a firm's SCM IS. The resource-based view of the firm is used, which distinguishes between IS resources or designs and the capabilities that emerge depending on their implementation. Examples include operational efficiency, flexibility, analysis, and process coordination.	(Camillus and Lederer 1985; Doty *et al.* 1993; Grant 1991; McLaren *et al.* 2004a; McLaren *et al.* 2004b; Segev 1989; Venkatraman and Ramanujam 1987; Zviran 1990)

Table 1.2 – Limitations of Existing Models of Strategic Fit of IS

Issue	Studies Demonstrating or Attempting to Address Issue
Limitations of traditional functional requirements analysis due to the complexity of modern enterprise information systems.	(Allen and Boynton 1991; Chopra and Meindl 2001; Ciborra 2000; Dagenais and Gautschi 2002; Henderson and Venkatraman 1992; Holland and Light 1999; Lucas 1981; Luftman 2001; Papp 2001; Reddy and Reddy 2001)
Limitations of reductionist bivariate models of strategic fit of IS.	(Fisher 1997; Reddy 2001a; Riggins and Mukhopadhyay 1994; Shah et al. 2002)
Difficulty operationalizing strategic fit due to multiple multidimensional constructs	(Brancheau et al. 1996; Camillus and Lederer 1985; Gupta et al. 1997; Henderson and Venkatraman 1992; Kearns and Lederer 2001; King and Teo 1997; Luftman 2001; Niederman et al. 1991; Sabherwal and Chan 2001)
Limitations of dominant rational model of strategic fit, which conceptualizes competitive strategy as intended behaviours rather than realized or emergent behaviours.	(Ansoff 1965; Ciborra 2000; Clarke 2001; Doty et al. 1993; Hambrick 1983; Henderson and Venkatraman 1992; Knoll and Jarvenpaa 1994; Meyer et al. 1993; Miles and Snow 1978; Miles et al. 1978; Miller 1986; Mintzberg 1978; Papp 2001; Porter 1985; Snow and Hrebiniak 1980; Venkatraman 1991; Yetton et al. 1995; Zahra and Pierce 1990)

For example, a competitor of Dell Computer tried to mimic Dell's successful "build-to-order" web-based SCM IS approach with disastrous results. One explanation for the customer service and inventory problems that resulted was a poor strategic fit between SCM IS that were designed for optimizing responsiveness and a competitive strategy that required a focus on efficiency rather than flexibility (Singh *et al.* 2001).

A lack of strategic fit could also explain why some public electronic marketplaces have failed to interest many buyers and suppliers (Dagenais and Gautschi 2002; Stevens 2001). Early marketplaces focused on vendor selection and reduced purchasing costs. However, they provided little support for operational efficiency or planning capabilities. As a result, these marketplaces may have had high strategic fit only for the minority of firms whose strategies are focused solely on flexibility.

The number of SCM IS alternatives makes it difficult for firms to determine which solution is best for their unique situation. The complexity of cross-enterprise SCM IS requirements analysis, implementation, and integration has resulted in frequent mismatches between the strategic objectives of a firm and the capabilities of the IS implemented (Ciborra 2000; Henderson and Venkatraman 1992; Luftman 2001; Papp 2001). For example, Nike's troubled SCM IS implementation has been blamed on a mismatch between their specialized requirements for agile distribution and the system's more standardized capabilities (Smith 2001).

Several studies have focused on the importance of achieving fit between a firm's IS strategy and its competitive strategy (Cragg *et al.* 2002; Gupta *et al.* 1997; Kearns and Lederer 2001; Sabherwal and Chan 2001). Researchers have also noted that strategic fit is

important for SCM IS in particular (Singh *et al.* 2001). Fisher (1997) suggested configuring supply chains and SCM IS for either efficiency or responsiveness depending on whether the products involved were "functional" or "innovative" by nature. Fisher's bivariate conceptualization of fit is useful for analyzing extreme supply chain cases where the product type is homogeneous. However, more recent research has highlighted need for many supply chains to optimize both efficiency and agility simultaneously (Adler *et al.* 1999; Reddy and Reddy 2001). This "efficiency-agility" paradox occurs in supply chains because of the mix of products and services they must support as well the range of processes that occur, some static and some very dynamic (Reddy 2001a).

Other studies have proposed SCM IS should fit the degree of communication and collaboration between supply chain partners (Riggins and Mukhopadhyay 1994; Shah *et al.* 2002). However, these studies only examined fit with the level of interorganizational information sharing and did not examine fit with other important dimensions such as competitive strategies, the level of process integration, or the level of joint decision-making between firms.

To address the shortcomings of these reductionist bivariate conceptualizations of fit, this research attempts a more systems-oriented approach by investigating the relationships and interactions of a larger number of factors simultaneously. For example, firms have different requirements for IS depending not only on their need for efficiency or agility, but also on the amount of market surveillance, long-term planning, and interorganizational information sharing they perform (Sabherwal and Chan 2001).

For over twenty years, researchers have proposed, refined, and debated models for studying the fit of competitive strategies with various high-level IS concepts (e.g., Henderson and Venkatraman 1992; Henderson *et al.* 1996; Luftman 2001; Papp 2001). However, the development of detailed operationalizable models suitable for exploring the strategic fit of the capabilities of specific types of information systems has been hindered by the limitations of many of the theories employed. To address this gap, this dissertation develops a theoretical model of the strategic fit of SCM IS capabilities — one that can be adapted and operationalized for use with specific types of information systems.

One reason for the scarcity of actionable theories of strategic fit of IS capabilities is that the theoretical soundness of the underlying assumptions has been widely debated (Ciborra 2000). Many existing models fail to distinguish between intended strategic designs and emergent strategic patterns (Mintzberg 1978). The conceptualization of strategic fit using intended strategies has apparently led some researchers to argue that strategic fit is only feasible in relatively static environments (Ciborra 2000; Knoll and Jarvenpaa 1994). However, several strategy theorists have noted that although intended strategies may frequently change, firms exhibit relatively stable patterns of competitive behaviour (Miles *et al.* 1978; Mintzberg 1978). This conceptualization views strategy as "a pattern in a stream of decisions and actions" (Mintzberg and McHugh 1985). These recurring patterns are often found grouped into a small number of commonly occurring configurations which can be used to predict, explain, or recommend various

organizational phenomena and approaches (Meyer *et al.* 1993; Miles and Snow 1978; Miller 1986).

The traditional view of the strategic alignment of IS proposes that various aspects of a firm's IS strategies, processes, infrastructure, and governance mechanisms should be aligned with the firm's competitive strategies or other aspects of the organization (Henderson and Venkatraman 1992; Papp 2001; Venkatraman 1991). Some researchers have challenged this conceptualization, suggesting that fit should be viewed as an incremental and mutual process rather than having to start with an understanding of a firm's strategy (Peppard and Breu 2003; Yetton *et al.* 1995). Other IS researchers have suggested that attempting to align IS with frequently changing strategies is futile and firms are better off trying to be flexible (Ciborra 2000; Knoll and Jarvenpaa 1994).

Many of the shortcomings of the dominant models of strategic fit arise from the traditional conceptualization of strategy as a rational organizational design or plan (Ansoff 1965; Porter 1985), rather than an emergent pattern of competitive behaviour (Clarke 2001; Mintzberg 1978). It may indeed be futile to attempt to align IS capabilities with a firm's designed or *intended* strategies since these frequently do not correspond with a firm's actual activities or *realized* strategies (Mintzberg 1978). This study overcomes many of the limitations of the traditional models of strategic fit of IS (detailed in the next chapter) and develops a more theoretically and empirically grounded model, which is operationalized for the detailed study of the strategic fit of the organizational capabilities enabled by SCM IS.

1.2 Research Objective

The objective of this dissertation is to develop an empirically supported and operationalizable model for measuring the strategic fit of a firm's SCM IS. Such a model helps researchers and practitioners better understand and assess the strategic fit of a firm's SCM IS.

This objective is motivated by a lack of theoretical basis for understanding how the strategic fit of a firm's SCM IS can be conceptualized and measured. Although concepts such as configurational theory, the resource based view of the firm, and emergent strategies and capabilitesground the study theoretically, further exploration and development of the theories, constructs, and measures is required.

An empirically supported theory of strategic fit of SCM IS can enable practitioners to implement SCM IS that better fit their organization's strategic requirements. Determining how well SCM IS enable various organizational capabilities in a firm can also reduce the complexity of evaluating different SCM IS. Using the developed model, firms can improve the effectiveness of their IS and reduce the risk and cost of misfits, by implementing information systems that fit their competitive strategies.

Building upon configurational theories of competitive strategy archetypes and IS capabilities, this dissertation presents a theoretical model for understanding and assessing the strategic fit of SCM IS capabilities. The model proposes that, first, a firm's emergent

competitive strategy patterns can be used to derive the level of support IS should provide to enable various organizational capabilities. Second, an assessment of the strategic fit of the IS capabilities can be made by comparing the theoretically ideal and perceived level of support the IS provide for each capability.

Following Eisenhardt's (1989) recommendations for developing theory from case study research, a theoretical model of the strategic fit of SCM IS is presented, which is informed by studies from multiple disciplines and refined and validated using a panel of experts and qualitative evidence from five Canadian manufacturers. Likert-scale questionnaire measures adapted from previous studies are used to pilot test, explore, and further refine the model — resulting in an emerging theory that is better grounded in empirical evidence.

1.3 Contributions to Theory

Several IS studies have focused on the importance of implementation success factors such as change management or executive leadership (Holland and Light 1999; Lucas 1981; Parr *et al.* 1999; Wixom and Watson 2001). Similarly, others have recognized that success is dependent on achieving strategic alignment between competitive strategies and IS strategies (Cragg *et al.* 2002; Gupta *et al.* 1997; Kearns and Lederer 2001; Sabherwal and Chan 2001). Although researchers have highlighted the importance of aligning competitive strategies with the capabilities of IS (Henderson *et al.* 1996; Luftman 2001; Papp 2001), this study is one of the first to empirically examine the strategic fit of a specific type of IS.

In a classic study of fit in supply chain management, Fisher (1997) explored the bivariate relationships of innovative versus mature products requiring efficient or flexible supply chains. While it is useful for firms in supply chains with homogeneous products, Fisher's (1997) model provides little guidance to firms that require both efficient *and* flexible supply chains. A major strength of the conceptualization used in this dissertation is that it enables the fit or appropriateness of a firm's SCM IS to be determined based on a number of capabilities simultaneously rather than focusing on single bivariate dimensions. Thus, firms can develop more holistic or systems-based analyses that include multidimensional profiles rather than being limited to studying various dimensions individually and ignoring their interrelationships.

This study extends theories of strategic alignment between competitive strategy and information systems IS into the specific domain of supply chain management and coordination — an area of increasing importance for many firms (Anderson and Lee 1999; Dagenais and Gautschi 2002; Lee 2000; Singh *et al.* 2001; Tapscott *et al.* 2000). Ultimately, the research should further the understanding of success factors for SCM IS and help firms minimize their risks by ensuring that their chosen systems fit their supply chain environment and competitive strategies.

The model developed proposes that the success of a SCM IS initiative is related to the degree of fit between the organizational capabilities enabled by a firm's SCM IS and

the competitive strategy patterns of the organization. Understanding these relationships is increasingly important as firms seek to intensify the level of collaboration with their partners while minimizing the risks of these strategic initiatives. The strength of the developed model appears to be its ability to quickly highlight areas of potential misfit in a firm's chosen supply chain strategies and systems.

For researchers, the theoretical model developed provides an interdisciplinary systems approach to understanding the strategic fit of SCM IS. The methodology could also be adapted for use in other strategic IS domains. As noted in the following chapters, the model is grounded in a comprehensive overview of the current research in the area of supply chain coordination and collaboration. Peer-reviewed studies of IOS are used where possible, but the scarcity of rigorous studies in this new area require they be supplemented with findings from non-peer reviewed literature that may not be as scientifically rigorous. As such, there is a need to examine the propositions made throughout this dissertation empirically and bring scientific rigour to this increasingly important area.

1.4 Importance to Practice

There are a number of alternative approaches for supporting supply chain management and coordination such as EERP systems, electronic marketplaces and portals, and using EDI or eXtensible Mark-up Language (XML) messaging. Many of these approaches are promoted as "cure-all" solutions with ready benefits for adopters, though problems and failures are also commonplace. Despite this, if chosen appropriately, these solutions can enable firms to better collaborate with their partners, thus reducing costs and increasing their responsiveness to market demands. The challenge that this research addresses is to determine the specific mix of SCM IS capabilities that are best suited for a particular organization.

While many IS researchers and practitioners are aware of the importance of success factors such as executive support or change management, most SCM IS implementations already try to follow best practices as much as is feasible. Thus, this study focuses on an issue that is often overlooked in implementing SCM IS — that the SCM IS must fit the unique strategic requirements of the specific firms.

In short, businesses don't know which SCM IS best fits their given situation. Proponents of the varying approaches are often commercial software vendors or customers who have invested in an initiative themselves and need to convince others to follow suit to maintain the viability of the solution[4]. Given this bias, it is very difficult for a firm to determine which is the best strategy for their situation. While many champions of SCM IS purport that their ICT is the solution for all situations, the reality is that the suitability of any specific type of ICT is likely limited to a much narrower cluster of firms.

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[4] For example, the Covisint electronic marketplace or RosettaNet information sharing standards require numerous adopters in order to achieve a "critical mass" or efficiency of scale.

This dissertation explores and develops a model for assessing the strategic fit of a firm's supply chain management information systems. The resulting contribution to industry practice is a reduction of the risks and uncertainty in planning a supply chain coordination and collaboration initiative. Practitioners will gain a better understanding of the strategic levers to focus on to maximize the success of their SCM IS. Thus, rather than choosing to implement a supply chain management information system because a competitor has had success with it, firms can analyze how the capabilities of the SCM IS will fit each dimension of their competitive strategy and their level of supply chain integration. Ultimately, this research should further the understanding of the relationship between SCM IS and competitive strategies and assist firms in ensuring that their chosen systems better fit their unique supply chain requirements.

The developed model enables IS planners to quickly analyze their firm's competitive strategy patterns and determine the ideal level of support required for each SCM IS capability. Firms can improve the effectiveness of their IS and reduce the risk and cost of misfits, by implementing information systems that fit their *emergent* competitive strategies. The developed model is a significant improvement over traditional models that advocate aligning information systems with a firm's intended strategies or their current functional requirements, both of which change more frequently than a firm's emergent competitive strategy patterns.

1.5 Outline of Dissertation

Following Eisenhardt's (1989) recommendations, the research cycled iteratively through literature review, data collection, analysis, and model development phases, although each of these phases are reported in separate chapters. Chapter 2 presents an analysis of previous studies to provide the necessary background and motivation for the study, examines debates and gaps in the literature, and identifies relevant theoretical constructs. A conceptual framework for developing and exploring a model of strategic fit of SCM IS is then presented, followed by the research questions to be addressed.

Chapter 3 discusses the exploratory multiple case study research methodology used in this dissertation. The research design, timeline, participants, and data collection and analysis methods are discussed and compared with similar studies. The chapter concludes with a discussion of the ethical considerations for the study including the reliability, validity, and trustworthiness of the findings.

Chapter 4 describes the findings from the field study and theoretical development. Each of the sections addresses a different component of the conceptual framework and questions outlined in Chapter 2. The findings presented are based on an analysis of qualitative and quantitative evidence, along with a concurrent comparison to previous studies where appropriate. The chapter concludes with a summary case study report for each of the cases analyzed.

Chapter 5 summarizes and discusses conclusions from the research. The findings from Chapters 4 are used to develop a theoretical model of the strategic fit of IS

capabilities. The model is operationalized for examining the strategic fit of the capabilities of a specific type of IS — SCM IS. The usefulness of the model is examined using an illustrative example as well as feedback from the study participants. Reflections on the study's methodology, theoretical contributions, and use in practice are also presented. The chapter concludes with a discussion of the study's limitations and suggestions for future research.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

The purpose of this chapter is to provide a theoretical background on SCM IS concepts through a review of relevant studies and presentation of the conceptual framework. The chapter begins by examining studies of supply chain management and interorganizational relationships. Next, an overview of different types of SCM IS is presented along with a discussion of the benefits and costs that can be expected from their usage. In Section 2.4, the strengths and limitations of existing theoretical models of strategic fit is discussed, along with the desirable attributes of the theoretical model developed in this dissertation. Section 2.5 outlines a conceptual framework for guiding further study of the research problem. Concepts such as configurational theory, the resource based view of the firm, and emergent strategies and capabilites — all of which are underutilized in current IS literature — are used to ground the framework theoretically. The chapter concludes with a discussion of the gaps in the current literature on the strategic fit of IS and the strategic fit of SCM IS capabilities in particular.

2.1 Introduction

This dissertation focuses on issues related to the fit of competitive strategies with supply chain management information systems. As shown in Figure 2.1, the major research disciplines contributing to this study include: competitive strategy, information systems, and supply chain management. There is a considerable body of research to draw upon from each of the individual disciplines, but much less rigorous research has been done in the areas of intersection between any two of these areas, and no known studies exist that intersect all three areas[5].

The following literature review draws upon studies from each area as well as the relatively scarce interdisciplinary studies that examine issues that emerge at the intersection of each area. For example, although there are relatively few studies that look specifically at IS for SCM, there are several more general studies of IOS that are also relevant. Similarly, there are few studies that focus on IS and competitive strategies simultaneously, although there is a growing body of mostly conceptual studies that focus on the strategic fit of IS. Even fewer studies were found that explicitly look at the fit of competitive strategies with SCM strategies, although there is often an implicit assumption (that is rarely investigated) that SCM strategies are derived from competitive strategies.

Studies from each of the three disciplines in Figure 2.1 were analyzed to inform this multi-disciplinary investigation. However, initial investigations highlighted the importance of being sensitive to the problems that can arise from applying constructs and measures developed in other disciplines to the newer area of strategic fit of SCM IS. For

[5] See Table 1.1 for a list of relevant studies related to the research constructs addressed in this dissertation.

this reason, this study uses exploratory theory development techniques to investigate the appropriateness of the theories, constructs, and measures used, rather than blindly applying and testing theories drawn from other disciplines.

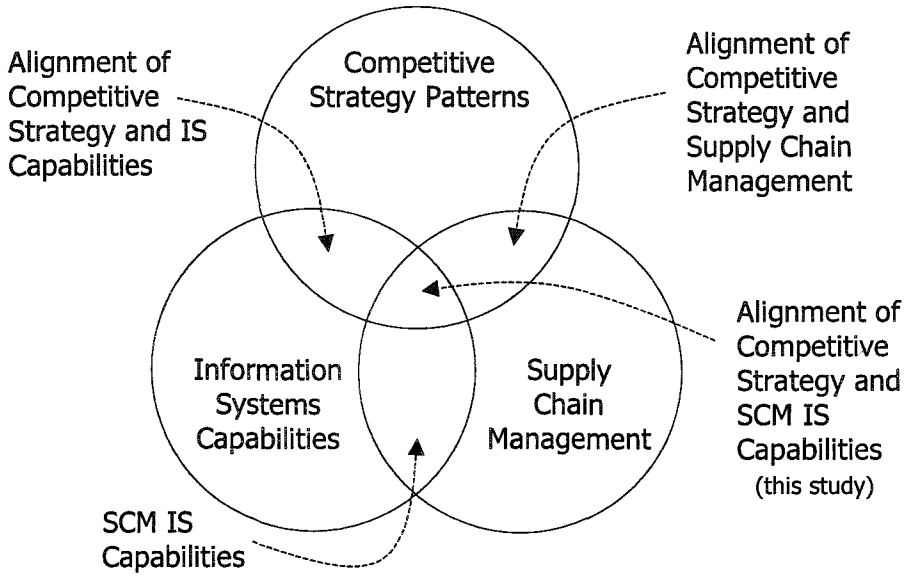

Figure 2.1 - Major Research Disciplines Contributing to this Study

2.2 Supply Chain Management, Coordination, and Collaboration

A *supply chain* is the collection of functional activities through which raw materials are converted into finished products for sale to a customer (Ballou 1999). Some researchers have felt that the term supply chain has a connotation that is limited to supplier processes and does not emphasize the customer or distribution processes involved. Thus, terms such as value chains (Porter 1985), supply networks (Harland *et al.* 2001), and business webs (Tapscott *et al.* 2000) are used interchangeably with supply chain[6], though their usage is not always consistent.

Businesses in the early part of the twentieth century were often characterized as vertically integrated operations. Integrated operations like Ford Motor Company performed manufacturing, sourcing, warehousing, sales, and logistics functions "in house." However, by the late 1900's, vertical integration had substantially disappeared and most firms included external partners in their supply chain. Since these external partners (e.g., suppliers, transportation providers, retailers, etc.) are outside of the

[6] In many cases, a web is a more accurate metaphor than a chain, though the distinction is not important to this dissertation, as transactions still mainly occur between only two partners at one time. The more traditional term *supply chain* is used in this dissertation.

management control of a firm, supply chain management has traditionally involved each organization managing its own portion of the supply chain and monitoring its partners to ensure they fulfill their contractual obligations (Ballou 1999).

There can be numerous problems with this approach, the best known perhaps being the "bullwhip effect" (see Figure 2.2). When demand is uncertain, orders to suppliers are often inflated to protect against running out of stock and to gain quantity discounts, among other reasons. When suppliers in turn inflates quantities ordered from their suppliers, the effect is an amplification in order size variability from the original end-customer demand to the demand seen by the suppliers' suppliers. This amplification of demand uncertainty, known as the bullwhip effect, leads to greater excess and/or obsolete inventory throughout the supply chain, since extra inventory is required to protect against stock outs between each link in the chain. However, with increased management coordination of the supply chain and by making end-customer demand information readily available to the entire supply chain, the demand uncertainty along the chain and its resulting bullwhip effect can be reduced (Lee *et al.* 1997).

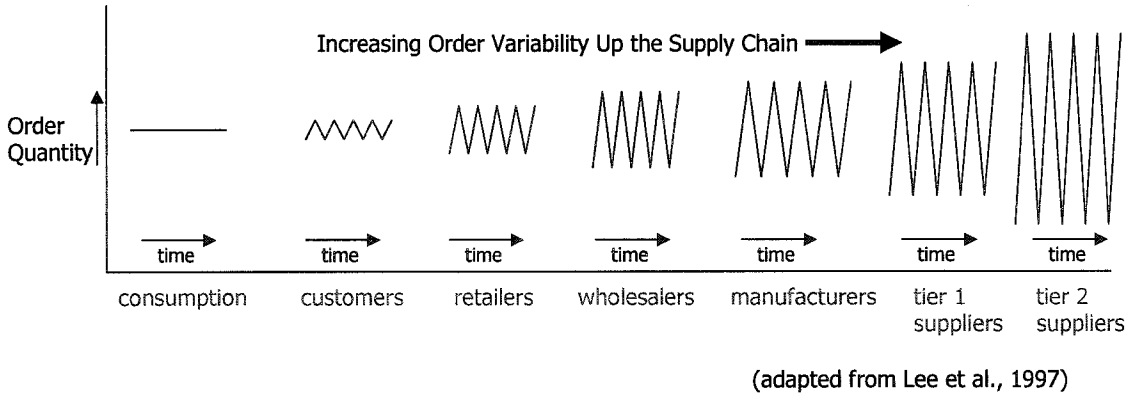

Figure 2.2 - Information Distortion: The Bullwhip Effect

Supply chain management is the coordination of material, information, financial transactions between a firm and its partners. It typically involves one organization managing its relationships and transactions with its partners. Similarly, *supply chain integration* usually involves one organization attempting to improve the information flow with its partners. In contrast, *supply chain optimization* or *coordination* typically involves each of the key partners in a supply chain making coordinated decisions to reduce information asymmetry and resulting excess inventory throughout the entire chain.

If only the dominant partner drives supply chain optimization decisions, this can create an asymmetrical distribution of information, inventory, and ultimately bargaining power between the firms (Iacovou *et al.* 1995). In order to optimize the entire supply network, instead of creating local optima in one or two partners, the firms involved must

make *joint* supply and demand decisions that create sustainable value for all. Hence, many firms are increasingly developing strategic partnerships with their suppliers and customers and implementing *supply chain collaboration* initiatives in an effort to reduce waste in their procurement and order fulfillment processes (Porter 1985).

The intent of supply chain collaboration is to gain additional business benefits beyond those obtained by simply exchanging and integrating information between suppliers and their customers. Collaboration usually involves tactical joint decision-making among the partners in the areas of collaborative planning, forecasting, distribution, and product design (Horvath 2001; Kumar 2001). Collaboration can also involve strategic joint decision-making regarding the management of partnerships and supply and distribution network design.

Researchers differ on how strictly they use the term "supply chain collaboration." Some emphasize that collaborative relationships are cooperative rather than adversarial or focused on price (Lamming 1993). However, most relationships are not truly collaborative and usually involve some imbalance of power that is wielded to the detriment of one partner (Bensaou 1999). The presence of true collaboration often depends on whether you talk to the buyer or the supplier. Other researchers use the term as a synonym for specific collaborative processes such as Collaborative Planning, Forecasting, and Replenishment (CPFR) or technologies such as electronic meeting rooms. This study defines supply chain collaboration more broadly as "any kind of joint, coordinated effort between two parties in a supply chain to achieve a common goal". Because it is not always clear whether a supply chain initiative is truly collaborative, this dissertation does not distinguish between supply chain management, coordination, or collaboration.

Supply chain management initiatives can be highly collaborative or can involve one party sharing information or coordinating their processes with another party. The focus of the initiative can be on operational, tactical, or strategic processes, or a combination of them. As shown in Figure 2.3, operational-level supply chain management initiatives focus on exchanging and integrating information between partners using interorganizational information sharing techniques such as EDI or extended ERP as well as transaction-cost reduction programs such as Vendor Managed Inventory (VMI). At the tactical level, programs such as CPFR, Continuous Replenishment (CRP), or sharing of Point-of-Sale (POS) demand information move beyond a focus on transactional efficiency and attempt to achieve further top- and bottom-line benefits through coordinating supply and demand (Barratt and Oliveira 2001). Finally, strategic-level applications of supply chain management involve gathering competitive intelligence and supporting decision-making about supply chain partnerships and network design.

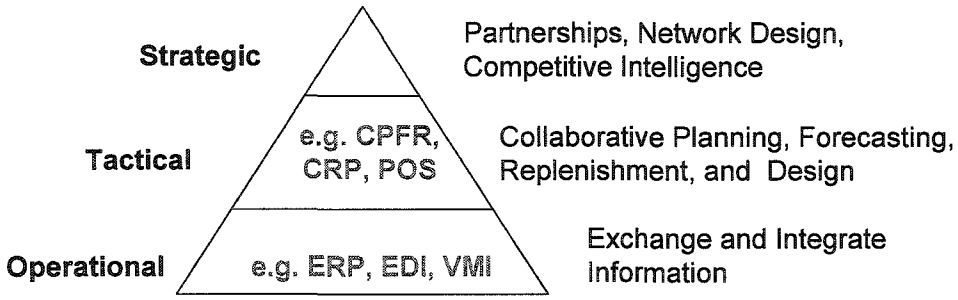

Figure 2.3 - Examples of Supply Chain Management Initiatives

2.3 Supply Chain Management Information Systems (SCM IS)

Traditionally, many supply chain activities have involved the usage of manual and semi-automated phone, fax, and email systems in addition to face-to-face and paper-based transactions. For some functions, such as establishing relationships and initial contract negotiations, these methods are indispensable and unlikely to be replaced completely by more automated systems. However, many supply chain processes can be made more efficient by employing information technology to reduce search costs (Bakos 1997), improve information sharing, minimize errors and rework, and free up resources to work on more value-added tasks (O'Leary 2000).

SCM IS are enterprise or interorganizational ICTs used to coordinate information in a supply chain. SCM IS can support supply chain management, coordination, and collaboration through three primary mechanisms: information integration, process and resource coordination, and reporting of performance measures to ensure accountability (Lee 2000). Individual purpose-built information systems, often termed *legacy systems*, primarily focus on meeting only one of these objectives, while more integrated systems such as ERPs are intended to meet all three requirements.

While operational-level IOS such as EDI systems often benefit customers more than suppliers (Lee *et al.* 1999), systems that support tactical and strategic collaborative planning help ensure that the benefits of coordination are sustainable and experienced by all members of the chain, not just the customers. This shared value enhances the sustainability of the relationship, while equalizing the bargaining power of the partners (Seidmann and Sundararajan 1998) and strengthening their level of trust (Karahannas and Jones 1999).

The migration towards extending information systems outside of the enterprise to include suppliers and partners typically follows an evolutionary approach. First, firms must integrate their systems and processes internally to allow seamless end-to-end processing of business transactions across functional areas such as purchasing, manufacturing, financial planning, and accounting (Diana 2001). Typically, firms will implement ERP systems or integrated legacy systems coupled with business process

reengineering initiatives to ensure that these processes can be performed efficiently before they are exposed to external partners (Heinrich 2001).

Once internal enterprise process and system integration has been achieved, firms can then implement an extended enterprise strategy using the same business process-centric approach as used for internal integration, except that the view of the business processes is more truly end-to-end rather than ending at the boundaries of individual firms. This phase requires coordination and standardization of mutually agreed upon business processes and the implementation or integration of interorganizational systems.

The final phase of an extended enterprise strategy is to collaborate fully with the integrated supply chain members to introduce innovative products, services, and distribution channels with a market responsiveness that creates a sustainable competitive advantage (Diana 2001). This phase requires SCM IS that support the higher level tactical and strategic capabilities outlined in Figure 2.3.

2.3.1 A Typology of Supply Chain Management Information Systems

There are many different types of SCM IS, such as EDI- or Extended Enterprise Application Integration (EEAI)-based systems, electronic marketplaces, or even non-computerized phone or fax-based systems. Unfortunately, there is often confusion and inconsistencies among the terms used to classify particular types of SCM IS[7].

Adding to the confusion is the considerable overlap in the technologies used and the capabilities provided by different types of SCM IS. Many firms adopt a portfolio of ICTs for supporting their supply chain, which frequently contain a mix of EDI, ERP, and procurement solutions, and it is difficult to classify such hybrid systems as strictly one type or another (Dagenais and Gautschi 2002). As with ERPs, a subjective set of capabilities and attributes are often used to identify SCM IS, rather than more deterministic classification schemes.

Different types of SCM IS have different capabilities for supporting supply chain management, integration, and collaboration. To examine their commonalities, this study classifies SCM IS into three general types:

1. Message-based systems that transmit information to partner applications using technologies such as fax, email, EDI, or XML messages;
2. Electronic procurement hubs, portals, or marketplaces that facilitate the purchasing of goods or services from electronic catalogues, tenders, or auctions; and
3. Shared collaborative SCM systems that include collaborative planning, forecasting, and replenishment capabilities in addition to electronic procurement functionality.

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[7] For example, what Kaplan and Sawhney (2000) call an "e-hub," others use the terms "online public trading exchange" or "third-party electronic marketplace." To others, an e-hub is something different — an internal software platform for providing connectivity to trading partners (Stevens 2001), something which other researchers call a "portal" (Reddy 2001b). Similarly, using the term "portal" can lead to confusion unless one specifies whether it is a customer portal, supplier portal, or internal (corporate) portal and more importantly what capabilities it provides.

However, there are distinctions between different types of SCM IS in each of these three categories. Figure 2.4 illustrates the major differences between different types of SCM IS, using terms most commonly used in practice.

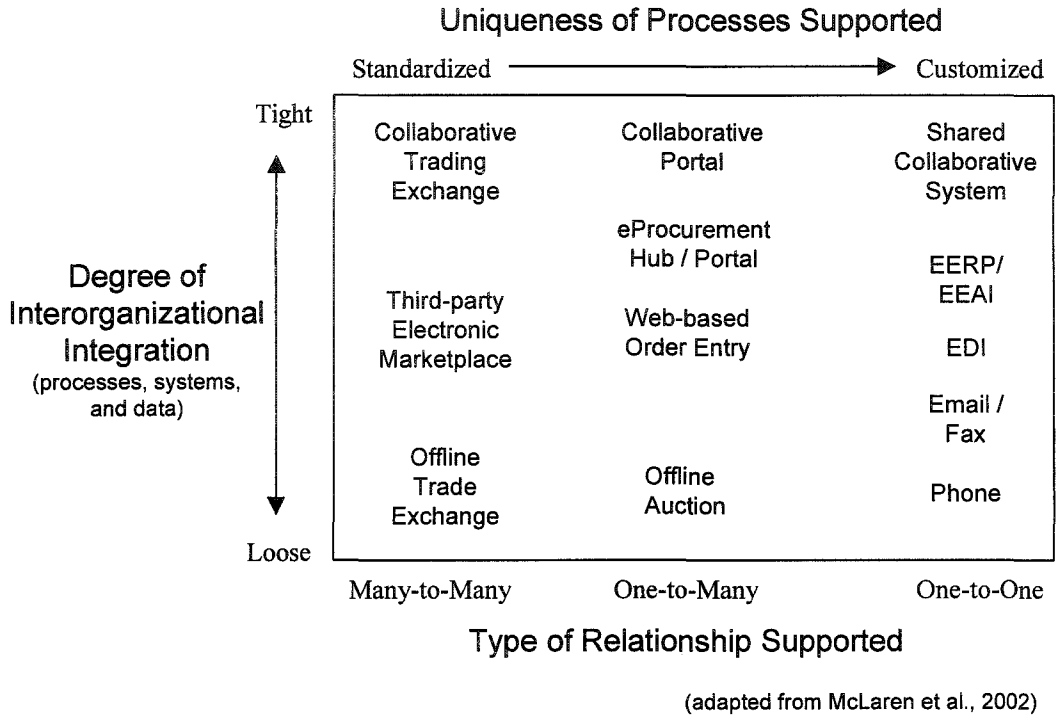

Figure 2.4 - Typology of Supply Chain Management Information Systems

A distinguishing attribute of SCM IS is the cardinality of the interorganizational relationships the system is designed to support. In other words, is the system optimized for supporting one-to-one relationships, such as EDI, or many-to-many relationships, such as multiple suppliers and customers interacting in an electronic marketplace? Somewhere in between these extremes lie systems designed for one-to-many relationships such as web-based order entry systems or auctions. This is not to say that EDI systems cannot be used to interact with dozens of suppliers and customers. Instead, each additional EDI customer-supplier link requires a significant effort to integrate the systems, processes, and data definitions between two partners, resulting in multiple one-to-one relationships with all of the EDI trading partners. In contrast, once a firm integrates its systems with an electronic marketplace, it can engage in multiple trading relationships with minimal incremental effort (Bakos 1997).

Similarly, the capability of the systems to support unique or customized supply chain processes between trading partners coincides with the type of relationship for which the system is designed. Since electronic marketplaces are designed for many-to-many supplier-to-customer relationships, these marketplaces require a high degree of standardization of business processes. In contrast, since systems using EDI or EEAI involve linkages between one customer and one supplier at a time, they can support more customized and unique business processes.

The other key variable that distinguishes SCM IS is the degree of integration achieved or required between the trading partners. Tight integration implies a close alignment of processes, systems, and data definitions between the partners, which allows information to flow efficiently between the firms. In contrast, loosely integrated trading partners have significant differences in business processes and data definitions that require substantial human intervention to pass information between the firms. Even though EDI achieves tight data integration, it often fails to facilitate the harmonization of business processes and systems among trading partners. By comparison, EEAI usually results in closer alignment of business processes and systems as partners are forced to agree upon a process, or use the process models embedded in the enterprise systems. Similarly, when joining an electronic marketplace, firms must align their processes and data definitions with the standards enforced by the marketplace.

The following sub-sections further describe and analyze the types of SCM IS available for supporting supply chain management and coordination. To highlight the capabilities of more sophisticated computer-based SCM IS, we begin with a brief description of the traditional less-automated approaches.

2.3.1.1 Phone / Fax / Email Systems

Phone, fax, and email systems all support highly flexible and customized trading relationships, though they lack standards in their usage. They are very suited for communicating unstructured information, but do not support communicating structured information into recipient systems electronically. As a result, they do not support a very tight degree of interorganizational integration. While email systems can transmit structured information, such as electronic purchase orders directly into a recipient system, that type of transaction should be classified as EDI. In this classification, it is assumed that phone, fax, and email messages contain unstructured text or images.

The net benefits accrued from information sharing using phone, fax, and email systems are limited mainly by the fact that the information communicated is difficult to integrate into a receiver's systems without manual processing and data translation.

2.3.1.2 Offline Auctions / Offline Trade Exchanges

Offline auctions involve one supplier and many customers (in a forward auction) or one customer and many suppliers (in a reverse auction). As the auction process usually focuses on price as the prime decision variable, they are best suited for commodities.

Offline trade exchanges help coordinate similar markets, yet are designed to support many-to-many relationships. Both offline auctions and trade exchanges support only a limited degree of interorganizational integration, as the systems and data are not electronically integrated, and the business processes among the trading partners are often disparate and uncoordinated.

Offline auctions and exchanges may yield benefits to a supply chain in increased market efficiency and reduced searching costs, which results in a moderate product and process cost reduction. However, as the information exchanged is typically not integrated with another system, there is minimal benefit in terms of increased responsiveness of the supply chain or reduction of inventory. As a result, many former offline auctions and exchanges have migrated to online electronic marketplaces (such as the General Electric Trading Exchange) to increase the benefits of integration and coordination among their members.

2.3.1.3 Electronic Data Interchange

The traditional method for businesses to exchange operational information electronically has been through a process known loosely as Electronic Data Interchange (EDI)[8]. Numerous studies have shown that EDI can reduce transaction-processing costs to near-negligible levels (Mukhopadhyay *et al.* 1995; O'Leary 2000). However, the total cost of ownership of EDI systems is substantial due to the systems and data integration efforts required. Furthermore, this integration effort usually requires a large amount of "hard-coded" data translations, which results in a system that is less flexible in adapting to changing partners, processes, and data structures (Konsynski 1996; Mukhopadhyay *et al.* 1995).

Since most firms are incapable or unwilling to support EDI transactions with numerous diverse partners, EDI trading networks often follow a hub-and-spoke architecture centred on the dominant customer rather than a web-like network. For example, in the retail sector, Wal-Mart has had sufficient influence with its suppliers to mandate the use of proprietary formatted EDI messages in order to do business with Wal-Mart (Macht 1995). This arrangement creates a barrier to entry for Wal-Mart competitors, as it makes it less likely that the suppliers will adopt different EDI message formats for smaller customers who have a different data structure than Wal-Mart. Once the balance of power changes or more flexible collaboration alternatives become available to its suppliers, Wal-Mart may be forced to reconsider this strategy. In general, the inflexibility of the EDI hub-and-spoke model has disadvantages to both suppliers and customers, as it makes it costly to share information electronically with alternative trading partners.

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[8] EDI is not a type of system or ICT, but rather a standards-based messaging methodology for formatting and communicating business transactions between organizations. As is common, this study uses the term EDI to imply an EDI-based ICT that supports primarily one-to-one transactions (unlike electronic marketplaces or procurement systems that may also utilize EDI messages but support higher degrees of process coordination).

2.3.1.4 Extended Enterprise Application Integration / Extended ERP

Extended Enterprise Application Integration (EEAI), sometimes known as "Web Services," is also a standards-based messaging approach to integrating systems similar to EDI. However, it usually implies the use of XML-formatted messages and integrated enterprise-wide systems rather than rigid EDI formats and disparate legacy systems. EEAI in a supply chain usually involves one-to-one integration between enterprise applications including legacy systems, ERP, SCM, or Advanced Planning and Scheduling (APS) systems.

Extended ERP (EERP or ERP II) involves the sharing of information electronically between two ERP systems, and can be done using industry-standard or proprietary EDI or XML formats. However, it increasingly uses open XML formats rather than traditional EDI messaging. Since EERP is a type of EEAI, this study does not further distinguish between the two.

Compared to traditional EDI, EEAI or EDI using XML provides a more efficient means of sharing structured data between firms (Glushko 1999). However, one can imagine that there is little benefit to every organization using their own XML schema. Instead, industry groups and software vendors have banded together to try to establish their own XML vocabularies and schema repositories. However, even in single industries, there are competing XML vocabularies, often spearheaded by competing firms or solution providers seeking industry dominance (McLaren 2001).

2.3.1.5 Web-based Order Entry Systems

Web-based order entry systems, sometimes referred to as business-to-consumer (B2C) or business-to-business (B2B) web sites or customer portals, enable customers to interact directly with a supplier's sales order system. As opposed to eProcurement applications, web-based order entry systems reside on a supplier's computers. Since the customer manually enters the information, the degree of systems and data integration between the customer and supplier is loose, even though the supplier's systems may be internally integrated. Furthermore, since the customer must conform to the supplier's business processes, the degree of process integration or coordination between the two parties is also loose.[9]

With web-based order entry systems, the information exchanged between customers and suppliers is consistent with the supplier's systems, resulting in lower error rates and less rework of information, as compared to voice- or paper-based transactions. However, while suppliers do not need to translate the information (as it is already entered into their systems), customers are required to do mental translations of their procedures and information into the procedures and formats required by the supplier's order entry system. Thus, while suppliers experience efficiency gains from the integration, customers

[9] If transactions are predominately communicated electronically rather than entered manually, these systems are better classified as EDI or EEAI systems (which are discussed in the preceding sections).

get fewer benefits, especially after having to learn how to interact with several different supplier web sites.

2.3.1.6 Electronic Procurement Hubs / Portals

Systems that support electronic procurement of goods or services typically take the form of customer or supplier portals, hubs, marketplaces, or trading exchanges[10]. Procurement hubs or portals are typically web-enabled SCM IS that allow a firm to electronically integrate its systems and processes with those of its trading partners.

An "electronic procurement portal" usually includes electronic supplier catalogues and functionality to submit purchase orders electronically to the supplier from within the portal application. Typically, the customer performs most of the effort of integrating the supplier catalogues into the electronic procurement system. A "supplier portal or hub" usually refers to a web site belonging to a firm that allows its suppliers to integrate their systems and processes with those of the firm (Stevens 2001). This dissertation refers to both types as electronic procurement portals. In contrast, a "customer portal" is another term for a web-based order entry system, which was discussed in the preceding section.

Electronic procurement systems increase the efficiency of trading partners by integrating the data, processes, and systems utilized in a supply chain. They can lead to lower product prices through spending consolidation and process efficiencies (Archer and Yuan 2000). However, the biggest savings often come from ensuring purchasing compliance by reducing off-contract buying and forcing purchases to be made against established contracts (Hope-Ross *et al.* 2000).

The benefits of electronic procurement solutions come at a cost of the integration and translation efforts required to facilitate electronic transactions between the partners (Archer and Gebauer 2000). Though electronic procurement can result in lower transaction costs, the expense of maintaining different electronic catalogues for different customers and integrating these into another firm's systems can be high (Ginsburg 1999). However, as integrating and aggregating information between applications in a supply chain using portal technology can be done incrementally and often quite cheaply, the payback period is usually much shorter than large-scale supply chain integration projects involving enterprise application integration (Reddy 2001b).

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[10] There are usually architectural differences behind these terms; however, the terms are often used interchangeably (e.g., Dagenais and Gautschi 2002; IDC 2001; Kaplan and Sawhney 2000; Rayport and Jaworski 2002) and their distinction is not important to this dissertation. In general, electronic procurement systems, hubs, or portals focus on facilitating electronic catalogue-based orders from select supplier partners, whereas electronic marketplaces (which are discussed in the next section) are geared towards competitive sourcing and auction mechanisms.

2.3.1.7 Electronic Marketplaces / Electronic Trading Exchanges

Electronic marketplaces or trading exchanges "are online business-to-business (B2B) community groups that link participants to a global network of buyers and sellers" (Stevens 2001, pg. 30). They include public marketplaces hosted by a third-party and private trading exchanges hosted by a supply chain participant. They usually include capabilities for product sourcing and ordering such as electronic catalogues, online auctions, and sometimes include approvals routing and contract management capabilities (Archer and Gebauer 2000). Public trading exchanges can be hosted by individual distributors (such as W.W. Grainger for indirect materials), consortiums (such as Covisint for automobile manufacturers), or third party market makers (such as CommerceOne, Chemdex, or eSteel) (Dagenais and Gautschi 2002; Kaplan and Sawhney 2000). However, because of factors such as interorganizational trust and market liquidity (attracting enough participants and transactions), private trading exchanges have typically been more successful than public ones (Dagenais and Gautschi 2002).

There are several obstacles to participating fruitfully in an electronic marketplace including supplier resistance, buyer resistance, connectivity, and ROI issues (Dagenais and Gautschi 2002; Stevens 2001). Initially, suppliers have been reluctant to join electronic marketplaces as the highly competitive auction process has typically focused on attaining unsustainably low prices. Price-focused auctions commoditize the goods or services sold and drive suppliers, who are unwilling to further reduce their margins, to seek alternative trading relationships in which they can compete on non-price terms such as quality and service levels (White 2000). In order to gain more acceptance with suppliers, electronic marketplaces increasingly facilitate negotiations on other terms such as quality, service level, and payment terms (Stevens 2001).

Likewise, buyers are often hesitant to join marketplaces that do not support the robust types of negotiations required for long-term successful relationships. They also have legitimate concerns about having their supply chain transactions and planning forecasts so easily visible to their competitors. Furthermore, buyers in industry-specific marketplaces such as Covisint have found it difficult to come to agreement with their business rivals on the required infrastructure, processes, and standards. The result has been that few electronic marketplaces have achieved the trading volumes originally budgeted for and many have been dissolved within years of their launch (Dagenais and Gautschi 2002; Stevens 2001). Nonetheless, as technology and standards evolve, electronic marketplaces hold considerable promise for reducing transaction costs and enabling tighter collaboration throughout the supply chain.

2.3.1.8 Shared Collaborative SCM IS

The IOS discussed so far are all similar in their approach in facilitating collaboration through system integration. In contrast, the use of shared or jointly owned collaborative systems takes a different approach that eliminates much of the integration and translation efforts, but instead focuses on reaching mutual agreement on shared processes and information systems. These systems include jointly-owned, dedicated SCM

IS or conventional planning, forecasting, and product design modules from ERP or APS systems such as SAP or i2, which have been made accessible for partner access.

Through their support of joint planning initiatives such as CPFR, shared collaborative SCM IS can greatly reduce the bullwhip effect and yield more accurate demand forecasts (Barratt and Oliveira 2001). Both suppliers and customers jointly agree upon supply and demand forecasts and coordinate their promotion and distribution strategies. The result is more predictable demand, which lessens the amount of inventory required in the supply chain and reduces the amount of exception processing and expediting required, leading to cycle time reduction and service level gains (Anderson and Lee 1999; Mentzer *et al.* 2000). This joint collaboration allows for a high level of market intelligence to be shared throughout the supply chain, as customers, distributors, and suppliers can all share information about customer needs (Anderson and Lee 1999).

As in any tightly integrated relationship, the process coordination costs involved with shared collaborative SCM IS are high, as each partner must adapt its own unique business processes to the jointly coordinated process. Similarly, both parties must agree on a mutual data format and must translate and integrate the shared data with their own systems, resulting in high data translation and integration costs. However, since the shared system acts like a single hub, the system integration costs are typically not as high as in many point-to-point EDI or EEAI solutions if there are several partners. Furthermore, since two or more partners invest in the shared system, the cost of switching partners is high. Although this limits flexibility, collaborative systems usually have large benefits for both partners in a trading relationship (Anderson and Lee 1999) and thus the relationships are often more sustainable and the costs of partnership instability are lower than in EDI systems, which typically benefit the customer more than the supplier (Emmelhainz 1988; Lee *et al.* 1999).

2.3.2 Benefits and Costs of SCM IS

In general, the benefits enabled by SCM IS can include not only the reduction of waste in the supply chain, but also increased responsiveness, customer satisfaction, and competitiveness among all members of the partnership (Chopra and Meindl 2001; Fogarty 2001; Industry Directions Inc. and Syncra Systems Inc. 2000; Mentzer *et al.* 2000; Supply-Chain Council Inc. 2002). Several studies specific to EDI implementations have found similar benefits, (Iacovou *et al.* 1995; Mukhopadhyay *et al.* 1995; Rockart and Short 1991). These studies have tended to focus more on cost reductions benefits, although they acknowledge that EDI also creates indirect benefits in process improvement and market responsiveness.

The costs of SCM IS include hardware, software, training, and implementation, as well as several less tangible costs. Although many studies attest to the transaction cost savings enabled by IOS (Mukhopadhyay *et al.* 1995; Seidmann and Sundararajan 1998), they often ignore hidden costs such as maintenance or errors or the opportunity costs of not being able to trade with other partners due to inflexible SCM IS. Less flexible SCM IS, such as EDI-based systems, have high costs for switching to other partners, which

results in reduced supply chain agility. This is because the inflexibility of EDI systems often precludes the firm from entering into relationships with other partners that could have been of higher value to the organization (Poirier and Bauer 2001).

For many firms, the goals of implementing SCM IS are to increase the efficiency and the agility of the supply chain, by sharing information electronically, reducing search costs, and enhancing communication with trading partners (McLaren *et al.* 2002). Each implemented supply chain management information system has different strengths and limitations that determine its suitability for supporting the strategic objectives of a firm. Since firms typically implement a portfolio of SCM IS solutions rather than a single IS, this dissertation does not further differentiate between different types of SCM IS within a firm and refers instead to a firm's collective SCM IS as if they were a single entity. The remainder of this dissertation develops a theory intended to apply to any type of supply chain management information system.

2.4 Analysis of Existing Theoretical Models of Strategic Fit of IS

In the IS literature, the dominant model of strategic alignment or fit, proposed and refined by several researchers (e.g., Henderson and Venkatraman 1992; Henderson *et al.* 1996; Luftman 2001; Papp 2001), suggests that for information systems, strategic alignment involves achieving fit between competitive strategies, IS strategies, organizational infrastructure and processes, and IS infrastructure and processes. These models conceptualize strategy using the rational "strategy as design" perspective (e.g., Ansoff 1965; Porter 1985) as opposed to the "strategy as emergent patterns of activities" perspective (e.g., Mintzberg 1978).

Although these rational and deterministic conceptualizations of strategic fit are useful for understanding strategic fit at a high level, limitations of existing theories have often prevented them from being developed into sufficiently detailed models to permit firms to understand and assess the strategic fit of *specific* IS in practice (Ciborra 2000). Models exist for assessing strategic fit between competitive strategies and IS strategies or architectures (e.g., Cragg *et al.* 2002; Luftman 2001). However, these models have not examined the strategic fit between a firm's competitive strategies and the organizational capabilities enabled by specific types of information systems. The following subsections examine the debates surrounding existing models of strategic alignment or fit and make recommendations for the development of a more detailed and satisfactory theoretical model of the strategic fit of IS capabilities.

2.4.1 Emergent Strategy versus Rational Strategy Perspectives

One reason the dominant rational models of strategic fit (e.g., Papp 2001) have not been operationalized at a more detailed level is the lack of differentiation between *intended* and *realized* or *emergent* competitive strategies, which creates measurement issues. The rational models generally assume that one could ask management what their competitive strategies are and implement IS whose capabilities support those strategies.

Measurement difficulties arise because a firm's actual patterns of strategic behaviour (their realized strategy) are often different from their stated or intended strategies (Clarke 2001; Conant *et al.* 1990).

A firm's realized strategies are typically different from their intended strategies due to environmental dynamism and difficulties in translating intent into action (Mintzberg 1978). Continual adjustment of intended strategies in response to the realized strategy produces an emergent pattern of strategic behaviour that results from the interplay of intended and realized strategy. Thus, the emergent view of strategy adopted in this dissertation suggests competitive strategy patterns emerge from the continuous interaction between strategic intent, strategic actions, and environmental changes. Similar emergent perspectives have also been useful in explaining the dynamic interaction between organizational behaviour, intent, and external environment (Pfeffer 1982) and the emergence of organizational change from the "unpredictable interaction between information technology and its human and organizational users" (Markus and Robey 1998, pg. 585).

Emergent competitive strategy patterns are often very different from the intended competitive strategies typically measured in studies adopting a rational view of competitive strategy (e.g., Ansoff 1965; Porter 1985). As a result, some IS researchers have debated the utility of attempting to align information systems with competitive strategy. Ciborra (2000) argues that strategic plans are difficult to ascertain and IS capabilities are continually drifting, thus alignment is difficult if not impossible. Knoll and Jarvenpaa (1994) highlight the infeasibility of trying to align IS to ever-changing strategies, structures, and environments and suggest that strategic flexibility may be more important than strategic fit, especially in turbulent environments. However, these critiques usually conceptualize strategy as a rational organizational design or plan (Ansoff 1965; Porter 1985), rather than an emergent pattern of competitive behaviour (Clarke 2001; Mintzberg 1978).

While strategic fit may be difficult to achieve in highly turbulent environments, empirical studies have found that even in highly turbulent environments, firms tend to exhibit relatively stable and consistent competitive strategy patterns — at least until a relatively infrequent marketplace upheaval occurs (Doty *et al.* 1993; Hambrick 1983; Miles *et al.* 1978; Snow and Hrebiniak 1980; Zahra and Pierce 1990).

This dissertation therefore adopts the view that it is inadvisable to attempt to align IS capabilities with a firm's stated or intended strategies as these frequently do not correspond with the firm's actual activities or realized strategies. Instead, the model developed in this chapter suggests examining the fit of IS capabilities with a firm's emergent and observable patterns of competitive strategy behaviour.

2.4.2 Emergent IS Capabilities versus Intended Functional Attributes

IS evaluation studies have traditionally focused on analysis of the functional attributes of the IS rather than the organizational capabilities supported by the IS. A

organizational capability is the ability of a firm to achieve its goals by leveraging its various resources (Ulrich and Lake 1990). Similarly, IS capabilities are organizational capabilities which are enabled by IS, while SCM IS capabilities are organizational capabilities enabled by SCM IS.

In the organizational literature, the "resource-based view of the firm" makes an important distinction between resources and capabilities. *Resources* are the basic inputs to production, while *capabilities* are the ability to do something with the resources. Resources are the source of a firm's capabilities, while capabilities are the source of a firm's competitive advantage (Grant 1991). Similarly, this study makes the distinction between IS functional attributes and IS capabilities. The functional attributes of information systems identify what functions the IS are *intended* to provide. In contrast, measuring the organizational capabilities enabled by implemented IS involves a more perceptual measure of *how well* the IS supports the firm's activities.

Several studies have noted that the benefits achieved from IS often depend as much on how they are implemented and utilized than on what functions they are designed to provide (Lucas 1981; Markus 1983; Parr *et al.* 1999; Robey and Boudreau 1999). The organizational capabilities enabled by a firm's IS will therefore differ from the intended design due to constant adjustment, re-configuration, and re-development (Markus and Robey 1998; Truex *et al.* 1999). Like competitive strategies, IS capabilities emerge from the dynamic interplay between intended and realized implementations of the IS.

The effectiveness of a firm's IS should therefore be measured by how well they meet a firm's goals rather than what functions they are designed to provide (DeLone and McLean 1992; Kaplan and Maxwell 1994). Thus, this dissertation focuses on the organizational capabilities enabled by implemented IS, rather than the functional attributes the IS are designed to provide. Furthermore, measuring the perceived capabilities of information systems (such as their level of support for internal analysis) incorporates additional factors such as usability, reliability, and management support of the IS, which are often of equal or higher importance as the functions that the IS provides (Holland and Light 1999; Lucas 1981; Parr *et al.* 1999; Wixom and Watson 2001).

2.4.3 State of Strategic Fit versus the Process of Strategic Alignment

Several researchers have also challenged the common assumption that a firm's competitive strategies should determine its IS strategies, processes, and infrastructure. Yetton *et al.* (1995) suggest alignment should be viewed as an incremental and mutual process, rather than having to start with an understanding of a firm's strategy. In actuality, Henderson and Venkatraman (1992) note that any of the components of their model can be used to align the others, while Papp (2001) suggests aligning individual components with two others simultaneously to create a "fusion" of strategies with IS infrastructure. However, in contrast to these deterministic approaches, Ciborra (1991) notes that many examples of successful IS implementations appear to be the result of incremental "tinkering" rather than any conscious strategic alignment. Similarly, Peppard

and Breu (2003) suggest that IS strategy and business strategy coevolve together in a non-linear and often unpredictable fashion.

Rather than attempt to generalize about the process and direction of strategic alignment, this study instead focuses on modeling the *state* of strategic fit of IS[11]. As a firm's competitive strategies and the capabilities enabled by their information systems are constantly emerging, strategic fit will necessarily be in a continual state of flux. Despite this, for most firms, their emergent competitive strategy patterns and IS capabilities are relatively stable (Miles *et al.* 1978; Mintzberg 1978; Venkatraman *et al.* 1993) and a careful operationalization of these constructs is expected to give a useful assessment of the strategic fit of IS.

2.4.4 Configurational Theories versus Contingency Theories

Contingency theories investigate the relationships between a limited number of variables of interest and a specified outcome. The underlying premise is that outcomes are dependent on the degree of fit between the independent variable(s) and additional interacting variables (Drazin and Van de Ven 1985). For example, in a contingency theory, organizational performance might be hypothesized to be contingent on the presence or quantity of other interacting variables such as the adoption of information systems and the stability of the industry. Due to the constraints of multivariate measurement and analysis, contingency theories typically must attempt to control for or reduce a large number of interacting variables into a manageable number of variables and relationships (Meyer *et al.* 1993).

Fisher (1997) proposes a popular contingency theory involving the fit between supply chains and the products involved. The theory suggests configuring a firm's supply chain and SCM IS to optimize either efficiency or responsiveness depending on whether the products involved were "functional" or "innovative." Fisher's bivariate conceptualization of fit is useful for analyzing less complex supply chain cases where the product type is homogeneous. However, many supply chains need to optimize both efficiency and agility depending on the product, process, customers, and other interdependent variables (Reddy and Reddy 2001). Similarly, for other types of IS, complex interdependencies among multiple variables usually exist, limiting the usefulness of contingency theories for exploring complex multidimensional constructs such as the strategic fit of IS capabilities.

In contrast, configurational theory can be used to reduce the complexity of multidimensional analyses by identifying consistent patterns and groupings of research variables (Doty *et al.* 1993; Meyer *et al.* 1993). A configuration is "any multidimensional constellation of conceptually distinct characteristics that commonly occur together" (Meyer *et al.* 1993, pg. 1175). Like systems theories, configurational theories are more holistic and less reductionist than contingency theories (Venkatraman and Prescott 1990).

[11] Studies that examine the process of strategic alignment are rare, although two particularly informative case studies include Reich and Benbasat (2000) and Broadbent and Weill (1993).

Configurational theories also employ the concept of equifinality, which assumes that equivalent outcomes can arise from different configurations, antecedents, or paths (Delery and Doty 1996).

The model developed in this dissertation uses configurational theories to reduce the complexity of the analysis to adopt a more systems-oriented perspective. By comparing the theoretically ideal configurations or profiles with those reported, the model avoids the infeasibility of correlating multiple interdependent variables (Venkatraman 1989a). This approach of using normative configurations is well established in the fields of organizational analysis (Meyer *et al.* 1993; Van de Ven and Drazin 1985), strategic management (Ansoff 1965; Miles and Snow 1978; Mintzberg 1978; Porter 1985; Shortell and Zajac 1990; Venkatraman and Prescott 1990) and information systems strategy (Kearns and Lederer 2001; King and Teo 1997; Sabherwal and Chan 2001).

2.4.5 Strategic Fit as Profile Deviation

Venkatraman (1989a) identifies several alternative conceptualizations of organizational fit including: fit as matching or co-varying variables; fit as moderating or mediating variables in contingency relationships; fit as internally consistent *gestalts* or configurations; and fit as deviation from an ideal profile or configuration. The gestalts and profile deviation conceptualizations are good candidates for the model developed in this dissertation, as this configurational approach can lead to a more holistic, systems-oriented view of organizational phenomena than reductionist univariate or bivariate contingency approaches (Meyer *et al.* 1993; Venkatraman 1989a). For future confirmatory studies, the profile deviation approach is preferred as it enables a quantitative measure of relative fit to be generated (Van de Ven and Drazin 1985), which is useful for validating the model and for examining the relationship between fit and outcomes such as organizational performance (Venkatraman 1989a).

An alternative approach to conceptualizing fit would be to study bivariate IS capability-strategy pairings and determine if the two are associated with some measure of success of the IS. However, determining the ideal IS capabilities for each possible competitive strategy variable would be infeasible due to the number of relationships and interactions involved. Instead, the analysis can be simplified by investigating competitive strategy *archetypes* or configurations, which are used to generate ideal IS capabilities profiles for a firm.

2.4.6 Summary of Desired Attributes for Theory Development

The preceding analysis identified several desired attributes for developing a theory of the strategic fit of IS capabilities that is operationalizable for assessing specific types of IS. These attributes include a theory that:

1. Conceptualizes competitive strategy as an emergent pattern of strategic activities rather than intended or stated strategic designs;

2. Focuses on the emergent organizational capabilities enabled through the implementation of IS, rather than the intended functional design of the IS;
3. Addresses the state of strategic fit rather than the process of strategic alignment;
4. Adopts a systems theory perspective using configurational rather than contingency theories; and
5. Models strategic fit as the deviation from ideal profiles.

2.5 Conceptual Framework for Developing Model of Strategic Fit of SCM IS

As described in Chapter 1, the objective of this dissertation is to develop an operationalizable model of the strategic fit of the capabilities of a firm's SCM IS. In a review of the literature, it became evident that the problem of *how* to determine the strategic fit of a firm's IS capabilities is compounded by a lack of clarity around how best to conceptualize and operationalize the constructs. Thus, an operationalized model of the strategic fit of SCM IS is required as well as further exploration of the research constructs. There is little pre-existing theory that addresses the fit of IS capabilities specifically and that could be used to derive testable hypotheses. Therefore, the focus of this research is to explore and develop an empirically supported theory of the strategic fit of SCM IS.

As noted in the previous section, holistic models of strategic fit that were suitable for examining the capabilities of specific types of IS were not found. This study draws upon the previous studies described in this chapter to propose a conceptual framework for exploring the strategic fit of SCM IS (see Figure 2.5). In particular, studies of fit between competitive strategy and IS strategy (e.g., Henderson *et al.* 1996; Sabherwal and Chan 2001) and fit between competitive strategy and supply chain strategy (e.g., Singh *et al.* 2001) have guided the conceptual framework, as described in further detail in the following sections.

The framework conceptualizes strategic fit of SCM IS as a measure of how well SCM IS support the competitive strategies and supply chain integration requirements of a firm (see Figure 2.5). If a firm's SCM IS possess capabilities that are theoretically ideal for a given set of competitive strategy patterns, they are considered to have a high level of strategic fit with the firm.

The organizational capabilities that should be provided by a firm's SCM IS are determined by the firm's competitive strategies and level of supply chain integration. The initial definition of strategic fit of SCM IS in Table 1.1 does not explicitly differentiate between competitive strategies in general and specific strategies for supporting supply chain management or integration. As detailed in the following sections, most conceptualizations of competitive strategy do not explicitly mention strategies for supply chain integration. However, the analysis of supply chain integration literature discussed in this chapter suggests the support SCM IS provide for supply chain integration is relevant to the strategic fit of SCM IS. Therefore, the conceptual framework in Figure 2.5 explicitly includes requirements for supporting supply chain integration in the development of the theoretically ideal capabilities of SCM IS.

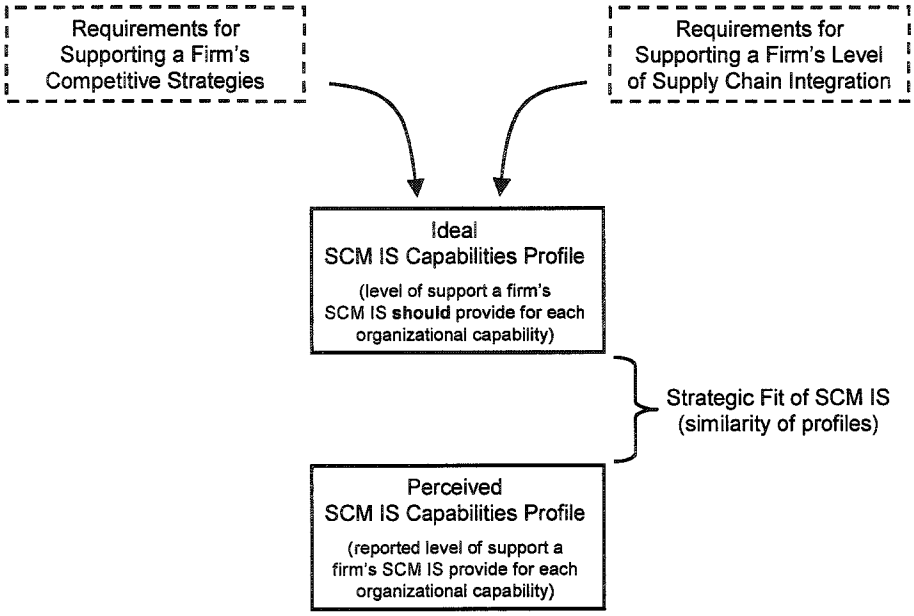

Figure 2.5 - Conceptual Framework for Model of Strategic Fit of SCM IS

The conceptual framework is grounded in configurational theories of alignment between competitive strategy and information systems proposed by Sabherwal and Chan (2001), King and Teo (1997), and Gupta *et al.* (1997). The model supports propositions by several researchers that supply chain successes are governed by how well IS support a firm's competitive strategies and supply chain requirements (Anderson and Lee 1999; Chopra and Meindl 2001; Reddy and Reddy 2001; Shah *et al.* 2002; Singh *et al.* 2001). The major components of the conceptual framework are described below.

2.5.1 SCM IS Capabilities

This sub-section provides an overview of existing conceptualizations of IS capabilities that are relevant to the development of an integrated model of SCM IS capabilities. In a review of previous studies of SCM IS and other enterprise and interorganizational IS, the capabilities of SCM IS that appeared to be most relevant to supply chain coordination initiatives were identified. Several researchers have studied the various organizational capabilities which can be enabled by IS in general (Bakos and Treacy 1986; Sethi and King 1994). Firms with a more cost-focused strategy require greater IS support for operational efficiency, while those focused on differentiation strategies require more operational flexibility (Camillus and Lederer 1985; Porter 1985). Support for operational efficiency requires IS that enable product and transaction costs to be controlled (Simons 1987). This can be accomplished through IS that improve

information coordination, reduce errors and administrative costs, and enable the standardization of business processes (Gattiker and Goodhue 2000).

Support for operational flexibility or agility requires IS that enable the rapid detection and response of competitive market opportunities (Sambamurthy *et al.* 2003). This can be enabled by IS that enable the modularization and reconfiguration of business processes as well as ease of information sharing with customers, suppliers, and other business partners (Bogucki Duncan 1995; Sambamurthy *et al.* 2003).

Operational efficiency and flexibility have traditionally been viewed as incompatible goals (Adler *et al.* 1999; Reddy 2001a). IS are often viewed as inhibitors rather than enablers of flexibility (Allen and Boynton 1991). However, SCM IS can enable operational flexibility by automating routine tasks and freeing up resources to concentrate on non-routine tasks (O'Leary 2000). SCM IS can also enhance flexibility by facilitating product and supplier searching (Bakos 1997; Kaplan and Sawhney 2000) and the management of multiple strategic sourcing and distribution relationships (Kalakota and Robinson 2001). SCM IS designed for flexibility may also improve operational efficiency by reducing transaction and product costs (Christiaanse and Kumar 2000).

On the other hand, SCM IS designed for efficiency have traditionally been relatively inflexible. EDI systems can reduce transaction-processing costs to near-negligible levels (Mukhopadhyay *et al.* 1995; O'Leary 2000). However, the systems and data integration efforts required to achieve this may result in a system that is less flexible in adapting to changing partners, processes, and data structures (Konsynski 1996). More flexible Internet technologies such as XML and web services promise to reduce the tradeoffs in achieving efficiency and flexibility, although the evidence is mostly anecdotal. Although there appear to be various interactions and overlaps between operational efficiency and flexibility, studies that examine both constructs in contemporary SCM IS were not found.

Planning and analysis capabilities are also widely cited in IS studies (Sabherwal and Chan 2001; Segev 1989; Venkatraman and Ramanujam 1987). However, the relative importance of each and distinctions between different types of planning and analyses vary. SCM IS increasingly incorporate support for collaborative planning, forecasting, and replenishment (CPFR) capabilities to enable tighter supply chain coordination between partners (Peterson 1999). Through their support of joint planning initiatives such as CPFR, SCM IS can greatly reduce the bullwhip effect and yield more accurate demand forecasts (Barratt and Oliveira 2001).

Traditional conceptualizations of IS capabilities have focused on a firm's internal operations and processes. However, more thorough theoretical models should extend the conceptualization of capabilities beyond the boundaries of a single firm and address the interorganizational coordination mechanisms (Bakos and Treacy 1986). Due to the unique requirements of interorganizational coordination (den Hengst and Sol 2001), it is often unclear whether the preceding conceptualizations apply to internal IS, interorganizational IS, or both.

SCM IS in particular must not only support internal coordination, but must also support interorganizational collaboration through the exchange and coordination of operational and tactical information such as electronic orders and supply and demand forecasts (Kumar 2001). The focus of this coordination can be internal, external, or both (Moncrieff and Stonich 2001; Poirier and Bauer 2001). SCM IS that provide a high level of support for external coordination have been successfully deployed at companies such as Dell Computers and Wal-Mart, although for other companies the focus is still on internal coordination (Dagenais and Gautschi 2002; Holland and Light 1999; Roloff *et al.* 2001). From these studies, it remains unclear whether a distinction between internal and external coordination is warranted, or whether the concepts are covered by conceptualizations of operational efficiency and flexibility.

Researchers have studied various IS capabilities such as operational efficiency (Sabherwal and Chan 2001; Sethi and King 1994) or strategic planning (Venkatraman and Ramanujam 1987; Zviran 1990), but integrated models were not found which would be suitable for analyzing SCM IS specifically. Although many of the aforementioned studies are expected to apply to SCM IS, there are sufficient ambiguities in the theories to warrant an exploratory field investigation of SCM IS capabilities. For example, at a high level, should long-term planning capabilities be distinguished from short-term? Similarly, is it useful to distinguish between internal and external process coordination capabilities or internal and external analysis capabilities?

To investigate these ambiguous constructs in a real world context, the various IS capabilities applicable to SCM IS discussed in the preceding sections are examined as part of the field study. Using the resource-based view of the firm as the theoretical lens, existing studies of IS capabilities suggest the candidate SCM IS capabilities should include: operational efficiency and flexibility; planning and analysis; and internal and external business process coordination.

2.5.2 Competitive Strategy Patterns and Configurations

Configurational theories have been widely used in competitive strategy studies such as the idealized typologies developed by Ansoff (1965), Miles and Snow (1978), Mintzberg (1978), and Porter (1985). Each typology focuses on different aspects of competitive strategy and thus their utility depends on how well they model the research variables of interest to a particular study (Miller 1986). For example, Mintzberg's (1978) typology of simple, machine, organic, and divisionalized firms focuses mainly on the structure and process of strategy formulation, while Porter's (1985) strategic archetypes of cost leadership, differentiation, and focus addresses the generic strategies that firms use to compete, and does not focus on structural and process-related variables. Similarly, Miles and Snow's (1978) Defenders, Prospectors, and Analyzers strategic archetypes focuses largely on the processes of innovation and its required structures and strategies (Miller 1986).

A review of the literature reveals several alternative competitive strategy typologies (Ansoff 1965; Miles and Snow 1978; Porter 1985). The Miles and Snow

(1978) competitive strategy typology is one of the most popular strategic typologies used in strategy and information systems studies, due to its comprehensive treatment of strategy, structure, and processes, its support in empirical studies, and its predictive utility (Conant *et al.* 1990; Croteau and Bergeron 2001; Doty *et al.* 1993; Gimenez 1999; Hambrick 1983; Miles *et al.* 1978; Shortell and Zajac 1990; Zahra and Pierce 1990). As opposed to the more one-dimensional models of strategic types such as Mintzberg (1978) and Porter (1985), Miles and Snow's (1978) archetypes have good predictive abilities and empirical support (Segev 1989; Shortell and Zajac 1990). It has been widely used and validated in numerous empirical studies of strategic fit (Doty *et al.* 1993; Hambrick 1983; Miles *et al.* 1978) including investigations of the strategic fit of IS organizational structures (Gupta *et al.* 1997; Tavakolian 1989) and IS systems capabilities strategies (Camillus and Lederer 1985; Sabherwal and Chan 2001). Furthermore, the Miles and Snow (1978) competitive strategy typology accounts for many of the high level differences between firms engaging in supply chain initiatives such as product innovativeness, rate of change of processes, or partnership characteristics (Conant *et al.* 1990; Sabherwal and Chan 2001; Segev 1989). Although the Ansoff (1965), Porter (1985), and Mintzberg (1978) typologies were initially examined, the Miles and Snow (1978) competitive strategy archetypes were selected to characterize firms deploying SCM IS for the aforementioned reasons.

According to Miles and Snow (1978), firms can be characterized according to their correspondence with ideal normative configurations that they termed Defenders, Prospectors, and Analyzers. These archetypes are internally consistent configurations of competitive strategy, structure, and processes, which were found in empirical studies of several industries (Miles and Snow 1978; Miles *et al.* 1978). Miles and Snow (1978) described the typical responses each ideal archetype adopts in response to their perceived environment. They studied marketing, production and distribution, and administrative problems that firms face and determined the responses that each of their archetypes have to these problems. Miles and Snow (1978) found that Defenders, Prospectors, and Analyzers each displayed unique patterns of responses to 11 dimensions of competitive strategy including: product-market breadth; market leadership, surveillance, and growth; process goals; competency breadth; infrastructure adaptability; administrative focus; planning; organizational structure; and control.

Miles and Snow's (1978) description of the competitive strategy archetypes is summarized in Table 2.1. At a high level, the Defender, Prospector, and Analyzer archetypes are often viewed as competitive strategies for operational efficiency, innovation, and risk minimization, respectively, although the actual descriptions are more detailed and multidimensional[12].

For each organization, consistent competitive strategy patterns can be observed and compared with the patterns found in Miles and Snow's (1978) competitive strategy

[12] Miles and Snow's (1978) studies also identified an additional strategic type known as Reactors, but since these firms do not appear to have an internally consistent strategy (Doty *et al.* 1993), the Reactor archetype is usually omitted from studies using the Miles and Snow typology (e.g., Hambrick 1983; Shortell and Zajac 1990).

archetypes. Thus, the degree of correspondence with each archetype can be determined. Following Doty *et al.* (1993), rather than ascribing each case to a single competitive strategy type, this study advocates analyzing how closely a case matches each of the Defender, Prospector, or Analyzer profiles. Knowing the degree of correspondence of the competitive strategy patterns of a firm with one of the Miles and Snow (1978) archetypes, one can then determine which SCM IS capabilities would be ideal for that case.

Table 2.1 - Competitive Strategy Archetypes

Competitive Strategy Archetype (Miles and Snow 1978)	**Typical Competitive Strategy Patterns** (after Conant et al. 1990; Miles and Snow 1978)
Defender (operational efficiency)	- High-quality standardized products and processes - Low prices achieved with economies of scale - Mechanistic organizational structure - High fixed-asset intensity - Highly cost-efficient but relatively few core technologies
Prospector (innovation)	- High research and development and market intelligence investments - Lower level of controls and operational efficiency - Organic organizational structure - Low fixed asset intensity - Flexible technologies, processes, and skills
Analyzer (minimize risk with proven opportunities)	- Maintains core products and adopts proven innovations - Large matrix organizational structure - Mix of processes and technologies for efficiency and flexibility
Reactor (quick response to market demands)	- Rapid, opportunistic responses to immediate market demands - Project-oriented processes and organizational structure - Negligible long-term planning - Inconsistent or uncoordinated responses to competitive environment

2.5.3 Level of Supply Chain Integration

Several studies indicate that in many supply chains, supply chain performance increases with the "maturity" of the supply chain practices, which usually coincides with the level of integration of the supply chain (Mentzer *et al.* 2000; Poirier and Bauer 2001;

Roloff *et al.* 2001). As discussed below, the level of supply chain integration[13] is the degree to which the processes, systems, and strategies used in a supply chain are jointly coordinated among the supply chain partners.

For many supply chains, such as automotive manufacturing or consumer packaged goods, progressing from low levels of supply chain integration to higher levels generally leads to higher levels of supply chain performance (Mentzer *et al.* 2000; Poirier and Bauer 2001; Roloff *et al.* 2001). However, for extremely fragmented supply chains where tight coordination between suppliers and customers would hinder flexibility to the degree that performance suffers, higher levels of integration are not always a desirable goal. For example, Dubois and Gadde (2000) suggest that supply chains in the highly fragmented construction industry have characteristics that hinder the development of high levels of integration.

The level of supply chain integration can be conceptualized as a scale progressing from local intraorganizational integration to interorganizational network optimization. Similar concepts include Venkatraman's (1991) levels of business transformation enabled by IT and Robey and Sales' (1994) levels of organizational interdependence.

Venkatraman (1991) describes five levels of business transformation that are made possible through information technology (IT) implementation. These include: Localized Exploitation; Internal Integration; Business Process Redesign; Business Network Redesign; and Business Scope Redefinition. While firms do not always perform these stages sequentially, in general, the higher the level, the greater the potential benefits, strategic impact, and degree of organizational change required.

Similarly, Robey and Sales (1994) applies Thompson's (1967) theory of interdependence of firms to describe different types of interorganizational systems (IOS). The first level of interdependence is "pooled dependency," whereby units are independent but share a common resource, such as a shared database or information portal. The second level is "sequential dependency," where output of a process becomes the input of a process in another organization, such as an EDI-based IOS. The third level of interdependency is "reciprocal dependency," wherein inputs and outputs flow recursively between the firms. A SCM IS example might be a collaborative portal used for joint supply chain planning with suppliers and buyers, such as the VWGroupSupply.com portal (Waheed 2001).

Kumar and van Dissel (1996) suggest that as the level of interdependence of firms increases, so does the potential for conflict, the impact of failed relationships, and the resulting risk. While higher interdependency can lead to many collaborative benefits, the information systems and coordinating mechanisms become more important and must rely less on rules and standards and more on joint planning, mutual adjustment, and trust. As

[13] Some studies use the term *level of supply chain maturity* instead of level of supply chain integration. This study prefers the latter term as it does not imply a sequential stage of growth, nor does it imply that more mature or integrated supply chains will perform better than less integrated supply chains.

such, while higher levels of supply chain integration may lead to more benefits, the risks, complexities, and importance of IOS are expected to increase as well.

As shown in Table 2.2, there is little agreement in terminology used to describe different levels of supply chain integration. In order to maximize the differentiability between these levels, a typology is presented that uses all five possible levels shown in the table and a terminology that is simple, precise, and agrees with accepted standard terms such as those of the Supply Chain Council's (2002) SCOR Model. The levels of supply chain integration used in this dissertation are: Functional Focus, Internal Integration, Linked Network, Integrated Network, and Optimized Network.

Table 2.2 - Level of Supply Chain Integration

Level of Supply Chain Integration (terms from this study)	**Level 1** **Functional Focus**	**Level 2** **Internal Integration**	**Level 3** **Linked Network**	**Level 4** **Integrated Network**	**Level 5** **Optimized Network**
Observable Patterns	Discrete processes managed at the department level. Performance measured at the functional level.	Company-wide processes managed at both functional and cross-functional process levels. Performance measured at the company, process, and diagnostic levels.	Core processes managed internally; info sharing with external partners. Outsourcing of non-core processes. Metrics defined by one firm. Joint performance monitoring and correction with partners.	End-to-end process mgmt., coordination, & collaboration with external partners. Alignment of business objectives and processes of each partner Joint metrics definition, monitoring, and correction with external partners.	Standardized, modular processes coordinated in real-time and executed by most capable partners. Standardized performance metrics monitored and corrected jointly at the company, process, and diagnostic levels.
Term used in Moncrieff and Stonich (2001)	Functional Focus	Internal Integration	External Integration		Cross-Enterprise Collaboration
Term used in Poirier and Bauer (2001)	Internal Supply Chain Optimization		Network Formation	Value Chain Constellation	Full Network Connectivity

2.6 Research Questions

The research objective of developing a theoretical model of the strategic fit of SCM IS can be addressed using the conceptual framework introduced in Figure 2.5. However, developing the conceptual framework into an *operationalizable* theoretical model requires several research questions to be addressed, as shown in Figure 2.6.

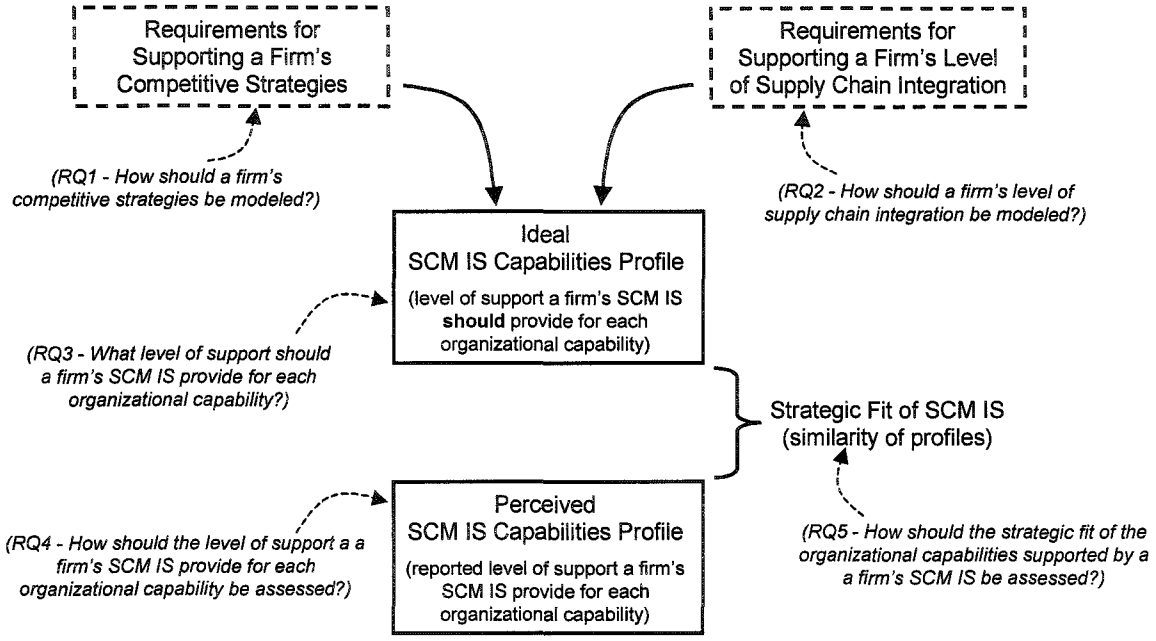

Figure 2.6 - Research Questions for Model of Strategic Fit of SCM IS

First, the dissertation must address the questions:

How should a firm's competitive strategies be modeled? *(RQ1)*

How should a firm's level of supply chain integration be modeled? *(RQ2)*

As described earlier in this chapter, various conceptualizations of the competitive strategy and supply chain integration constructs have been proposed and debated in several studies. Many of these conceptualizations have limitations when applied to this study. By addressing RQ1 and RQ2 using a multiple case study approach, this dissertation explores these constructs and develops more useful and well-grounded conceptualizations and operationalizations of these constructs.

The conceptual framework then proposes that a firm's competitive strategies and level of supply chain integration can be used to determine the theoretically ideal level of

support the firm's SCM IS should provide for various organizational capabilities. Thus, the study must address the question:

> *What level of support should a firm's SCM IS provide for each organizational capability?* *(RQ3)*

An analysis of prior studies in the areas of competitive strategy, supply chain integration, and information systems capabilities will address RQ3. However, first, an exploratory investigation must be conducted to determine which organizational capabilities are relevant to the study of SCM IS. An initial review of prior studies indicates there is currently no comprehensive model of SCM IS capabilities that would facilitate the detailed examination and assessment of the strategic fit of SCM IS. Previous studies have examined organizational capabilities enabled by various types of IS or organizational IS in general (Bensaou 1997; Sabherwal and Chan 2001; Venkatraman and Ramanujam 1987; Zviran 1990); however, no single model exists that is suitable for examining and evaluating the capabilities enabled by SCM IS specifically[14].

Studies specifically focusing on SCM IS have explored the organizational benefits of specific types of SCM IS, such as Electronic Data Interchange (EDI) systems (Lee *et al.* 1999; Mukhopadhyay *et al.* 1995), Electronic Marketplaces (Dagenais and Gautschi 2002; Kaplan and Sawhney 2000), or Extended Enterprise Resource Planning (EERP) systems (Green 2001). However, no empirically derived models were found that were suitable for analyzing the organizational capabilities supported by a range of SCM IS alternatives. As a result, firms face complex and risky decisions analyzing and selecting an appropriate SCM IS solution or ensuring that their implemented systems are aligned with their competitive strategies (Reddy and Reddy 2001). Thus, answering RQ3 requires integrating findings from previous studies with exploratory field research from this dissertation.

Next, to measure the perceived level of support a firm's implemented SCM IS provide for each SCM IS capability, the study must address the following question:

> *How should the level of support a firm's SCM IS provide for each organizational capability be assessed?* *(RQ4)*

A multiple case study approach will be used to explore how to operationalize the level of support a firm's SCM IS provide for each organizational capability.

Once the preceding questions have been answered, the perceived level of support a firm's SCM IS provides for each capability can be compared to the theoretically ideal levels to determine the strategic fit of the capabilities of the SCM IS. The use of a profile deviation approach is recommended by several researchers for examining the fit of two multi-dimensional constructs (Sabherwal and Chan 2001; Van de Ven and Drazin 1985; Venkatraman 1989a). However, for the model developed in this study, it is uncertain

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[14] For example, this dissertation found existing generic IS capabilities constructs such as "analysis" (Sabherwal and Chan 2001; Venkatraman 1989b) did not sufficiently discriminate between *internal* and *external* analysis, which subsequent interviews showed to be an important distinction in SCM IS.

whether such an approach will lead to valid findings that can be corroborated with other sources of evidence. Thus, the final research question to be addressed is:

> *How should the strategic fit of the organizational capabilities supported by a firm's SCM IS be assessed?* *(RQ5)*

The reliability, validity, and usefulness of the developed model for examining the strategic fit of a firm's SCM IS will be assessed by examining the findings from an exploratory multiple case study.

2.7 Chapter Summary

Effective supply chain management is increasingly important to the competitiveness of most firms. In an effort to maintain a competitive advantage, many firms are increasingly collaborating with their partners in order to increase supply chain efficiency while remaining agile enough to be responsive to rapidly evolving markets. SCM IS can be used to disseminate supply and demand information throughout the chain in near real-time, which greatly reduces the bullwhip effect (van Hoek 2001) and enables collaboration. These systems can reduce transactions costs by not only reducing the cost of performing the transactions or processes, but also by reducing the cost of monitoring and controlling the relationship (Clemons and Row 1992; Malone *et al.* 1987).

Information systems for supporting these varying degrees of supply chain integration and collaboration include three major types: message-based systems such as fax, email, EDI, or XML messages; electronic procurement hubs, portals, or marketplaces; and shared supply chain collaboration systems that include CPFR capabilities in addition to electronic procurement functionality.

Several studies have suggested that the success of IS is in part dependent on achieving strategic alignment between competitive strategies and IS strategies (Cragg *et al.* 2002; Gupta *et al.* 1997; Kearns and Lederer 2001; Sabherwal and Chan 2001). Researchers have proposed, refined, and debated models for studying the fit of competitive strategies with various high-level IS concepts (e.g., Henderson and Venkatraman 1992; Henderson *et al.* 1996; Luftman 2001; Papp 2001). However, the development of detailed operationalizable models suitable for exploring the strategic fit of the capabilities of *specific* types of information systems such as SCM IS has been hindered by limitations of the theories used.

To address the shortcomings of existing models of strategic fit of IS, a theoretically and empirically grounded model of the strategic fit of SCM IS is required that:

1. Focuses on the organizational capabilities realized through the implementation of the SCM IS rather than the intended functional design of the SCM IS;
2. Conceptualizes competitive strategy as an emergent pattern of strategic activities rather than intended or stated strategic designs;
3. Addresses the state of strategic fit rather than the process of strategic alignment;

4. Adopts a systems theory perspective using configurational rather than contingency theories; and
5. Models strategic fit as the deviation from ideal profiles.

A conceptual framework was presented for exploring the concept and measurement of the strategic fit of the capabilities of a firm's SCM IS. Concepts such as configurational theory, the resource based view of the firm, and emergent strategies and capabilites — all of which are underutilized in current IS literature — are used to ground the framework theoretically. The framework conceptualizes the strategic fit of SCM IS as the fit between the theoretically ideal and perceived levels of support a firm's SCM IS provide for various organizational capabilities. Several research questions were posed for further exploring, refining, operationalizing, and validating the theoretical model. These questions are addressed in the remainder of this dissertation.

This chapter provided a comprehensive overview of current issues and research in the area of strategic fit of SCM IS. Where possible, it used peer-reviewed studies of interorganizational information systems but the lack of such studies required including research from non-peer reviewed literature that may not be as scientifically rigorous. Clearly, there is a need for more empirically grounded theories that will help practitioners make better-informed decisions about SCM IS implementations.

The following chapter describes the research methodology for the study. The subsequent chapters present and discuss the findings of the field studies and their use in developing an operationalizable theoretical model of strategic fit of SCM IS.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the general research methodology guiding the study. The following section describes the multiple case study design, which generally used a positivist pattern-matching approach to develop and explore the theoretical model using case study evidence. Section 3.3 outlines the quantitative and qualitative data collection and analysis methods. The quantitative analyses used Likert-type questionnaire measures to examine the constructs for each of the cases. The qualitative methods primarily used pattern-matching techniques to compare and contrast the evidence between cases and with the theoretical model. Section 3.4 describes the cases and participants and the methods used for selecting each. Section 3.5 describes theoretically and methodologically related studies to compare and contrast the methods used in this study with exemplary studies from the literature. The chapter concludes with a discussion of ethical concerns including ensuring the reliability and validity of the findings.

3.2 Exploratory Multiple Case Study Design

To develop and explore a theoretically and empirically grounded model of the strategic fit of SCM IS, a methodology for building theory from multiple case studies (Eisenhardt 1989; Miles and Huberman 1994; Stake 1995; Strauss and Corbin 1998; Yin 1994) was used. A case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 1994, pg. 13). Since the theoretical model involves comparisons between the different types of competitive strategies exhibited by different firms, this dissertation emulates exemplary *multiple* case study designs from the IS literature (e.g., Jones and Price 2001; Sarker and Lee 2002) rather than more intensive single case study designs (e.g., Markus 1994; Walsham and Waema 1994).

Researchers often distinguish between *confirmatory* and *exploratory* research designs. The former seeks to test or confirm a specified relationship, while the latter defines possible relationships only in general terms and uses quantitative or qualitative data analysis to estimate and investigate the relationships (Hair *et al.* 1995). Typically, scientific research follows an iterative cycle through theory-building exploratory research followed by theory-testing confirmatory research, which then allows a researcher's conceptual models to be refined and further developed through more exploratory and confirmatory research (Straub 1989). This study is exploratory in nature as there is currently insufficient development of the theories and concepts related to the strategic fit of SCM IS that could be definitively tested or confirmed. Future confirmatory studies using the theoretical model and operationalization developed are anticipated.

Some researchers naively assume exploratory research is interpretivist and qualitative while confirmatory research is positivist and quantitative. In actuality, each of these is a separate concept that need not be associated with the others (Stake 1995). Positivists generally assume researchers can generate knowledge through an objective measurement of the singular reality of a phenomenon (Creswell 2003; Lee 1991). Interpretivists assume that different "realities" exist through the differing perspectives of the participants. Hence, interpretivist research typically spends considerable effort investigating the different experiences, motivations, and biases of the participants, as well as the hidden meanings in the words used to describe their view of reality. In contrast, this dissertation assumes that an objective understanding of the evidence can be gained by following rigorous positivist case study research methods (e.g., Yin 1994), while taking care to reduce bias by triangulating the findings using multiple sources of evidence and comparing patterns of evidence between participants, cases, and existing studies and theories (Creswell 2003; Eisenhardt 1989).

As this research is exploratory, the models were developed and refined concurrent with the data collection and analysis — rather than being completely specified *a priori* (Eisenhardt 1989; Strauss and Corbin 1998). Following Eisenhardt (1989), while care is taken to not be overly biased by pre-existing theories and hypotheses, some constructs developed from previous studies, preliminary data collection, and the previous experiences of the researcher were specified in the conceptual framework described in Chapter 2. This pre-specification helps ground the developed theories and ensure that they are more testable (Eisenhardt 1989).

In order to ensure the developed model was grounded in empirical evidence, the study iterated between data collection and analysis, theory-building, and validating the emerging model using informants from the supply chain field (Eisenhardt 1989; Strauss and Corbin 1998). Rather than following a sequential timeline from model development to data collection and analysis, the model was continuously revised in light of new evidence that refined or contradicted previous assumptions (Eisenhardt 1989). The theoretical model was developed, explored, and validated using a scientifically rigorous process outlined in Figure 3.1. This iterative process ensured the researcher's assumptions, theories, and methods were continually assessed and revised in order to produce findings that were consistent with the gathered evidence.

The gathering and analysis of the case study data began in April 2002 following a review of previous studies. To strengthen the research design, feedback on the conceptual framework, methods, and preliminary findings was gathered through presentations at the International Conference on Information Systems (ICIS 2002) Doctoral Consortium in Barcelona, Spain in December, 2002 and at the World Congress on the Management of Electronic Business Doctoral Consortium in Hamilton, Canada in January, 2003. The reviewers were supportive of the research and methodology and provided useful suggestions that were incorporated into this dissertation. The data collection, analysis, and development of the theoretical model concluded in January 2004.

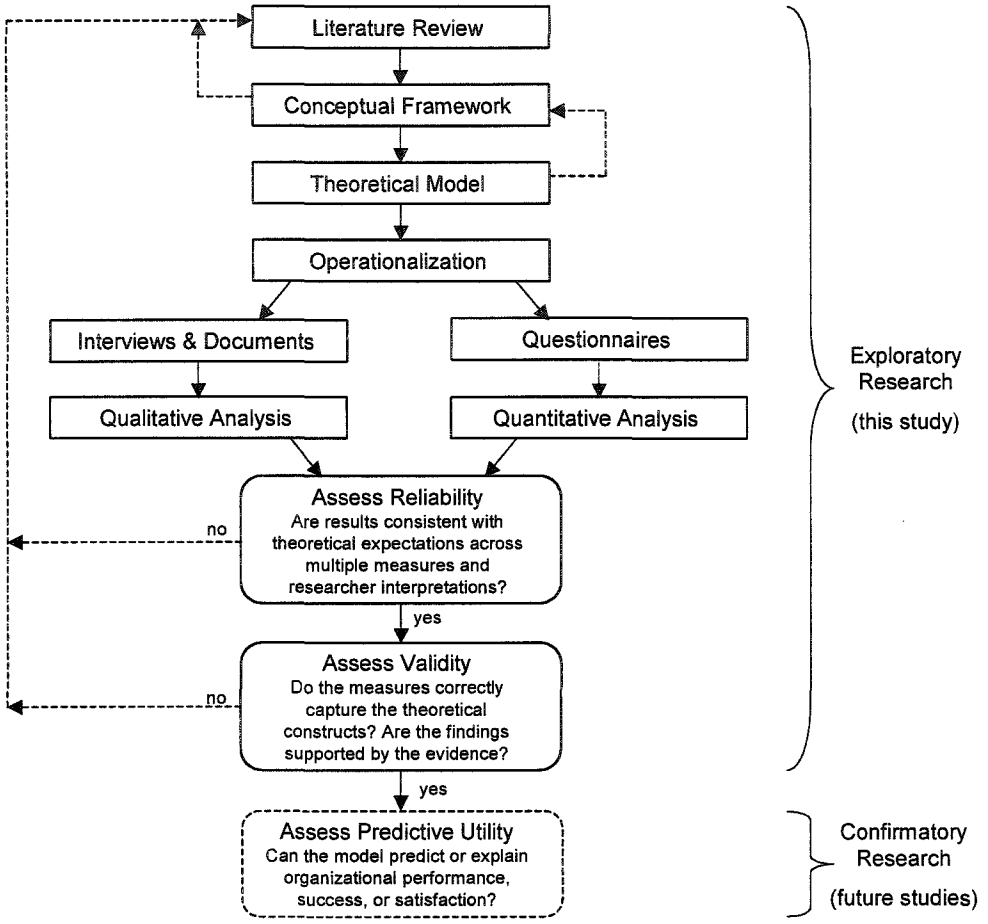

Figure 3.1 - Research Design

3.3 Quantitative and Qualitative Data Collection and Analysis

As Yin (1994) notes, case studies are frequently assumed to involve purely qualitative data analysis[15], but they can be strengthened by the inclusion of quantitative data to corroborate findings (Eisenhardt 1989; Kaplan and Duchon 1988; Yin 1994). A purely qualitative approach was not desired for this study, as the objective was to develop an operationalizable theory that would facilitate evaluation of the strategic fit of a firm's SCM IS without requiring each firm to undergo lengthy analyses of qualitative evidence.

Similarly, a purely quantitative survey method approach was deemed inappropriate after the results of initial questionnaires were deemed implausible when reviewed with a panel of experts and the study participants. Subsequent analysis revealed

[15] Frequently cited examples of exemplary case studies in IS involving only qualitative data include Olson (1983) and Markus (1983).

that the theories on which these instruments were based were not sufficiently developed in the area of SCM IS and thus a more exploratory approach was required to further explore and develop the theories on which the proposed survey instruments could be based. An added benefit of analyzing alternative questionnaires using preliminary quantitative data and rich qualitative data was that the instruments could be used in future confirmatory studies. Since it would be difficult to collect enough evidence to make strong conclusions using only quantitative or qualitative evidence, both types of data were analyzed.

The empirical analyses triangulated qualitative analyses of interviews and archival documents with quantitative questionnaire measures that provided more structured results. The quantitative evidence facilitated comparisons between the cases and between the cases and the proposed theories (Yin 1994). The richer qualitative evidence was used to see if the quantitative findings could be corroborated, as well as to further explore the evidence and emerging theories (Jick 1983; Sawyer 2001). While statistically significant relationships were not sought in this exploratory study, Baroudi and Orlikowski's (1989) recommendations were followed for increasing statistical power by using purposeful sampling strategies and care in the research design and analysis.

Five point Likert-scale questionnaires[16] were used to further examine constructs and relationships outlined in the conceptual framework (de Vaus 1990). These measures also highlighted areas where the results contradicted the emerging measurement model, which was then further refined (Eisenhardt 1989). Where possible, the questionnaire measures used were adapted from previously validated instruments, which increased the ease of determining their reliability. However, the number of alternative explanatory variables involved and the complexity of their interactions called for supplementing the quantitative research with qualitative findings and interpretations (Lee 1991).

Evidence gathered included: questionnaires; transcripts from interviews with senior managers and consultants who worked for the company; public documentation including documents from Internet-enabled SCM IS web sites; and previous case reports, interviews, and publications (see Appendix B - Case Study Protocol). In analyzing these sources of data, the researcher looked for corroboration of results and probed contradictions with follow up interviews conducted by email or in person (Eisenhardt 1989; Yin 1994).

For each case, multiple informants were interviewed and given questionnaires to assess the case's competitive strategy attributes, level of supply chain integration, implemented SCM IS capabilities, and experience with the SCM IS (see Appendix C). The questionnaires attempted to measure the research constructs, while the interviews attempted to probe and validate the answers with questions of "how?" and "why?."

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[16] A five-point Likert-type scale was used to enable participants to respond relative to their competitors. For example, a questionnaire asked participants to rate the level of support their IS provided for a capability relative to their competitors' IS. The five possible responses were: much lesser than, lesser than, the same as, better than, much better than. A three-point scale would not have had sufficient discrimination between responses, while a seven-point scale would have involved more subjective terms for the potential responses.

Results from the questionnaires were discussed in further interviews with the informants and a panel of three experts (two senior consultants and one eBusiness Director) to determine if their findings were accurate, verifiable, and relevant (Miles and Huberman 1994). Any interviews on the same topic as the questionnaires were conducted at least one week *after* the questionnaires, so that discussions with the researcher did not bias the questionnaire responses. Although the interviews probed some of the same concepts in further detail, the interview questions were less structured and more open-ended to minimize the likelihood the interview responses would mimic the questionnaire responses.

3.3.1 Questionnaire Design

As shown in Appendix C, the quantitative data collected included questionnaires measuring each case's current:

1. Competitive strategy type (using previously validated instruments);
2. Level of supply chain integration (using questionnaire items adapted from non-academic studies);
3. SCM IS capabilities (using previously validated instruments); and
4. Strategic fit of SCM IS capabilities (using two new questionnaire items).

For each construct, several alternative questionnaire items were examined and the results were compared with evidence from other sources. Following de Vaus's (1990) recommendations for increasing the validity and reliability of survey measures, the following steps were performed to evaluate the measures:

1. Adapt previously validated instruments from related studies.
2. Administer instruments to 5 senior informants on 3 cases (A-C).
3. Iteratively revise wording of instruments based on feedback.
4. Use a panel of supply chain experts to analyze the validity and plausibility of the instruments and results.
5. Replace invalid instruments and repeat pilot tests until the panel is satisfied with validity of instruments.

Following the pilot testing of the measures, the most reliable and valid measures were used for the full case study analyses. The findings from the pilot testing of the questionnaires as well as the results from the full study are reported in Chapter 4.

3.3.1.1 Competitive Strategy Archetype

Three alternative questionnaire measures for determining a case's correspondence with the Miles and Snow (1978) archetypes were pilot tested. Miles and Snow's (1978) measure asked respondents to select the paragraph that best describes their case's competitive strategy patterns. The measure was chosen as it is widely used in other empirical studies and enables a quick self-typing to be done. The measure has been found to have good predictive utility and generally agrees with other measures of competitive strategy patterns (Hambrick 1983). However, some studies have uncovered limitations in

its operationalization (Conant *et al.* 1990; Zahra and Pierce 1990), thereby warranting the investigation of additional or alternative measures.

The second measure used follows Sabherwal and Chan's (2001) approach of mapping Venkatraman's (1989b) Strategic Orientation of Business Enterprises (STROBE) measure to the competitive strategy type. The STROBE construct describes a firm's competitive strategy in six dimensions or attributes including:

1. Defensiveness,
2. Risk Aversion,
3. Aggressiveness,
4. Proactiveness,
5. Analysis, and
6. Futurity.

According to Sabherwal and Chan (2001), the responses of the STROBE attributes can be used to determine if a case was closest matched to the Defender, Analyzer, or Prospector profiles based on how closely the case's competitive strategy attributes matched the ideal profile of each of the strategy types. For example, Sabherwal and Chan (2001) found that previous studies suggest that Defenders are expected to score relatively high in the Defensiveness, Risk Aversion, and Futurity attributes, and low in the Proactiveness attribute. Since each of the strategy types have very different profiles, one could measure these attributes and determine which strategy type the case matches the closest using a mathematical profile deviation approach.

The third measure of the Miles and Snow (1978) archetype used was adapted from a measure developed by Conant *et al.* (1990). As the Miles and Snow (1978) paragraph descriptions do not fully cover all 11 dimensions of their archetype construct, Conant *et al.* (1990) developed an 11-item measure that operationalizes each of these dimensions individually. By analyzing the patterns exhibited by a case for each of Miles and Snow's (1978) 11 dimensions, Conant *et al.*'s (1990) measure can be used to determine the relative correspondence of a case's competitive strategy patterns with each of the competitive strategy archetypes.

Finally, qualitative evidence on competitive strategy patterns from the exploratory case studies was analyzed. This evidence was used to assess the plausibility of the findings from the three questionnaires described above. A panel of three judges reviewed the results from each of the measures and the case reports to assess the face validity of the measures and findings.

As detailed in Chapter 4, the findings from pilot testing suggested that a case's competitive strategy archetype should be determined using the questionnaire adapted from Conant *et al.* (1990). However, results from this questionnaire should be triangulated with results from the Miles and Snow (1978) paragraph-type measure and if possible with results from an analysis of interviews and archival documents. Thus, for the overall analyses, findings from all three measures were triangulated to analyze each case's competitive strategy type.

This study used perceptual measures of a case's *realized* strategies relative to their competitors. While managers tend to report *intended* rather than realized strategies when self-typing measures are used (Shortell and Zajac 1990), this effect was reduced in this study by using items that probe the firms' *behaviours* rather than attitudes or intentions. For example, the measure adapted from Conant *et al.* (1990) asked questions such as "*In contrast to our competitors, my organization ... offers fewer, selective products and services...*" (see Appendix C). The questions in this study began with "*In contrast to our competitors*" since competitive strategy should be measured relative to a firms' competitors (Dess 1990; Snow and Hambrick 1980).

While there are obvious shortcomings in using perceptual measures of any business phenomena, studies such as Shortell and Zajac (1990) and Hambrick (1983) found that self-typing measures of competitive strategy type do appear to correlate with more objective archival measures. Similarly, Snow and Hambrick (1980) note that the self-typing approach could be well suited to measuring organizational strategies, particularly when triangulated with other measures such as using external experts, researcher inference, or objective measures. The measurement approach in this study also uses a multiple methods strategy to strengthen the validity of the findings.

3.3.1.2 Level of Supply Chain Integration

As this study was exploratory, the purpose of investigating a case's level of supply chain integration was to: explore the construct; determine if there were important relationships between it and the other research constructs; and determine the feasibility of measuring a case's level of supply chain integration. There are several factors that made measuring this construct difficult:

1. Lack of agreement on terminology (e.g., maturity, integration, and what various levels should be named) as shown in Table 2.2;
2. Lack of agreement and clarity on the meaning of the construct and its underlying dimensions; and
3. Lack of peer-reviewed studies that rigorously examine the validity and reliability of potential measures.

Despite these limitations, there was some convergence among the literature on the meaning and measurement of the level of supply chain integration used to guide the study. As described in Section 2.5.3, this dissertation arrived at the following five-level conceptualization of a case's level of supply chain integration:

1. Functional Focus,
2. Internal Integration,
3. Linked Network,
4. Integrated Network, and
5. Optimized Network.

The quantitative analysis was guided by preliminary non-academic studies that surveyed and benchmarked the level of supply chain integration several industries (Moncrieff and Stonich 2001; Supply-Chain Council Inc. 2002). Questionnaire measures

developed by Moncrieff and Stonich (2001) were adapted for this study as detailed in Appendix C. Although these non-academically reviewed studies helped ground the investigations in prior experience (Eisenhardt 1989), care was taken to fully explore the operationalizations and triangulate the findings using qualitative evidence and more rigorously documented research methods.

The dimensions of a case's level of supply chain integration that were assessed included:

1. Supply Chain Strategy;
2. Supply Chain Performance Management;
3. Supply Chain Processes; and
4. Supply Chain Organization Decision-Making.

Similar to the Conant *et al.* (1990) instrument, the level of supply chain integration was measured for each dimension by having the respondents choose the statement that best describes their case's current situation. Each statement corresponded to the Functional Focus, Internal Integration, Linked Network, and Integrated Network levels of supply chain integration[17], although these were not identified by name to avoid self-responding biases (Dillman 1978).

A 15-item measure adapted from Moncrieff and Stonich (2001) was used to assess each of the dimensions of the overall supply chain, as well as for each of the Plan, Make, and Deliver[18] process areas of the supply chain. As in Conant *et al.* (1990), the overall level of supply chain integration was determined by the level that was chosen most frequently across each of the dimensions. For example, for the Overall Supply Chain Strategy dimension, if a respondent selected the statement "*Each department or business unit has a separate supply chain strategy. Little coordination of strategies across enterprise or supply chain.*," they could be inferred to be at the Level 1 – Functional Focus level of supply chain integration for their supply chain strategy.

The qualitative analysis looked for patterns in the evidence that most closely matched one of the above levels of supply chain integration, which were further described in Table 2.2. For example, if review of a case indicated their internal units were well integrated but there were few linkages with external partners, they would be inferred to be at Level 2 – Internal Integration.

3.3.1.3 Level of Support for SCM IS Capabilities

The quantitative analysis used previously validated questionnaire measures from prior studies in order to strengthen the validity of the findings. Since a single instrument

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[17] The Optimized Network level was not included in the measure since a wider study did not find any firms that consistently operated at that level (Moncrieff and Stonich 2001). In the measure used in this study, any such firms would therefore be identified as Level 4 companies.

[18] Here the industry-standard terminology of the Supply Chain Council's Supply Chain Operations Reference (SCOR) Model is used (Supply-Chain Council Inc. 2002) to describe the Overall, Plan, Make, and Deliver process areas.

for measuring the various SCM IS capabilities did not previously exist, items were adapted from several separate studies of IS capabilities (Bensaou 1997; Sabherwal and Chan 2001; Venkatraman and Ramanujam 1987; Zviran 1990). The level of support each case's SCM IS provide for the SCM IS capabilities was measured using a 5-point Likert-type multi-item questionnaire as shown in Appendix C. Respondents were asked how well their SCM IS provided support for each capability on a 5-point scale ranging from much lesser to much greater support than that of their competitors SCM IS[19]. A value of 3.0 indicates that the SCM IS provide roughly the same level of support for a capability as the SCM IS of a case's competitors. Values higher than 3.0 indicate relatively high levels of support and values less than 3.0 indicate relatively low support.

The qualitative analysis looked for patterns in the evidence that allowed the researcher to assess how well a case's information systems supported each SCM IS capability. For example, interview and archival data was coded and analysed to assess how well the case's IS supported their requirements for operational efficiency and long-term planning, among other capabilities.

3.3.1.4 Strategic Fit of SCM IS

The strategic fit of SCM IS construct was initially operationalized as the deviation (Euclidian distance) between the theoretically ideal and perceived level of support that a case's SCM IS provide for each capability. The distance was determined by subtracting the perceived level of support for each IS capability from the theoretically ideal level and calculating the square root of the sum of the squared differences:

$$\text{distance} = \sqrt{\sum[(\text{theoretically ideal level of support}) - (\text{perceived level of support})]_i^2}$$

for each *i* IS capability. A lower distance implied a higher degree of strategic fit.

This operationalization of strategic fit as the Euclidean distance between two multi-dimensional profiles was well-established in prior studies of firms, information systems, and competitive strategies[20] (Bergh and Fairbank 2002; Sabherwal and Chan 2001; Van de Ven and Drazin 1985; Venkatraman 1989a).

To determine if the findings using this operationalization were corroborated by other evidence, a qualitative analysis of interview transcripts and archival documents looked for patterns that indicated the relative level of strategic fit. In addition, a Likert-type questionnaire item measured the perceived strategic fit of the SCM IS capabilities for each case. The questionnaire item asked respondents to indicate on a 5-point scale

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[19] Competitive strategies and hence a firm's theoretically ideal level of support for each capability are measured relative to the firm's competitors (Dess 1990). Thus, the perceived level of support for each capability was also measured relative to the firm's competitors.

[20] Future studies testing the statistical relationship between strategic fit and dependent outcome such as performance are cautioned that profile deviation equations may confound the effects of the component variables (Edwards 1992). However, with careful research design and testing, these limitations may be no more troublesome than alternative methods such as the multivariate analyses of individual components (Bergh and Fairbank 2002).

(from very low to very high) to respond to the following question: "While I may not have direct knowledge of my competitors' supply chain information systems, my perception is that compared to our competitors' systems, the degree to which the capabilities of our supply chain information systems support our business needs is..." This questionnaire item was used to provide a parsimonious measure for triangulation in this exploratory investigation. However, like the other measures, it should be statistically validated if used in future confirmatory studies.

3.3.2 Interview Design

The purpose of the interviews was to collect further evidence to investigate, triangulate, and strengthen the findings from the questionnaires (Jick 1983) and to provide further details about the cases' experience with and plans for their SCM IS. To increase the consistency, efficiency, and flexibility of data collection, semi-structured interviews were used in an ethnographic technique known as "grand tour" (McCracken 1990). The experiences, perceptions, and insights of the participants were probed with further questions to obtain more thorough explanations and dig below surface responses. Many of the participants were interviewed several times over the course of the study to assess the consistency of their attitudes and responses. A further benefit of the repeated interview method was "to allow the participants to become more comfortable with the researcher, and hence more frank and open" (Walsham and Waema 1994, pg. 157).

Each interview lasted up to one hour. The interview transcripts were organized and coded using QSR NVivo qualitative analysis software and the results were combined with other documentary evidence to produce a detailed report for each case. The qualitative data collected included archival documents (e.g., financial reports, analyst reports) and semi-structured interviews to gather evidence of the case's current and expected:

1. Competitive strategy attributes (used to triangulate competitive strategy type questionnaire items and determine if a strategy was relatively stable);
2. Supply chain integration (used to triangulate level of supply chain integration questionnaire);
3. Supply chain management information system capabilities (used to triangulate with the SCM IS capabilities questionnaire item and to provide insights into efforts to reduce strategic gaps/misfits);
4. Satisfaction with and benefits of supply chain management information systems (used provide additional details on the participants' experiences with the SCM IS); and
5. Perceptions of how well the SCM IS fit the needs of the business (used to triangulate with the other measures of strategic fit of SCM IS).

The case study protocol is shown in Appendix B. Data from the archival documents is summarized in Table 3.1 (see page 57).

3.3.3 Data Analysis

A systematic data collection and analysis process was used, which was informed by highly cited quantitative and qualitative research methods for case studies (Creswell 2003; de Vaus 2001; Eisenhardt 1989; Miles and Huberman 1994; Yin 1994). The quantitative data analysis involved converting Likert-type questionnaire responses into numerical values and determining whether the results could be corroborated with other evidence. Since the questionnaires were used to explore the constructs rather than confirm their relationships, a statistically significant sample was not required. Instead, the reliability and validity of the findings was assessed by triangulating the evidence and checking the findings with the participants and other researchers.

The qualitative data analysis used principles of pattern matching (Yin 1994) and coding of constructs (Eisenhardt 1989) to parse the interview and archival data for consistent patterns used to develop the theoretical model. As demonstrated in Sarker and Lee (2002), pattern matching can be applied to case study analyses using the positivist approach of specifying initial propositions and looking for evidence that supports or disconfirms the propositions. In this dissertation, while pattern matching was used to examine the initial constructs, formal hypotheses were not pre-specified. This was to retain theoretical flexibility and to better ensure the resultant theory was based on empirical evidence rather than solely on the researcher's preconceptions (Eisenhardt 1989; Reich and Benbasat 1996). The interviews were tape recorded, transcribed, and stored as electronic documents in a case study database using QSR's NUD*IST Vivo (Nvivo) software[21].

The transcript and archival document data were then analyzed for recurring themes and patterns and coded into categories. As new evidence was analyzed, constant comparison with the emerging categories was used to iteratively reorganize, expand, and collapse the categories until the model was sufficiently developed. The list of codes used to categorize the phrases into patterns or themes thus evolved over the course of the study — the final state of the codebook is outlined in Appendix D. The data gathering, analysis, and model building was repeated until "theoretical saturation" was achieved — in other words, until the probability of new insight being obtained from further data collection and analysis significantly diminished (Strauss and Corbin 1998).

Since this study was largely deductive rather than inductive, the coding and analysis of qualitative data was used to explore, examine, and further develop the proposed model, rather than to induce a new theoretical model, as is done in grounded theory studies. Thus, the analysis involved investigating the patterns in the content and checking whether these patterns matched the matched the model's propositions or corroborated results from other measures (Yin 1994).

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[21] NVivo is the most recent version of NUD*IST (Non Numerical Unstructured Data Indexing Searching and Theorizing), one of the most popularly used computerized qualitative data analysis tools for research in IS and other disciplines (Agosto 2002; Rouse and Dick 1994). The software enables large amounts of case study data to be analyzed to uncover patterns in the data without losing sight of the context of the data (Rouse and Dick 1994).

Following Strauss and Corbin (1998), Yin (1994), and Eisenhardt (1989), the process used for analyzing the qualitative evidence included:

1. Quickly reading over the transcripts to get an overall idea of the content;
2. Reading over the transcripts again highlighting key phrases and making notes in the margins to form a general picture of what was being discussed;
3. Circling, underlining, or highlighting individual words and phrases and writing codes in the margins (or using the analysis software) to identify the categories of what was being discussed (e.g., operational efficiency, strategic planning, differences between business units, (dis)satisfaction with the information systems);
4. After coding all the important words and phrases, grouping the codes into similar categories;
5. Using the new categories, re-coding the documents looking for additional evidence that belongs in (or contradicts) the categories;
6. Grouping the categories into themes or patterns and highlighting where these occur in the transcripts;
7. Looking for patterns of evidence that contradict the themes developed in the previous step and creating more refined themes that more accurately convey the patterns in the evidence;
8. Breaking down the themes into more accurate codes or categories if needed and repeating the process until the resulting findings (codes, categories, and themes) leads to an accurate theoretical depiction of the cases;
9. Writing up a brief case summary based on the analysis; and
10. Summarizing how the findings support (or contradict) the developed model and/or the results from other measures.

In coding the data, both manifest and latent content analyses were employed. Manifest content is "the surface structure present in the message," while latent content is the underlying "deep structural meaning conveyed by the message" (Berg 1998, pg. 226). Since people use different words to convey the same meaning (and may even use sarcasm), researchers must interpret some of the latent meaning of the words. To reduce interpretive bias and increase the reliability of findings, two other reviewers repeated the coding and interpretation process to check that they arrived at the same findings (Berg 1998). The participants also reviewed the resulting case reports to determine if the interpretations and findings were valid (Yin 1994). After some minor corrections requested for clarity, the participants confirmed the reports were accurate and suitable for inclusion in the study for further analyses.

3.4 Case Study Participants

The cases consisted of four manufacturers in the electronics sector and one manufacturer in the energy sector all based in Canada. Each firm was composed of multiple business units for serving the firm's various markets. Each case represented a single business unit within the firm, rather than all the different businesses of the firm.

Apart from Case A (described in the next section), the cases studied were from a single industry — electronics manufacturers in Canada[22]. Focusing primarily on a single industry facilitated comparison and theoretical replication among similar firms, while reducing extraneous phenomena and cross-industry differences (Dess 1990; Weill and Olson 1989; Yin 1994). The inclusion of Case A (an integrated energy production and distribution company) allowed for comparison and contrast with a different industry and a more internally integrated supply chain.

The electronics manufacturing industry was a good candidate for providing evidence for development of the theoretical measurement model for several reasons. First, the industry was known to be extensive users of SCM IS (Roloff *et al.* 2001) and thus could provide ready evidence and insight for theory development (Eisenhardt 1989). Second, initial investigations suggested the industry was composed of relatively diverse firms with differing competitive strategies, levels of supply chain integration, and SCM IS capabilities. This diversity provides good theoretical coverage of the constructs in the conceptual framework. Finally, the researcher had previous experience working in and researching this industry, which enabled theoretical sensitivity in interpreting the cases and understanding the issues that arise from the evidence (Strauss and Corbin 1998).

3.4.1 Selection of Cases

The purpose of sampling in case study research is not to collect data that is statistically representative of a population, but rather to find evidence that allows theories to be explored, refined, supported, or discredited (Eisenhardt 1989; Miles and Huberman 1994). This study used *theoretical* rather than *random sampling* by focusing the analysis on "theoretically useful cases — i.e., those that replicate or extend theory by filling conceptual categories" (Eisenhardt 1989, pg. 533). Thus, a purposive theory-driven sampling strategy was used to ensure all aspects of the proposed theory were included in evidence gathered from informants (Eisenhardt 1989).

To enable the preliminary theories to be quickly explored, three initial cases (Cases A-C in Table 3.1) were identified as having met several criteria for exploratory case studies (Eisenhardt 1989; Miles and Huberman 1994; Yin 1994). First, the cases had sufficient experience with SCM IS to provide useful evidence for developing the theoretical model. Second, the evidence anticipated from the cases covered as much of the theoretical constructs as possible. For example, the researcher expected Cases A-C to represent three different competitive strategy archetypes[23]. Third, stemming from previous relationships, the researcher had ready access to the case participants on an

[22] Future studies or the judgement of the reader should be used to determine if the theories developed are likely to apply to other situations.

[23] Case B was expected to have an Analyzer- or Prospector-type competitive strategy due to the innovative nature of its industry (electronics manufacturing). In actuality, it turned out to be more similar to a Defender on closer analysis. This surprise finding was one of many that suggested the theoretical model and its operationalization can lead to more evidence-based analysis and more informed managerial decisions.

ongoing basis so that initial assumptions, evidence gathering, and model development iterations could proceed quickly.

After initial investigations of Cases A-C, it became apparent that additional cases were needed to provide further evidence to develop the theoretical model and allow more comparison and contrasts to be made between the cases. Cases B-E were selected from a single industry to help control for industry effects (Dess 1990; Weill and Olson 1989; Yin 1994) and because classification and comparison of competitive strategies should be done relative to a firm's competitors (Snow and Hambrick 1980). Since Cases B and C were both in the electronics manufacturing industry, a snowball sampling strategy (Miles and Huberman 1994) was used to identify two additional cases in the same industry. Participants from Cases B and C identified additional cases or participants that would help further analyze the emerging model and facilitated access to some of their contacts in Cases D and E.

In total, this study examined six business units in five firms. The number of cases was chosen to maximize coverage of the research variables, while maintaining a manageable and economical study. Eisenhardt (1989) suggests between four and ten cases enable theories to be sufficiently developed, without generating an unmanageable volume of data[24]. The cases were selected so that their diversity and similarities allowed both theoretical and literal replications (Yin 1994). Theoretical replication was evident when cases that were dissimilar on the constructs of interest provided contrasting evidence for examining the theoretical model. Literal replication was evident when cases that were similar on the constructs of interest yielded similar findings. It is anticipated the findings will be strengthened in future studies with literal replication from other studies and through large sample studies using confirmatory statistical analyses.

3.4.2 Description of Cases

As outlined in Table 3.1, the first case investigated was an integrated energy company located in Canada. The organization, referred to as "Case A," was involved in production and distribution of energy products primarily in Canada. While Case A owned and operated a large portion of their supply chain, they also purchased and sold petroleum products with other competitors within their industry. While much of their supply chain was vertically integrated within Case A's organization, downstream business units in their supply chain purchased product from the upstream units in a manner similar to supply chains with external partners.

Case A was purposefully selected for the study as the vertically integrated nature of the company allowed the researcher to gather information quickly about different units of the supply chain by interviewing a few key decision-makers within the company. Since many of the participants in Case A's supply chain were internal to the corporation, information, plans, goals, and motivations about the supply chain decisions were

[24] In a methodologically similar multiple case study of IS-strategy alignment, Reich and Benbasat (2000) studied ten business units from three firms (see Section 3.5 - Related Studies).

exchanged more freely within the company. Thus, the conceptual framework could be explored more quickly than by trying to uncover the same information from several different firms. The lack of conflicting perspectives that can arise from studying different firms made Case A a good choice for quickly gaining evidence to explore and refine the theoretical model and methods. However, this also makes findings from Case A more relevant to similar internally integrated supply chains rather than ones that are dispersed among external partners. The remaining cases provided evidence from the more typical supply chain that is less vertically integrated and has a higher dependence on external supply chain partners.

Table 3.1 - Overview of Cases Studied

	Case A1/A2	Case B	Case C	Case D	Case E
Business	Production and distribution of energy products	Contract electronics manufacturing	Design and manufacturing of integrated circuits	Sales, service, manufacturing of networking, communication devices	Sales, service, manufacturing of networking, communication devices
Sales for FY2002 (in US$ millions)	>10,000	>10,000	~100	>10,000	>10,000
Profit Margin for FY2002	>5%	<0%	>10%	>10%	<0%
Employees in FY2002	>5,000	>30,000	<500	>30,000	>30,000

Subsequent investigation of Case A identified at least two distinct businesses operating within the integrated corporation, which appeared to have very different competitive strategies. For this reason, the initial case was split into two cases (Cases A1 and A2), which represent corporate and retail business units, respectively. Although their competitive strategies appeared to differ, both Case A1 and Case A2 shared much of the same SCM IS used throughout the firm. The SCM IS were primarily comprised of a centralized ERP application with EDI-based procurement functionality.

Case B was a business unit in a large contract manufacturer focusing on the electronics industry. Case B's company was a third-party manufacturer of electronics devices and components typically for large clients who outsourced their manufacturing requirements to the company. The business unit Case B belonged to specialized in telecommunication network devices and components (e.g., network routers and switches), although the overall firm also manufactured computer components, telephone equipment, and other electronics devices.

The operating margins for Case B's products was typically below 5% and usually around 1-2%. Since contract manufacturing can potentially be a commodity business, Case B attempted to differentiate itself by focusing on cost performance, quality, and customer service (see Table 3.1). As a whole, the company attempted to provide superior supply chain management and collaboration capabilities to its internal and external customers. The SCM IS deployed typically had advanced capabilities for coordinating and optimizing the supply chain. However, the diversity of product lines, geographic dispersion of the facilities, and frequency of mergers and acquisitions resulted in Case B having a large number of different SCM IS, which were not always well integrated.

Case C was also in the electronics manufacturing industry, but was a smaller firm than the other cases with slightly under US$100 million in sales for Fiscal Year 2002 (see Table 3.1). Case C designed and manufactured integrated circuits ("electronics chips") for use in electronics products that were manufactured by other firms. Case C was highly focused on design and manufacturing of the products they created, which were often very innovative and difficult for other firms to replicate. Because of this ability to capitalize on proprietary knowledge, Case C's operating margins were high, and their overall profit margin was above 10% for Fiscal Year 2002.

The relatively small size of the organization and the limited breadth of products made it easier for Case C to deploy a simple, integrated, and centralized SCM IS portfolio. Although there was some interest in collaborative supply chain capabilities, the relatively low volume, high margin transactions had not required Case C to invest heavily in supply chain collaboration systems.

Case D was a business unit in a large firm involved in the sales, service, manufacturing, and distribution of computer networking and telecommunication devices, such as network routers and switches. Case D focused on sales of innovative high-end networking equipment for "long-haul" networks, which increasingly used fibre optics equipment. The operating margins in this cutting-edge product line tend to be very high, as are the risks in this relatively immature market. According to publicly available documents, the firm Case D belongs to appeared to have competitive strategies focused on operational efficiency, as well as increasing profit margins, return on assets, and market share through technology innovation and inter-firm collaboration (see Table 3.1).

Case D outsourced much of its product manufacturing to contract manufacturers (which included Case B). Thus, the SCM IS Case D used focussed mainly on order management and finance, rather than manufacturing and distribution. A centralized SCM IS was used throughout the firm to aggregate demand for parts between business units of the firm and manage purchasing. However, this system was used more intensively in other business units in the firm, which had higher volume, more mature products with lower margins (Case D's business unit handled very innovative and high margin products). Although supply chain coordination and collaboration were important to Case D, it appeared that the high margin and low volume transactions along with short product life cycles limited usage of highly sophisticated or automated SCM IS in Case D.

Case E was a business unit in a large firm that was a direct competitor to Case D (and which also used Case B as a contract manufacturer). As with Case D, Case E sold, serviced, manufactured, and distributed networking and telecommunication devices, although some of the product offerings did not overlap with Case D. Case E generally had a larger product and geographic range than Case D although Case D tended to lead in market share in the markets it did serve. Publicly-available documents which discussed Case E's stated priorities emphasized cost performance, innovation, and inter-firm collaboration, which were similar to Case D's competitive strategies (see Table 3.1). However, Case E documents also mentioned leveraging their product-market breadth and focusing heavily on customer relationships and customer satisfaction.

Case E used a variety of SCM IS, none of which appear to be highly integrated with each other. Separate order management, finance, and product lifecycle management (PLM) applications were used to manage order fulfilment and product development. The PLM application managed customer service and was used to gather requirements for future product offerings. As in Case D, the high margin and low volume transactions forming the core of Case E's business appeared to lessen need for highly integrated and sophisticated SCM IS. Instead, their SCM IS appeared to focus on order management, aggregating demand for components across the firm, and managing knowledge about existing and potential customers, products, and markets.

3.4.3 Access to the Participants

Using Miles and Huberman's (1994) recommendations for purposive and snowball sampling, participants were recruited through the researcher's network of business contacts and recommendations from existing participants. The interviews were held in the Toronto and Ottawa areas of Ontario, Canada. Access to the participants was gained by demonstrating the benefits that would likely be gained by participation (e.g., the study would help firms better analyze and improve the strategic fit of their supply chain systems). The informants participated in the study on condition their organizations remained anonymous. Although this limited the ability of other researchers to verify the evidence, it encouraged participants to be more honest and forthcoming in their responses instead of trying to put a positive skew on their competitive strategies and supply chain management capabilities.

The results and recommendations were offered to the participants, as well as the ability to review, correct, or withdraw information from the study, as shown in the consent form in Appendix E. This provided an incentive to participate and reduced fears of having inaccurate, confidential, or identifying information disclosed. Other than providing participants with tools and analyses to improve the strategic fit of their SCM IS, the informants did not receive any compensation for participating.

The informants were selected using a purposive sampling approach after the researcher determined they met the criteria established for case informants. The overriding criterion was that informants had to be knowledgeable about the case and its competitors from their role as either: a senior manager from within the case organization,

an external consultant who worked for the case, or a researcher who had expert knowledge of the case[25] (see Table 3.2). Informants had to have five years experience in the industry in order to be able to compare the case with its competitors. In addition, senior managers had to have worked in the company for a minimum of three years in a variety of business units, so that they had a broad perspective on the firm's activities.

Table 3.2 - Case Study Participants

Case	Business Description	Average Profit Margins for Case	Number of Participants[26]		
			Senior Manager	External Consultant	Other Expert
A1	Production and distribution of energy products – Corporate Unit	Low	2	1	1
A2	Production and distribution of energy products – Retail Unit	Low	2	1	1
B	Contract manufacturing of telecommunication devices	Low	2	1	2
C	Design and manufacturing of integrated circuits	High	1	1	2
D	Sales, service, and manufacturing of "long haul" telecom. devices	High	1	1	2
E	Sales, service, and manufacturing of "long haul" telecom. devices	High	2	1	1

Although some studies advocate using senior executives such as CEOs as the respondents, Snow and Hambrick (1980) note that such informants tend to respond with their *intended* rather than realized strategies. Since this study seeks to measure realized rather than intended strategies, it avoids relying on senior executives as informants. Instead, this study assumes that responses from senior managers are less likely to be biased by previous discussions about the strategic intent of the firm.

3.5 Related Studies

This study integrates and extends research methods from several exemplary studies from the IS literature. For example, Walsham and Waema (1994) used an

[25] The questionnaire responses and quotes used come solely from senior managers from each case; the external participants were used only to corroborate evidence and provide feedback on the analyses and findings.

[26] A total of 7 senior managers, 2 consultants, and 3 other experts were interviewed as some had knowledge of multiple cases. Senior Managers were responsible for SCM IS; consultants had SCM IS consulting experience at the case; other experts had knowledge of the case only through publicly available documents.

interpretivist case study approach to provide "a more detailed perspective on processes in IS strategy and implementation than typically available in the literature" (Walsham and Waema 1994, pg. 150). Time and space constraints prevented this study from going into the same depth of detail. However, as in Walsham and Waema (1994), the cases are used to develop some general implications on IS capabilities and strategy and to enable the reader to further explore their interaction.

Reich and Benbasat (1996; 2000) used a multiple case study method to explore the social aspect of business and IS strategy alignment. Interviews and documents were analyzed and compared across ten business units from three firms. As with this investigation, case study evidence was used to: (1) refine the constructs and evaluate potential measures (Reich and Benbasat 1996) and (2) build an explanatory theoretical model based on a causal analysis of alignment in each of the cases (Reich and Benbasat 2000). The key differences with this study are that this study: (1) focuses on the alignment or fit of business strategy with *IS capabilities* and (2) develops a measurement model rather than a causal model.

Rather than studying factors that lead to fit (e.g., Broadbent and Weill 1993; Reich and Benbasat 2000), this dissertation develops a theoretical model for conceptualizing and measuring fit (e.g., Papp 2001; Sabherwal and Chan 2001). Although exemplary studies of different aspects of strategic fit of IS exist (e.g., Palmer and Markus 2000; Sabherwal and Chan 2001), this study is the first known to explore and operationalize the strategic fit of IS capabilities for specific types of IS, such as SCM IS.

The analysis of qualitative evidence in this dissertation follows other positivist multiple case studies in information systems (e.g., Iacovou *et al.* 1995; Sarker and Lee 2002). Through a process of pattern matching, empirical evidence was continuously compared and contrasted with the researcher's hypotheses, propositions, or assumptions. Throughout this study, case study evidence was compared with the emerging theoretical model to explore the constructs of the model, examine the relationships of the constructs and their underlying dimensions, and provide initial validation of the model (Eisenhardt 1989; Yin 1994).

However, as noted by Eisenhardt (1989), the traditional positivist approach of pre-specifying hypotheses can bias case study findings and prevent the researcher from uncovering unforeseen relationships. This limits the likelihood that the developed theory is based on empirical evidence rather than the researcher's prior assumptions. To avoid such theoretical bias, this dissertation has avoided specifying formal hypotheses *a priori.* Instead, the conceptual framework enables a theoretical model to be developed, explored, refined, and extended based upon the analyses of case study evidence.

Although pattern matching was the predominant mode of analysis, this dissertation also used an iterative process of data collection, analysis, and theory development. This iterative process is often referred to as the constant comparative method (Glaser and Strauss 1967) or more recently as the grounded theory method (Strauss and Corbin 1998). Although early proponents of the grounded theory method seemingly ignore the potential for theoretical and researcher bias (Bryant 2002), this

study adopts the more contemporary assumption that care must be taken to acknowledge and limit such biases (Eisenhardt 1989; Klein and Myers 1999).

In summary, the research methods in this dissertation follow most closely more positivist information systems case studies (e.g., Reich and Benbasat 2000; Sarker and Lee 2002), but are also informed by exemplary grounded theory studies in IS (e.g., Kaplan and Duchon 1988; Orlikowski 1993) and more interpretivist approaches such as Walsham and Waema (1994). As in each of the aforementioned studies, the informants in this dissertation were chosen from a cross-section of managerial roles, rather than restricting the study to chief executives. This helps ensure the responses are more grounded in the firms' actual patterns of strategic activity (realized strategies), rather than the executives' intended strategies (Mintzberg 1978; Snow and Hambrick 1980).

3.6 Ethical Concerns

Research involving human subjects raises a number of ethical concerns that must be addressed. As Berg (1998) notes, these concerns primarily include not harming the participants and not presenting misleading results. This study passed an ethical review by the McMaster University Research Ethics Board. The following subsections describe steps taken to ensure the ethical integrity of the dissertation.

3.6.1 Preventing Harm to Participants

Participants in organizational studies could potentially be harmed through mistreatment or disclosure of confidential, embarrassing, or proprietary information. This investigation presented little risk of harm through physical or emotional mistreatment as participation was voluntary and anonymous and participants could withdraw themselves or their case information at any time. Participants were informed of these rights prior to joining the study and again before any interviews or questionnaires were conducted. They were also given the opportunity to have any questions or concerns addressed prior to data collection.

The chief risk was that an informant could divulge confidential information that could lead to loss of a competitive advantage or embarrassment to the firm. However, the information gathered was related to high-level strategic patterns of behaviour that is generally available in other public documents. No proprietary information on specific tactics or competitive secrets was gathered or retained. In addition, the identity of participants and firms was disguised and will not be released, except to the researcher's advisors. The participants also had the opportunity to review and correct or withhold the case reports to ensure they were accurate and did not include information that could potentially identify or harm any participant or firm in the study.

Formal letters of introduction, consent to participate, and non-disclosure agreements were provided to the participants explaining the purpose, benefits, methods, and confidentiality of the research (see Appendix E). These documents, as well as the interview protocol, questionnaires, and research methods, were reviewed and approved

by the McMaster University Research Ethics Board. The research followed the policies of McMaster University and the Canadian Tri-Council Policy Statement for conducting ethical research and protecting participants from harm. These policies also required that all questionnaire responses, archival documents, and transcripts of interviews were kept by the investigator in a secure location for a minimum of two years after completion of the study per guidelines governing research at the university.

3.6.2 Ensuring Objectivity, Reliability, and Validity of Findings

The objectivity of a study refers to the chance that findings are based solely on the researcher's perceptions and biases. The researcher's previous work experience with several of the case participants provided theoretical sensitivity to the data analysis and theory development. Such sensitivity "can enable the researcher to move into an area more quickly because he or she does not have to spend time gaining familiarity with surroundings or events" (Strauss and Corbin 1998, pg. 47). However, care was taken to not be overly biased by previous experiences during the data analysis. For example, the researcher's initial research questions, constructs, hypotheses, and guiding theories were kept from the participants so that "hypothesis guessing" by the participants was minimized (Miles and Huberman 1994).

Objectivity has two components: *reliability* and *validity* (Kirk and Miller 1986). Reliability is "the extent to which a measurement procedure yields the same answer however and whenever it is carried out" (Kirk and Miller 1986, pg. 19). Validity is the extent to which the measurement gives the "correct" answer.

3.6.2.1 Reliability

Reliability in case studies is related to how easy it would be for another researcher to replicate the investigation and arrive at similar findings. Qualitative data analysis lacks statistical techniques to demonstrate reliability of the measures. Instead, reliability is demonstrated by how well the measures lead to consistent findings that can be logically predicted or explained by theory (Miles and Huberman 1994; Strauss and Corbin 1998; Yin 1994).

The reliability of the findings was strengthened by using a formal case study protocol and maintaining a database of the evidence and findings (Yin 1994). The use of QSR NVivo software facilitated the organization, coding, comparison, and analysis of electronic documents. Hard copy documents and tape recorded transcripts were also archived to maintain a "chain of evidence" leading from the evidence to the theoretical assertions (Miles and Huberman 1994).

Reliability was also enhanced by using multiple iterations of data collection, analysis, and model revision and using multiple researchers with theoretical sensitivity to the problem to analyze the transcripts and compare their interpretations and findings (Eisenhardt 1989; Strauss and Corbin 1998).

3.6.2.2 Validity

The research methods and measures employed in this study were validated to ensure that the conclusions made were supported by the evidence gathered. The content, construct, internal, and external validity of the findings were assessed throughout this study and strengthened by following rigorous research procedures.

Content validity refers to whether there any other valid ways of measuring the property that might give different results. The content validity of this study was strengthened by using multiple quantitative and qualitative measures and sources of information such as questionnaires, interviews, and archival documents (Sawyer 2001). Furthermore, the questionnaires were adapted from several previously validated studies, which increased the different perspectives on the constructs studied. Multiple alternative questionnaires were pilot tested to determine which had the strongest reliability and validity after comparing the results to qualitative evidence and reviewing the findings with a panel of three experts.

Construct validity addresses whether the instruments are stable and repeatable across different methodologies and whether they actually measure what they are intended to measure (Trochim 2000). In addition to using previously validated measures, results from multiple quantitative and qualitative measures were compared across different measures, informants, and cases to determine whether each measure gave plausible results, which would indicate they measured the construct appropriately (Yin 1994).

Internal validity challenges whether there are unexplored alternative hypotheses that could explain the observed results. The traditional positivist view is that a study is internally valid if the results lead to consistent conclusions without alternative explanations (Straub 1989). The post-positivist perspective is that there are often untested rival explanations for social phenomenon and that these should be explored and discussed in the limitations of the study, but eliminating all rival explanations in a study is often infeasible (Klein and Myers 1999). Although this study could not rule out all rival explanations, triangulation of evidence strengthens the findings that are presented.

External validity looks at whether the results are generalizable to other firms, locales, or situations (Trochim 2000). Although surveys and case studies can be generalized to other populations using statistical analysis if the sample is large enough, only analytical generalization (theoretical elaboration) is possible with small sample case studies and experiments (Stake 1995; Stone 1978; Yin 1994). Thus, the experiences of the cases studied in this dissertation cannot be definitively generalized to other cases[27].

However, the aim of this study was to build theory from case studies and so the focus was on generalizing the findings to a theory of SCM IS capabilities, rather than generalizing the findings to other situations or populations (Eisenhardt 1989). Sufficient

[27] In fact, the findings from any single test of a theory are not generalizable, regardless of the method (Lee 1989). Building theory from a limited number of cases can potentially be problematic due to a researcher's preconceptions, but if done systematically, it can overcome the simplifications and abstraction needed in experimental designs or other purely quantitative methods (Kaplan and Duchon 1988; Orlikowski 1993).

details are provided in this dissertation so that readers can draw their own inferences on whether the findings apply to other situations. Furthermore, the patterns of evidence provided from the cases suggest that similar results would be found at other firms in the same or similar industries, although further investigation is required to confirm this.

The validity of generalizing to an overarching theory depends not on the representativeness of the cases in a statistical sense, but on the plausibility of the reasoning in the analysis and conclusions (Craig Smith 1989). The iterative comparison across cases, measures, and theories in this dissertation has lead to a "constant juxtaposition of conflicting realities [that] tends to unfreeze thinking, and so the process has the potential to generate theory with less researcher bias than theory built from incremental studies or armchair, axiomatic deduction" (Eisenhardt 1989, pg. 546).

3.7 Chapter Summary

As the purpose of this study was to gather evidence to develop and explore a theoretical model of strategic fit of SCM IS, a large sample with powerful statistical models was deemed inappropriate (Creswell 2003). Instead, a mix of quantitative and qualitative analyses was used to gather insights that could be used to explore and refine the conceptual framework. Further validation of the measures can be done in future studies once sufficient data for statistical analyses is collected.

Due to the immaturity of the existing theories on which this study was based, care was taken to ensure the developed theories were derived from evidence rather than by solely attempting to find data that validated the theories (Strauss and Corbin 1998). However, a purely grounded theory approach was not used, as the theoretical model developed herein had been partially informed by the researcher's practical experience and familiarity with prior studies of competitive strategy and information systems. Nonetheless, the researcher's assumptions, beliefs, and emerging theories were continuously tested and refined in light of ongoing data collection and analysis (Eisenhardt 1989). Although a largely deductive and positivist case study approach was followed (Yin 1994), the researcher remained sensitive to the possibility of multiple interpretations and biases in the evidence collected (Klein and Myers 1999).

This investigation used an exploratory multiple case study design for developing a theoretical model of the strategic fit of SCM IS. Informants from five manufacturing firms in Canada were used to explore and further develop the theoretical model. Four of the firms were involved in the electronics industry, while one was from the energy industry.

The empirical analysis used exploratory questionnaires adapted from previous studies and the coding and interpretation of archival documents and transcripts from semi-structured interviews. Multiple quantitative and qualitative data collection and analysis methods were used to provide a richer understanding of the research constructs, while compensating for the limitations of any single approach (Sawyer 2001; Strauss and Corbin 1998; Yin 1994). Although the qualitative analysis primarily used deductive

pattern matching techniques (Yin 1994), an iterative coding, analysis, and theory development process helped ensure the developed theory was well grounded in empirical evidence (Eisenhardt 1989). Following Yin (1994) and Stake (1995), a rigorous and well-documented case study protocol was followed to ensure the reliability and validity of the findings and to enable the study to be replicated by other researchers.

The goal of this chapter was to describe the research methodology for developing and exploring the theoretical model of the strategic fit of SCM IS. The justification for the methodology was presented as well as the steps taken to maximize the reliability, validity, and ethical integrity of the study. Due to the immaturity of the developed theory and measures, an exploratory rather than confirmatory approach was taken. An analysis of case study evidence described in the next chapter suggests the developed theoretical model is valid, reliable, and useful. Although the developed theory and measures have not been confirmed using a statistically significant sample size, the model is sufficiently developed and operationalized to enable future confirmatory studies.

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

The purpose of this chapter is to describe the evidence used to develop the theoretical model discussed in the final chapter. The evidence is also used to demonstrate how the model may be operationalized to provide an accurate and useful assessment of a firm's competitive strategies, the organizational capabilities supported by the firm's SCM IS, and the resultant fit between the two.

As shown in Figure 4.1, each of the following sections of this chapter addresses a different research question for further developing the conceptual framework outlined in Chapter 2. The findings presented are based on an analysis of qualitative and quantitative evidence, along with a concurrent comparison to previous studies where appropriate. Section 4.2 presents findings on each case's competitive strategy patterns and archetypes. Section 4.3 examines the level of supply chain integration in the case studies. Section 4.4 analyzes the cases to identify relevant SCM IS capabilities constructs. The section then analyzes prior studies to determine the theoretically ideal level of support a firm's SCM IS should provide for each capability according to a firm's competitive strategy archetype. Section 4.5 examines the perceived level of support for each capability provided by each case's SCM IS. Section 4.6 examines the gaps between the theoretically ideal and reported SCM IS capabilities and compares this to qualitative measures of the strategic fit of SCM IS. Section 4.7 summarizes the case study analyses for review and feedback from the participants. This chapter concludes with a summary of findings.

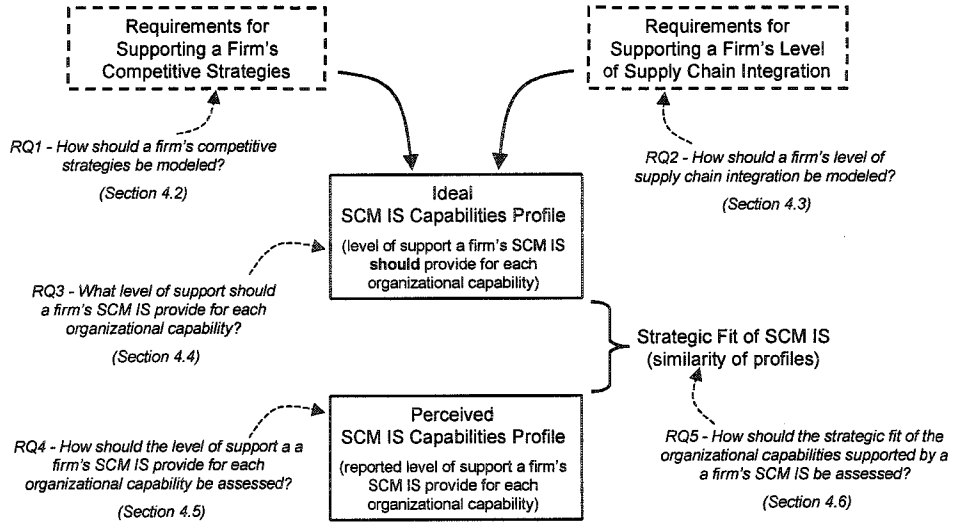

Figure 4.1 - Chapter Outline for Addressing Research Questions

To answer each of the research questions, each of the Sections 4.2-4.6 are organized into: the research question addressed, qualitative analyses, quantitative analyses[28], overall findings for each case, and an answer to the research question. The qualitative and quantitative evidence are compared and contrasted within and between cases to triangulate findings, check for corroboration, answer the research question, and uncover additional insights.

4.2 Competitive Strategy Archetype

How should a firm's competitive strategies be modeled? *(RQ1)*

The first requirement for developing the model further and operationalizing the constructs was to determine the most appropriate method for characterizing a firm's competitive strategies. This section presents findings from qualitative and quantitative analyses of each case's competitive strategy patterns. The patterns were then used to determine the competitive strategy archetype of each case.

4.2.1 Qualitative Analysis of Competitive Strategy Patterns

Coding and analysis of interview transcripts and archival documents allowed the researcher to determine the Miles and Snow (1978) competitive strategy archetype each case most closely matched. Miles and Snow's (1978) description of each archetype addresses eleven dimensions of competitive strategy including: product-market breadth; market leadership, surveillance, and growth; process goals; competency breadth; infrastructure adaptability; administrative focus; planning; organizational structure; and control.

The competitive strategy patterns in each text were identified using the codes outlined in Appendix D. Each case's competitive strategy patterns were then matched with the patterns exhibited by Miles and Snow's Defender, Prospector, Analyzer, and Reactor archetypes, which were summarized in Table 2.1 and were described in greater detail in Miles and Snow (1978)[29]. For example, Case E respondents described several Prospector-like competitive strategy patterns such as speed-to-market, product leadership, innovation, as seen in the following excerpts:

> *The most important thing in our industry — which is highly competitive — is [being] first to market ...leading the customers in the next generation of products... defining what our customers will need in the future.*

> *It's having the people ... to react quickly to the latest innovations in science. Our company invests 10-15% of its revenue in purely research and development.*

---

[28] For Section 4.4, which identifies relevant SCM IS capabilities constructs, an analysis of prior studies is reported rather than quantitative analyses or overall findings for each case.

[29] The competitive strategy questionnaire described in the following section and in Appendix C provides further description of the patterns associated with Miles and Snow's (1978) competitive strategy archetypes.

Patterns in the texts were also used to identify which archetypes the cases did *not* match. For example, Defenders typically focus on achieving low prices through operational efficiency, yet Case E did not appear to focus on low prices:

> *We may even be more expensive... However, [customers] rely on us because of the fantastic levels of support we are able to provide.*

In addition to the interview transcripts, archival documents such as publicly available financial reports were analyzed for competitive strategy patterns. Table 4.1 summarizes the competitive strategy patterns mentioned in publicly available documents for each case's parent firm. Although these documents provided further evidence of competitive strategies, they were not relied upon as heavily as the interview transcripts since these documents tended to describe intended rather than realized strategic patterns.

Table 4.1 - Stated Corporate Priorities for each Case

	Case A1/A2	Case B	Case C	Case D	Case E
Corporate Priorities[30] from Public Documents	Operational efficiency	Operational efficiency		Operational efficiency	
	Cost performance	Cost performance		Increase profit margins	Cost performance
		Inter-firm collaboration		Inter-firm collaboration	Inter-firm collaboration
		Technology innovation	Technology innovation	Technology innovation	Technology innovation
	Increase sales		Grow/maintain market share	Grow market share	Leverage product and geographic range
	Increase Return on Assets			Increase Return on Assets	
		Customer satisfaction	Highly Tailored products		Customer relationships
	Quality	Quality			

[30] Items are grouped to facilitate comparisons but are not in order of priority.

Several cases exhibited competitive strategy patterns that were associated with two or more different archetypes. For these cases, the researcher determined which archetype the case most closely resembled (Doty *et al.* 1993) and looked for further evidence to resolve the ambiguity. For example, although a respondent for Case B noted that growth is primarily achieved through "serving existing markets" (a Defender-like behaviour), the respondent also noted that Case B does "selectively enter new markets." Further analysis indicated Case B did not enter new markets as frequently as their competitors did and thus Case B was more Defender-like than their competitors in terms of serving existing markets[31].

Similarly, some cases did not match the competitive strategy patterns of a single archetype for all eleven dimensions of competitive strategy. Thus, while the archetype each case most closely matched was identified, many of the cases also exhibited some secondary characteristics of other archetypes. For example, while Case D exhibited Prospector-like patterns of product innovation and risk taking, there was also some evidence of analytical and risk-averse patterns more similar to an Analyzer, especially when compared to Case D's competitors:

> *Our company is known as an innovator. But it's not innovation gone unchecked like some of the competition... We would never offer a product that we didn't feel would be number one or two in the world, but at the same time, the company is willing to take big risks to go into market areas that are as yet unknown.*

This excerpt suggests that Case D was not as strong a Prospector as some of its competitors. However, willingness to take risks and aggressively create new markets is a strong example of Prospector behaviour. Overall, Case D showed some characteristics of Defender and Analyzer behaviours such as a focus on cost management and extensive market analyses. However, the majority of its competitive strategy patterns were most similar to those of a Prospector.

After analysis of the competitive strategy patterns found in the qualitative evidence for each case, the competitive strategy archetype each case most resembled was determined, as shown in Table 4.2. As described in Chapter 3, the coding and analysis was repeated by two other researchers and the final analyses were checked for corroboration by a panel of three experts and by case study participants.

[31] Since a firm's competitive strategy is relative to its competitors, analysis of a firm's competitive strategy should be done relative to its competitors (Dess 1990). Thus, a case was characterized a Defender if it was as or more "Defender-like" than its competitors.

Table 4.2 - Competitive Strategy Archetype from Qualitative Analyses

Case	Archetype Inferred	Example Qualitative Evidence
A1	Defender	Focus on: cost controls; risk management; quality; market dominance; long-term relationships/contracts
A2	Analyzer	Focus on: sales; risk management; adopting proven technologies; competitive intelligence; market scanning
B	Defender	Focus on: cost controls; quality; economies of scale; long-term relationships/contracts
C	Prospector	Focus on: technology innovation; customized products; market share growth
D	Prospector	Focus on: innovation; inter-firm collaboration; market share growth; market scanning; time-to-market
E	Prospector	Focus on: research; innovation; collaboration; breadth of products; customer relationships

4.2.2 Quantitative Analysis of Competitive Strategy Patterns

In addition to qualitative analyses, several quantitative measures have been proposed for determining the correspondence of the competitive strategy patterns of a case with each of the Miles and Snow (1978) competitive strategy archetypes (e.g., Conant *et al.* 1990; Miles and Snow 1978; Sabherwal and Chan 2001). The most commonly used operationalization involves having an informant select the paragraph description that most closely describes their competitive strategy patterns (Miles and Snow 1978). However, Miles and Snow's (1978) "paragraph-type" approach has been criticized for failing to operationalize all of the 11 dimensions of their theoretical model (Conant *et al.* 1990). The paragraph approach also forces the classification of a case into one of the ideal archetypes, rather allowing for hybrid configurations or measuring the degree of correspondence with each of the ideal types (Doty *et al.* 1993). The operationalization of these measures is discussed further in Chapter 3.

4.2.2.1 Evaluation of Alternative Measures of Competitive Strategy

To determine the most suitable operationalization of competitive strategy for this study, quantitative data was gathered from each case using several alternative measures and the 12 participants described in Table 3.2. The findings were evaluated by a panel of three expert judges and compared with qualitative evidence to check for corroboration. Findings and recommendations for each of the potential questionnaire measures are summarized in Table 4.3.

Table 4.3 - Evaluation of Competitive Strategy Questionnaire Measures

Measure Evaluated	Results and Observations	Recommendations
Mapping of STROBE (Venkatraman 1989b) attributes to Miles and Snow (1978) competitive strategy type (after Sabherwal and Chan 2001)	- Did not agree with experts - Insufficient discrimination between external and internal analysis. - Lack of theoretical support for mapping to Miles and Snow's typology.	- Replace with more direct measures of Miles and Snow Competitive Strategy Type.
Miles and Snow (1978) Paragraph Self-Typing (respondents read four paragraphs describing competitive strategy types and choose the one that most closely matches their organization)	- Had fastest response times. - Results from each informant agreed with Expert Panel assessment in five of six cases. - Risk of mistyping errors due to paragraph not covering all 11 dimensions of the theoretical construct. - Reactors appeared to be a valid strategic type.	- Use along with a more robust measure such as Conant et al. (1990). - Reactors should be included as a valid strategic type.
Conant *et al.*'s (1990) 11-dimension scale for determining Miles and Snow (1978) competitive strategy type	- Results from each informant agreed with Expert Panel assessment. - Useful for analysis of underlying dimensions of competitive strategy (e.g., can highlight misalignment between different dimensions of competitive strategy).	- Use along with Miles and Snow 's (1978) paragraph type for triangulation.

The Miles and Snow (1978) paragraph-type measure had the fastest response time, as the one page questionnaire was considerably shorter than the other measures used. For five of the six cases, the archetype selected by each respondent was consistent and was corroborated by the three judges who reviewed publicly available evidence on the cases. One of the 12 respondents selected an archetype that was not corroborated by the additional evidence. However, they indicated they had difficulty deciding between two paragraphs and their second choice did agree with the other ratings.

Results of the STROBE measure could not be corroborated with other measures of competitive strategy patterns for three of six cases. Further examination of the STROBE measure revealed the items and constructs did not adequately address the differences between the Miles and Snow (1978) archetypes. For example, the Analysis construct did not distinguish between external (market scanning) and internal (company performance) analysis, which is a key differentiator between Analyzers and Defenders. Although the STROBE measure did not produce plausible results when used to determine the competitive strategy type through Sabherwal and Chan's (2001) profile deviation techniques, their techniques were very helpful in determining the profile deviation

between the ideal and perceived SCM IS capabilities using the more direct measures of competitive strategy archetype.

Results from the 11-item measure adapted from Conant *et al.* (1990) were corroborated by evidence from the case studies for all six cases and were deemed sufficiently plausible by the panel of judges.

Although the Miles and Snow (1978) measure appeared to have acceptable validity for a quick and economical measure, the single mistyping that occurred supported Conant *et al.*'s (1990) criticism that the paragraph descriptions do not cover all 11 dimensions of the Miles and Snow (1978) competitive strategy construct. Of the three questionnaires, the Conant *et al.* (1990) measure and results were judged to have the highest apparent or face validity. As suggested by Doty *et al.* (1993), the measure allows for a finer-grained analysis and highlighted the degree of correspondence with the archetypes, rather than classifying each case as a pure archetype. Since none of the cases corresponded fully with an archetype for all 11 dimensions, the level of support required for each of the SCM IS capabilities were weighted according to the percentage of dimensions that corresponded with each of the archetypes.

In summary, the evaluation of alternative measures suggested the 11-dimension measure yielded the most optimal trade-off between richness of analysis and ease of administration. However, the paragraph-type measure and analysis of qualitative evidence may also be used to triangulate findings, check for corroboration, and uncover additional insights.

4.2.2.2 Results of Quantitative Analysis of Competitive Strategy

Based on the preceding recommendations, the competitive strategy archetype to which each case most closely corresponded was determined from results from an 11-item questionnaire measure (from Conant *et al.* 1990) and a paragraph-type questionnaire measure (from Miles and Snow 1978). These findings are triangulated with qualitative evidence in the next section to determine the overall assessment of competitive strategy type for each case.

As shown in Table 4.4, the results from the questionnaire adapted from Conant *et al.* (1990) implied that Cases A1, A2, B, C, D, and E corresponded most closely with the Miles and Snow (1978) competitive strategy archetypes of Defender, Analyzer, Defender, Prospector, Prospector, and Prospector, respectively. For each case, the number of responses corresponding to each of the four archetypes for the 11 dimensions was averaged across the multiple respondents for that case and reported in the table, along with the range of responses for that archetype. For example, for Case A1, in their responses to each 11 questions, the respondents chose a response typical of an Analyzer on average three out of the 11 times. The range of responses was two since respondents chose the Analyzer response between one and five times in the 11-item questionnaire.

Table 4.4 - Responses to Competitive Strategy Questionnaire

Case	Average Number (Range) of Responses for each Archetype (out of a total of 11 items)				Archetype from Most Responses	Archetype from Paragraph Measure
	Defender	Analyzer	Prospector	Reactor		
A1	**7.0** (0)	**3.0** (2)	0.5 (1)	0.5 (1)	Defender	Defender
A2	2.0 (2)	**8.5** (1)	0.5 (1)	0.0 (0)	Analyzer	Analyzer
B	**6.0** (2)	**3.5** (1)	0.0 (0)	1.5 (1)	Defender	Defender / Reactor[32]
C	2.0 (0)	1.0 (2)	**7.0** (0)	1.0 (2)	Prospector	Prospector
D	2.5 (1)	**3.0** (0)	**4.0** (0)	1.5 (1)	Prospector	Prospector
E	0.0 (0)	1.5 (1)	**8.5** (1)	1.0 (0)	Prospector	Prospector

The final column in Table 4.4 shows the archetype corresponding to the Miles and Snow (1978) paragraph description that was chosen by each of the respondents for the case. All but one respondent (see footnote to table) chose the paragraph that corresponded with the archetype resulting from the 11-item questionnaire. This high degree of agreement between measures suggests the results have good reliability. It also suggests the more parsimonious yet controversial paragraph-type measure provides an accurate assessment of Miles and Snow's (1978) competitive strategy archetype in most, but not all cases. Regardless, this study found Conant *et al.*'s (1990) 11-dimension assessment of competitive a more descriptive and more theoretically sound assessment of Miles and Snow's multidimensional competitive strategy construct.

4.2.3 Overall Assessment of Competitive Strategy Archetype

As described previously, the same archetype was arrived at using each measure, with one exception using the paragraph-type measure. The less time-consuming questionnaire measures appear to give as valid and reliable indicators of competitive strategy archetype as the more in-depth interpretive analyses of interviews and archival documents. While the paragraph-type measure yields only the archetype, the 11-item measure can be used to investigate each of Miles and Snow's (1978) eleven underlying dimensions of competitive strategy. The qualitative analysis of interview and archival data can enable an even richer analysis of the underlying competitive strategy patterns.

[32] One respondent chose the Reactor paragraph but noted on the questionnaire that it was difficult to decide between that paragraph and the paragraph describing Defenders. Since the other respondent chose the Defender paragraph, there is reasonable support for classifying the case as a Defender using the paragraph measures.

However, the validity of any findings using the qualitative analysis cannot be established using statistical techniques, as has been done in previous studies for the questionnaire measures (e.g., Conant *et al.* 1990; Doty *et al.* 1993; Hambrick 1983; Miles and Snow 1978; Shortell and Zajac 1990; Zahra and Pierce 1990).

Table 4.5 summarizes the competitive strategy archetype each case most closely resembled. The first two columns of the table present the archetype derived from the questionnaire measures adapted from the Conant *et al.* (1990) 11-item measure and the Miles and Snow (1978) paragraph-type measure, respectively. The third column shows the archetype derived from an interpretive analysis of the interview transcripts and archival documents. The final column presents the archetype inferred from reviewing the results of each of these analyses.

Table 4.5 - Competitive Strategy Archetype for each Case

Case	QUALITATIVE	QUANTITATIVE		OVERALL
	Archetype from Interviews and Documents	Archetype from Most Responses to 11-item Measure	Archetype from Paragraph-type Measure	
A1	Defender	Defender	Defender	Defender
A2	Analyzer	Analyzer	Analyzer	Analyzer
B	Defender	Defender	Defender / Reactor	Defender
C	Prospector	Prospector	Prospector	Prospector
D	Prospector	Prospector	Prospector	Prospector
E	Prospector	Prospector	Prospector	Prospector

4.2.4 Answer to RQ1: Modeling a Firm's Competitive Strategies

Initial investigations found stronger support for modeling a firm's competitive strategies using the firm's emergent competitive strategy patterns rather than the firm's stated or intended strategies (Mintzberg 1978; Mintzberg and McHugh 1985). After a review of several competitive strategy conceptualizations, Miles and Snow's (1978) typology of competitive strategy archetypes was found to be the most promising.

Miles and Snow's typology (1978) is one of the most widely used in competitive strategy studies (Gimenez 1999; Hambrick 1983). It enables a more holistic, multi-dimensional analysis of a firm's emergent competitive strategy patterns to be undertaken, while reducing the complexity of analysis by grouping the firm's patterns into one of Defender, Prospector, and Analyzer, or Reactor archetypes. The chief limitation of the Miles and Snow (1978) typology is that the traditional paragraph-type measure used to

identify a firm's archetype does not properly operationalize all 11 dimensions of the competitive strategy typology (Conant *et al.* 1990). Thus, there is a risk that a firm will be mistyped if only the paragraph measure is used.

This study found the archetype identified using Miles and Snow's (1978) paragraph measure was corroborated by other measures in 5 of the 6 cases. However, an 11-dimension measure adapted from Conant *et al.* (1990) provided a more reliable and detailed analysis of a case's competitive strategy patterns and resulting competitive strategy type, that was corroborated by qualitative evidence in all 6 cases. Furthermore, the Conant *et al.* (1990) measure identified which archetype a case was most like for each of the 11 dimensions of competitive strategy separately. Thus, unlike with the paragraph-type measure, the *degree of correspondence* a case had with each of the Miles and Snow (1978) archetypes could be determined.

The qualitative evidence more strongly supported the use of Conant *et al.*'s (1990) multi-dimensional questionnaire measure of competitive strategy type rather than the traditional Miles and Snow (1978) paragraph measure. The findings also suggests additional evidence from field studies and Miles and Snow's (1978) paragraph-type measure should be gathered as a check for corroboration where feasible. Thus, the findings suggest Conant *et al.'s* (1990) multidimensional questionnaire measure be used to measure a case's competitive strategy patterns and hence derive the Miles and Snow (1978) competitive strategy archetype a case most resembles (see Figure 4.2).

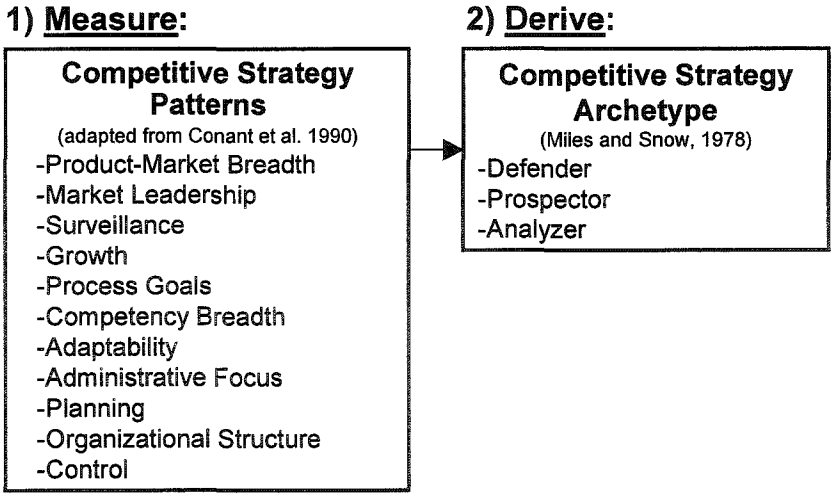

Figure 4.2 - Deriving Competitive Strategy Archetype from Strategy Patterns

4.3 Level of Supply Chain Integration

How should a firm's level of supply chain integration be modeled? *(RQ2)*

This question arose from the assumption that a firm's level of supply chain integration is an important determinant of the capabilities enabled by a firm's SCM IS. For example, a high level of integration between supply chain partners requires a high level of support for external process coordination capabilities (Poirier and Bauer 2001; Roloff *et al.* 2001). An exploratory examination of supply chain integration was necessary because there was a lack of clarity on the meaning and operationalization of the construct and its underlying dimensions in the literature. Although there have been some non-academic surveys of supply chain integration (Moncrieff and Stonich 2001), there was a lack of peer-reviewed studies that rigorously examine the validity and reliability of potential measures.

To determine its importance to the strategic fit of SCM IS model, the level of internal and external supply chain integration was examined for each case using a qualitative analysis of interview transcripts and archival documents and a review of results from 15-dimension and 4-dimension questionnaire measures.

4.3.1 Qualitative Analysis of Level of Supply Chain Integration

Coding and analysis of interview transcripts and archival documents were used to examine the level of supply chain integration for the cases. The codes outlined in Appendix D were used to identify patterns in the texts and determine the level of integration between the case and its supply chain partners. The purpose of this analysis was to triangulate the findings from the questionnaire measures and to further explore the level of supply chain integration construct.

Pattern matching analyses determined which of the five levels of supply chain integration best described the case: Functional Focus, Internal Integration, Linked Network, Integrated Network, or Optimized Network. As outlined in Table 2.2, cases at different levels of supply chain integration would exhibit different patterns of information sharing, process management, performance management, and decision-making within its organization and between its supply chain partners. Generally, higher levels of integration exhibit more collaborative information sharing, management, and decision-making patterns.

For example, analysis of the texts suggested Case A focused primarily on internal integration but had linked some systems and processes with key suppliers. Most of their integration efforts were aimed at improving *internal* information sharing to reduce costs and improve decision-making. Interview respondents highlighted how Case A had implemented a centralized ERP, which was felt to improve information sharing and decision-making within the organization:

> *Since we've moved to the [new ERP], I think our information sharing is a lot more robust and accessible so that you can go and do analyses without having to go to someone else for that information.*

Based on this evidence, Case A was inferred to be at least at the Internal Integration level.

The texts were examined further to determine if there was evidence that Case A had formed linked networks with its customers and suppliers. Although there was some evidence of this, most patterns exhibited in the transcripts and documents indicated that overall, Case A was at Level 2 and could be considered to be at Level 3 for only a few processes and supplier relationships. Most of the external information exchange involved incorporation of supplier information into Case A1's systems for procurement of indirect supplies, rather than sharing information or collaborating with its suppliers.

> *For [indirect supplies] we use our procurement systems a lot. We try to standardize across all our operating units so we can get into higher volume, longer-term relationships with one larger supplier... We try to move our purchase orders electronically across to them and make it more efficient.*

However, there did appear to be a recent trend towards more collaboration and sharing of information and benefits with strategic suppliers that indicates Case A may soon reach a higher level of supply chain integration:

> *I think traditionally we've had more of the upper hand in the relationship because of our volume, because we're a big customer. But I think we look to our suppliers for ideas on how to reduce cost... To be more efficient you have to share more information in order to get out some of that slack in the system... A good example is the contract trucking [suppliers].*

The qualitative analyses highlighted how the difficulty of determining a case's overall level of supply chain integration when the firm may be at very different levels for different processes, relationships, or product lines. Case B had several ERP, EDI, and web-based SCM IS, suggesting internal and external integration were both important to Case B. However, the presence of multiple non-integrated ERP systems across the corporation suggested internal coordination was not been fully realized in all areas. Furthermore, a respondent for Case B noted the supply chain strategies were not highly coordinated between business units across the firm:

> *We may have an excellent SCM solution as a corporation, [but it is] only deployed in certain geographies...Siloing can be an issue, forcing each business unit to have a separate supply chain strategy with little coordination.*

Thus, Case B appeared to be at the internal integration level for most of its processes and businesses, but at lower or higher levels for others. Although similarly ambiguous patterns were found in the evidence for the other cases, an attempt to identify the overall level of supply chain integration for each case was made as shown in Table 4.6.

Table 4.6 - Level of Supply Chain Integration from Qualitative Analyses

Case	Level of Supply Chain Integration	Example Evidence
A[33]	Level 2: Internal Integration (approaching Level 3 in some areas)	- Implemented ERP gave improved access to information "*without having to go to someone else.*" - Supplier information incorporated into procurement systems, but little sharing of Case A's information with customers or suppliers.
B	Level 2: Internal Integration (approaching Level 3 in some areas)	- Usage of multiple non-integrated ERP systems across firm suggests internal integration is incomplete; however, some external sharing of information using EDI and web-based portals. - "*There is not strong external and even cross-functional representation" in supply chain decision-making.*
C	Level 2: Internal Integration (approaching Level 3 in some areas)	- ERP system facilitated information sharing across functional areas, but not widely used to share information externally. - Strong cross-functional representation for supply chain decision-making, with some involvement of external partners.
D	Level 2: Internal Integration (approaching Level 3 in some areas)	- ERP and other SCM IS used to integrate information internally, although "*not integrated very well.*" - Information sharing was unidirectional (given to suppliers) rather than collaborative and not in electronic formats. - Management and decision-making controlled by Case D rather than jointly performed with partners.
E	Level 2: Internal Integration (approaching Level 3 in some areas)	- Two separate SCM IS used for supply and demand-side processes, respectively, with some integration. - Some external integration; however, information exchanged mostly limited to product requirements and purchase orders rather than order forecasting.

The rich qualitative data also produced some additional interesting findings related to supply chain integration. For example, the importance of supply chain integration appeared to differ among the cases and between business units in the firms. A respondent for Case D suggested the use of sophisticated SCM IS to facilitate tighter supply chain integration was not a priority in their business unit. This was attributed to the high-margin, low volume nature of the products produced:

> *For the company, [SCM IS are] very important [for products where] we sell a lot of units. But [for the Case D business unit], sales of units aren't as high. It's a very high-end product... To generate a lot of income, we don't have to sell all that*

[33] Since the level of supply chain integration was measured at the corporate level, Cases A1 and A2 were reported together as Case A.

> *many units. So I'm not sure that the distribution and logistics systems need to be as good as maybe other business units... I would say our business unit isn't as reliant on [SCM IS].*

This may also be because Case D outsourced many of its supply chain management processes to contract manufacturers (including Case B) who then managed the operational data. Although one might expect these transactions would require sophisticated SCM IS, much of the information sharing between Case D and its suppliers was via non-integrated phone and fax communications. A respondent suggested this was because Case D's power over their contract manufacturers allowed them to offload the responsibility of managing the transactions to the manufacturer:

> *We use contract manufacturers almost exclusively. [Sophisticated SCM IS] probably are more useful to our contractors. We shift off all the responsibility to the contract manufacturers and they must use their systems. We basically tell our contract manufacturers how to build something and what parts to buy and who to buy them from and what price that they should pay for it... A lot of it is old-fashioned phone/fax because like I said, the quantities are lower.*

It appeared that Case D's power over their suppliers meant that the relationship does not need to be collaborative in order to gain low prices and keep costs under control:

> *Unfortunately for our suppliers, our company holds all the cards. It's probably one of the biggest customers... Sometimes we'll say [to our suppliers] 'you're competitor is 20% cheaper'. And they'll say, 'we're unable to meet that price'. And we'll say, 'okay, we're going to chop off your orders by 30% now'. And they have to take that. It can backfire, but ... they are forced to eat inventory as a sign of goodwill, business-relationship-wise. And it's unfair to them, but... I think they realize that the [money] they make from our company over the long haul certainly compensates for any short term inventory eating that they have to do.*

As can be seen, the qualitative data provided rich findings at a detailed level, but at a high level, there was little to differentiate the level of supply chain integration between the cases.

4.3.2 Quantitative Analysis of Level of Supply Chain Integration

A 15-item scale (Appendix C) adapted from Moncrieff and Stonich (2001)[34] was pilot tested for Cases A1, B, and C using four respondents. The 15 items covered each 15 dimensions of the four process groupings of the SCOR model: Overall, Plan, Make, and Deliver processes (Moncrieff and Stonich 2001; Supply-Chain Council Inc. 2002). There was little differentiation between average responses between the Overall, Plan, Make, and

[34] An analysis of the validity of the proprietary benchmarking surveys reported in Moncrieff and Stonich (2001) has not been published. However, the measures have been peer-reviewed and endorsed by the Supply-Chain Council (2002) in a non-academic journal. Care must be taken in interpreting any findings from these preliminary measures as their validity has not been established using statistical techniques.

Deliver processes (see Table 4.7). Thus, the researcher concluded that further analyses could use a more parsimonious four-item questionnaire to investigate the four dimensions of the overall process group in the SCOR model. These four dimensions include: Supply Chain Strategy; Supply Chain Performance Management; Supply Chain Processes; and Supply Chain Organization (see Appendix C).

Table 4.7 - Pilot Test of Level of Supply Chain Integration

SCOR Process	Dimension	Level of Supply Chain Integration by Respondent (1=at Functional Focus level, 4=at Integrated Network level)			
		A1-1	A1-3	B1-2	C1-1
Overall	Supply Chain Strategy	2	3	4	3
Overall	Supply Chain Performance Management	2	2	3	2
Overall	Supply Chain Processes	3	2	2	2
Overall	Supply Chain Organization	2	3	3	2
Plan	Demand Planning	2	3	3	3
Plan	Supply Planning	3	3	2	2
Source	Source Strategy	4	3	3	3
Source	Commodity & Spend Management	3	2	2	2
Source	Supplier Development & Management	4	2	2	4
Source	Sourcing Organization & Infrastructure	3	2	2	2
Make	Make Strategy	3	2	3	3
Make	Production Scheduling	3	2	2	2
Make	Inventory Management	4	2	2	2
Deliver	Deliver Process Management	4	4	4	2
Deliver	Order Management, Logistics, & Invoicing	2	3	2	2
Overall	Average Overall Processes	2.5	2.3	3.0	2.3
Plan	Average Plan Processes	3.0	2.5	2.5	2.5
Source	Average Source Processes	2.3	3.5	2.3	2.8
Make	Average Make Processes	2.0	3.3	2.3	2.3
Deliver	Average Deliver Processes	3.0	3.5	3.0	2.0
All Items	Average All Items	2.5	3.0	2.6	2.4

Comparing results of the four overall items with the 15-dimensions in Table 4.7 suggests that the four-item measure may adequately describe the level of supply chain integration without subjecting the respondent to an overly lengthy and redundant questionnaire. Results using the four-dimension questionnaire for measuring the overall level of supply chain integration for Cases A-E are shown in Table 4.8.

As can be seen from Table 4.8, the overall level of supply chain integration for each case varied between 2.3 and 2.9. Therefore, the level of supply chain integration for each case was somewhere between Internal Integration (Level 2) and Linked Networks (Level 3).

Table 4.8 - Overall Level of Supply Chain Integration for each Case

Case	Average (Range) of Level of Supply Chain Integration for the Four Overall Dimensions (1=at Functional Focus level, 4=at Integrated Network level)				Average (Range) of the Four Overall Dimensions
	Supply Chain Strategy	Supply Chain Performance Management	Supply Chain Processes	Supply Chain Organization	
A	2.5 (1)	2.0 (0)	2.5 (1)	2.5 (1)	2.4 (0.2)
B	4.0 (0)	2.5 (1)	2.0 (0)	3.0 (0)	2.9 (0.2)
C	3.0 (0)	2.0 (0)	2.0 (0)	2.0 (0)	2.3 (0.0)
D	1.5 (1)	3.5 (1)	1.5 (1)	3.0 (0)	2.4 (0.2)
E	3.0 (0)	1.5 (1)	1.5 (1)	3.0 (0)	2.3 (0.0)

4.3.3 Overall Assessment of Level of Supply Chain Integration

Although the qualitative analyses revealed rich insights into supply chain integration in the cases, it did not find significant differences between the overall level of integration between the cases (see Table 4.6). Similar results were found from the questionnaires — there were variations in the level of supply chain integration between the supply chain strategy, performance management, processes, and organization dimensions, but the overall level of supply chain integration was similar for each case (see Table 4.8). The quantitative and qualitative data analyses indicated each case had only a moderate level of supply chain integration — somewhere between the Internal Integration and Linked Networks stage.

4.3.4 Answer to RQ2: Modeling Level of Supply Chain Integration

The purpose of answering this question was: to explore the level of supply chain integration construct; to determine if there were important relationships between this and the other research constructs; and to determine the feasibility of measuring a case's level of supply chain integration.

By integrating the preliminary work of several studies (Moncrieff and Stonich 2001; Poirier and Bauer 2001; Supply-Chain Council Inc. 2002), this study proposed the level of integration of a supply chain could be modeled as five stages or levels. These levels are: Functional Focus, Internal Integration, Linked Network, Integrated Network, and Optimized Network.

A 15-item measure was adapted from (Moncrieff and Stonich 2001) and used to assess the level of supply chain integration of a case's overall supply chain, as well as for each of the Plan, Make, and Deliver process areas of the supply chain. The measure

assessed four dimensions of the supply chain including supply chain strategy, performance management, processes, and decision-making.

In a pilot test of the measure, there was little differentiation between responses for each of the Plan, Make, Deliver process areas and the overall supply chain. Therefore, these areas were dropped from the questionnaire and a 4-item measure of the level of supply chain integration for the overall supply chain was used for the remainder of the cases. Although a statistically significant sample was not taken, results of the measure were corroborated with qualitative evidence and appeared to have good reliability and validity.

The quantitative and qualitative data analyses indicated each case had only a moderate level of supply chain integration — somewhere between the Internal Integration and Linked Networks stage. This finding agrees with preliminary studies of supply chain integration in several other industries (e.g., Moncrieff and Stonich 2001; Roloff *et al.* 2001). However, the lack of differentiation suggests that at present, a measure of the overall level of supply chain integration for a firm may not be a sufficiently important component of the theoretical model of strategic fit of SCM IS. However, as supply chain practices mature and firms become more differentiated by the level of supply chain integration, it may yet prove to be an important construct in future models of strategic fit of SCM IS.

4.4 Theoretically Ideal Level of Support for SCM IS Capabilities

What level of support should a firm's SCM IS provide for each organizational capability? *(RQ3)*

This question examines the ideal level of support a firm's SCM IS should provide for various organizational capabilities. The conceptual framework (repeated in Figure 4.1) suggested a firm's competitive strategies can be used to derive the theoretically ideal level of support the firm's SCM IS should provide for various organizational capabilities[35]. This section analyzes prior competitive strategy studies to determine the theoretically ideal level of support a firm's SCM IS should provide for various organizational capabilities. However, since it was unclear which organizational capabilities were relevant to modeling the strategic fit of SCM IS in particular, the first step was to identify an appropriate set of SCM IS capabilities. A qualitative analysis undertaken to identify relevant SCM IS capabilities constructs is described below, followed by an analysis of previous studies to determine the theoretically ideal level of support a firm's SCM IS should provide for each capability.

[35] The conceptual framework also suggested that a firm's level of supply chain integration could also be used to determine the ideal capabilities of a firm's SCM IS. However, due to a lack of differentiation among the cases studied, the level of supply chain integration construct was not found to currently play a significant role in the model of the strategic fit of SCM IS.

4.4.1 Qualitative Analysis of Relevant SCM IS Capabilities Constructs

The literature review revealed various IS capabilities that were potentially relevant in evaluating SCM IS. However, since many of the supporting studies were either not done specifically for SCM IS, or were only for specific types of SCM IS such as EDI systems, an exploratory field study was conducted to develop theoretically and empirically grounded constructs which can be operationalized for further study. Findings from three firms in the electronics manufacturing industry in Canada are examined to further refine and explore the operationalization of the SCM IS capabilities constructs.

4.4.1.1 Methods

The lack of an existing theoretical model of SCM IS capabilities prohibited the pre-specification of propositions and causal relationships, so an exploratory rather than confirmatory research approach was chosen (Eisenhardt 1989; Lee 1991). As firms were expected to differ in the relative importance they assign to each SCM IS capability, a multiple case study design was chosen for building theory from case study research (Eisenhardt 1989; Yin 1994). As the exploratory case studies involved researcher interpretation, care was taken to discuss potential alternative interpretations as well as the limitations of the theories and instruments used (Klein and Myers 1999; Stake 1995).

Three of the six cases from the dissertation study (Cases B, D, and E from Table 3.1) were analyzed to identify the appropriate SCM IS capabilities constructs. The analysis was limited to these three cases for several reasons. First, initial interviews suggested that much of the evidence and findings on SCM IS capabilities from all six cases would be redundant. Thus, theoretical saturation could be achieved without requiring excess time or redundant reporting (Eisenhardt 1989; Reich and Benbasat 2000). Second, all three cases are from the electronics manufacturing industry in Canada, which facilitates comparison and theoretical replication among the cases while reducing extraneous phenomena and cross-industry differences (Weill and Olson 1989; Yin 1994). Third, the cases were early adopters of SCM IS and thus expected to have well-developed experiential knowledge of SCM IS capabilities. Finally, two of the firms were direct competitors, while the third firm was a contract manufacturer and supplier to the other two. This interrelationship enabled comparisons of the constructs and findings to be made between the responses of the competitors and between supplier and customer. In summary, this theoretical sampling strategy helps ensure all aspects of the proposed theory are included in the evidence gathered from the informants (Eisenhardt 1989).

Using an iterative process of data gathering and analysis (Eisenhardt 1989), the researcher evaluated the case study evidence to assess the relevance of each of the initial candidate IS capabilities constructs to a model of SCM IS capabilities. A high, medium, or low level of relevance was assigned to each construct based on the researcher's subjective evaluation of the case study evidence. For example, if a capability were described as being highly important to the organizational effectiveness of a case, it was judged to have high relevance to the model. If a capability were not mentioned in the case evidence or the participants indicated that it did not contribute significantly to the overall

organizational effectiveness of the firm, then it was given a rating of low. If the relevance appeared to be more ambiguous, it was given a rating of medium. These ratings were examined by two other researchers who confirmed their face validity.

4.4.1.2 Results

The relevance of the operational efficiency capability for modeling SCM IS capabilities was found to be high for each case overall (see Table 4.9[36]). However, the evidence highlighted the fact that not all firms require the same level of support for operational efficiency. A respondent for Case B noted: *"We focus more on cost control compared to our competitors."* Similarly, within a firm, different business units often require different levels of support for operational efficiency. For example, a Case D respondent noted, *"For the company it's very important because we sell a lot of units...[But in my business unit,] it's an expensive product... the logistics systems don't need to be as good."* The respondent appears to support Fisher's (1997) proposition that operational efficiency is more important for products with high transaction volumes and low profit margins. Case E had similar responses, with one respondent noting the need for operational efficiency changes over time: *"When the market becomes saturated ...margins decrease and saving money internally is more of a focus."*

Table 4.9 - Relevance of Initial Constructs to Model of SCM IS Capabilities

Case	Operational Efficiency	Operational Flexibility	Planning	Analysis	Process Coordination
B	High	Medium	Short-term: High Long-term: Medium	Internal: High External: Medium	Internal: High External: High
D	High[37]	High	Short-term: Low Long-term: Low	Internal: Low External: High	Internal: High External: High
E	High	High	Short-term: High Long-term: Low	Internal: High External: High	Internal: Medium External: Medium

Operational flexibility was judged to be of high relevance for Cases D and E. A Case D respondent noted: *"Flexibility is way more important [than automation], we have to be able to make quick changes and override things just based on a meeting."* It was of medium relevance to their contract manufacturer. A Case B respondent stated it is *"less of a focus than [for] our competitors,"* but *"at the last minute [the customer] changes the*

[36] Appendix F describes the findings in further detail. The full transcripts are available upon request.

[37] Respondents for Cases A and B suggested the relevance was medium for the specific business unit studied in the case, but high for the company overall.

way a component works, we have to be flexible enough to change the design and retool." Case E remarked, "*We could be dissatisfied with our supplier and change suppliers overnight... so there is not very much business-to-business systems set up.*" This suggests the need for operational flexibility may be an inhibitor to the adoption of SCM IS.

Evaluating the relevance of the planning and analysis capabilities was more complicated. The initial "analysis" construct (Sabherwal and Chan 2001; Venkatraman 1989b) was split into external (market scanning) and internal (company performance) analysis, after the interviews showed differing levels of relevance between the two. For example, for internal analysis, Case D stated, "*For things like planning and analysis, our IS are not a competitive strength.*" However, for external analysis, they noted, "*In knowing what the customers need [we're] probably best [in the industry] ...we have better systems [than our competitors] for information on competitive products.*"

Similarly, the planning construct was initially split into "long-term" and "short-term" planning to distinguish findings on strategic planning from shorter-term operational and tactical planning. However, the distinction between separate planning and analysis constructs was ambiguous. For short-term planning, the responses were difficult to distinguish from the responses for internal analysis. In each of the cases, the perceived relevance of short-term planning was similar to that of internal analysis. For Case E, both were high, as they noted, "*With a company of this size, a reliable order processing and production planning system is imperative*" and "*collating the data for analysis requires an exceptional expenditure of time and effort.*" For Case D, both were rated low, as they noted, "*I don't think [short-term planning] systems would make as much of an impact as making very sound business decisions*" and "*for things like planning and analysis, our IS are not a competitive strength.*" Thus, this investigation had difficulty differentiating short-term planning from internal analysis, although both were judged to be of high relevance to two of the three cases. It did appear that the construct of long-term planning was significantly distinct from internal or external analysis, although there are potential overlaps that must be dealt with in the operationalization of these constructs[38].

After analysis of the interviews, the business process coordination construct was initially split into internal and external process coordination as the responses noted significant differences between these two dimensions. For Cases D and B, their high level of usage of integrated ERP, EDI, and web-based portal SCM IS indicated both internal and external process coordination was of high relevance. However, Case E appeared to place only moderate importance on internal coordination. They noted, "*There is some aggregation that the purchasers do, but I'm not certain that it crosses business units.*" They also noted that "*various ERP systems are used in different business units,*" indicating that while internal coordination was important enough to warrant using an

[38] The questionnaires reported in Section 4.5.2 used separate items for short-term planning, long-term planning, internal analysis, and external analysis in order to examine whether the responses differentiated among these concepts. As reported in that section, there was insignificant differentiation between the average responses to long-term and short-term planning within each case. However, responses did indicate that planning, internal analysis, and external analysis were distinct concepts.

ERP, it was not relevant enough to justify a single corporate-wide ERP. Similarly, for Case E, external process coordination capabilities were apparently important only for supporting collaborative design processes rather than other planning or replenishment activities. Thus, it was judged to be of only medium relevance to Case E overall.

Since both internal and external coordination were judged to be of equal relevance within each case, the constructs were then collapsed back into a single business process coordination construct. However, evidence on the distinction between operational efficiency and business process coordination was also ambiguous. Within Cases D and B, operational efficiency and internal and external process coordination were all judged to be of equally high or medium relevance depending on whether the respondent was judging the specific business unit or the company overall. Thus, this study found that at a high level, there was little difference in the relevance of the SCM IS capabilities of internal and external process coordination and operational efficiency. However, a more detailed study is suggested to resolve the conceptual ambiguities uncovered.

An examination of the summary results in Table 4.9 suggests that several of the initial candidate SCM IS capabilities identified in the review of IS literature should be either collapsed together or split into different dimensions. The operational efficiency and operational flexibility constructs appeared to be highly relevant to the cases and thus should be included in the revised model of SCM IS capabilities. However, since the length of the planning horizons was different for each case, there did not appear to be empirical support for distinguishing between short-term and long term planning as was initially attempted. Although, the distinction between short-term planning and internal analysis was somewhat ambiguous, the evidence did suggest that internal analysis should be distinguished from external analysis. Finally, there did not appear to be significant differentiators between the operational efficiency construct and the internal or external process coordination constructs — at least at the high level of abstraction of the model.

Thus, the empirical evidence from the case studies suggest that the resultant revised model of organizational capabilities enabled by SCM IS should include: operational efficiency, operational flexibility, planning, internal analysis, and external analysis. Table 4.10 presents the summarized results using the revised SCM IS capabilities constructs. As can be seen from this table, all five of the revised constructs were highly relevant in at least two of the three cases examined.

Table 4.10 - Relevance of Revised Constructs to Model of SCM IS Capabilities

Case	Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis
B	High	Medium	High	High	High
D	High	High	Low	Low	High
E	High	High	High	High	Medium

4.4.2 Analysis of Previous Studies of SCM IS Capabilities

The review of previous studies and qualitative analysis described above found that the most important organizational capabilities enabled by SCM IS included: operational efficiency, operational flexibility, planning, internal analysis, and external analysis. This sub-section examines how an analysis of a firm's competitive strategy patterns be used to derive the ideal level of support a firm's SCM IS should provide for each of these capabilities.

Various researchers have studied the ideal IS capabilities that are associated with each of the Miles and Snow (1978) archetypes (Camillus and Lederer 1985; Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978; Miles *et al.* 1978; Sabherwal and Chan 2001; Segev 1989; Simons 1987). For example, Simons (1987) studied accounting IS in 76 business units and found that businesses the study classified as Prospectors or Defenders had higher performance when several specific IS capabilities fit the theoretically ideal capabilities for their archetype. Prospectors that had more flexible IS performed better than Prospectors with less flexible IS, suggesting that operational flexibility is an ideal IS capability for Prospectors.

No single previous study has focused on the ideal level of support SCM IS should provide for each of the relevant organizational capabilities identified in the previous section. However, through analysis of a number of conceptual and empirical studies that used the Miles and Snow (1978) archetypes, the theoretically ideal level of support a firm's SCM IS should provide for each capability was determined. The relative level of support (low, medium, or high) a firm's SCM IS should provide for each of the four capabilities is summarized in Table 4.11.

Table 4.11 - Competitive Strategy Archetype and Support for SCM IS Capabilities

SCM IS Capability and Ideal Level of Support	Justification from Previous Studies
Operational Efficiency Defenders - High Prospectors - Low Analyzers - Medium	- Defenders invest heavily in cost and technological efficiency while Prospectors have inherent inefficiency. Analyzers require efficiency for their mature product lines but not to the level of Defenders overall (Miles *et al.* 1978). Supported by empirical studies (Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978). - Segev (1989) arrived at same ratings for operational efficiency after surveying a panel of judges. - Camillus and Lederer (1985) and Sabherwal and Chan (2001) suggested Defenders should have IS that support efficiency although the latter study of 226 firms failed to find empirical support for the proposition. - In a study of 76 firms, Simons (1987) found Prospectors should have a relatively low focus on operational efficiencies and cost controls although support for Defenders focusing on operational efficiency was not found.

SCM IS Capability and Ideal Level of Support	Justification from Previous Studies
Operational Flexibility Defenders- Low Prospectors - High Analyzers - Medium	- Defenders are less focused on responding to shifts in market environment while Prospectors require a large degree of technological and operational flexibility. Analyzers require flexibility for their immature product lines but not to the level of Prospectors overall (Miles *et al.* 1978). Supported by several empirical studies (Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978). - Camillus and Lederer (1985) suggested Prospectors should have IS that support flexibility, which was empirically supported by studies of Sabherwal and Chan (2001). - Simons (1987) found Prospectors required more flexible accounting IS while Defenders required more stable accounting IS.
Planning Defenders - High Prospectors - Medium Analyzers - Medium	- Defenders require intensive planning to meet cost and efficiency goals while decreasing risks, while Analyzers plan heavily for their stable products but less so for their innovative products. For Prospectors, planning is less intensive and for shorter terms, but has broader coverage across potential products and markets (Miles *et al.* 1978). Supported by several empirical studies (Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978). - Sabherwal and Chan (2001) arrived at same ratings for an equivalent construct they termed "futurity." They noted that Prospectors should be rated medium rather than low as they do some sophisticated shorter-term planning (Shortell and Zajac 1990).
Internal Analysis Defenders- High Prospectors - Low Analyzers - High	- Defenders invest heavily in internal monitoring and controls for efficiency, while Analyzers invest heavily in internal analysis to coordinate complex matrix administrative structures. Prospectors have low levels of internal controls, formalization, and routinization and hence require lower levels of internal analysis (Miles *et al.* 1978). Supported by several empirical studies (Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978). - Segev's (1989) study arrived at same ratings for internal analysis.
External Analysis Defenders - Low Prospectors - High Analyzers – High	- Prospectors invest heavily in scanning the environment for potential opportunities while Defenders tend to ignore external changes. Analyzers must frequently monitor the marketplace to adopt successful innovations (Miles *et al.* 1978). Supported by several empirical studies (Conant *et al.* 1990; Doty *et al.* 1993; Miles and Snow 1978). - Segev's (1989) study arrived at same ratings for external analysis. - Simons (1987) found Prospectors ideally scanned competitor activities more aggressively than Defenders and used more external forecasting.

A panel of three practitioners in senior supply chain management and consulting roles also assessed the credibility of the ratings in Table 4.11. After reviewing the descriptions of the constructs and supporting literature, the judges stated that each of the ideal capabilities ratings appeared to be valid.

4.4.3 Answer to RQ3: Ideal Level of Support for SCM IS Capabilities

The organizational capabilities that are particularly relevant to the study of SCM IS were identified through analysis of qualitative evidence and a review of prior studies. The qualitative analysis explored the constructs and their dimensions and identified a parsimonious yet holistic set of organizational capabilities that were particularly relevant to the study of SCM IS.

To further assess the unidimensionality of the developed constructs, a quantitative analysis (Section 4.5.2) compared a participant's responses across the constructs to look for similarities or differences among the answers. For example, if a respondent answered long-term planning and short-term planning questions similarly, one could infer that there are not significant differences between these two constructs for that respondent.

The qualitative analysis found both operational efficiency and operational flexibility were highly relevant organizational capabilities for SCM IS. However, there appeared to be interrelationships between each of the capabilities. Although some researchers view operational efficiency and operational flexibility as contradictory goals (Camillus and Lederer 1985), the findings of this study support the suggestion that both can be important IS capabilities in some cases (Allen and Boynton 1991; Reddy 2001a).

Evidence on the analysis construct showed that some conceptualizations were problematic when applied to SCM IS. Internal analysis (such as performance reporting) should be distinguished from external analysis (such as market scanning), as there were differences in their relative importance in the firms studied. Furthermore, the quantitative analysis of Section 4.5.2 showed that responses to the internal analysis and external analysis questions were significantly different for many of the cases. Thus, conceptualizations that distinguish between internal and external analysis such as Segev (1989) are preferable to those that view "analysis" as a single construct (e.g., Venkatraman 1989b).

The qualitative evidence initially suggested long-term planning should be distinguished from short-term planning. Long-term planning did not appear to be an important capability of SCM IS in the qualitative interviews, although short-term planning did appear to be relevant. However, the responses to the long-term planning and short-term planning items on the questionnaires suggested that respondents did not distinguish between these two constructs in their answers. This suggests that a single planning construct is sufficient, as the respondents either did not consider long-term planning a particularly relevant capability for their SCM IS, or more likely did not distinguish between long-term and short-term planning.

Finally, the findings suggested that, at the high level of analysis of this dissertation, a model of SCM IS capabilities does not need to distinguish between process coordination capabilities and operational efficiency. At a more detailed level, SCM IS may support internal process coordination to a different level than external process coordination (Roloff *et al.* 2001), both of which could be conceptualized as contributing to overall operational efficiency (Bakos and Treacy 1986). However, the findings of this

study did not justify distinguishing either internal or external process coordination from the operational efficiency construct.

The findings suggest the organizational capabilities enabled by a firm's SCM IS can be evaluated in terms of the level of support provided for: operational efficiency; operational flexibility; planning; internal analysis; and external analysis. The perceived relevance of each of these capabilities to the evaluation of SCM IS was collectively high in the cases studied. While other firms and business units within firms may view the relative importance of each of these capabilities differently, the cases examined demonstrate that each capability is important to understanding and evaluating SCM IS.

The conceptual framework in Chapter 2 suggested a firm's competitive strategies and level of supply chain integration could be used to determine the theoretically ideal level of support SCM IS should provide for the organizational capabilities identified above. However, as described in Section 4.3, the level of supply chain integration did not vary significantly between the cases and hence there was insufficient evidence to propose any relationships between level of supply chain integration and ideal levels of support for SCM IS capabilities. Therefore, the developed model indicates the theoretically ideal level of support a firm's SCM IS should provide for each SCM IS capability can be derived solely from the firm's competitive strategy archetype.

An analysis of previous studies of IS capabilities and competitive strategies was used to derive the theoretically ideal level of support a firm's SCM IS should provide according to the firm's Miles and Snow (1978) competitive strategy archetype. The relative level of support (low, medium, or high) a firm's SCM IS should provide for each of the five capabilities is summarized in Table 4.11 and graphically shown in Figure 4.3.

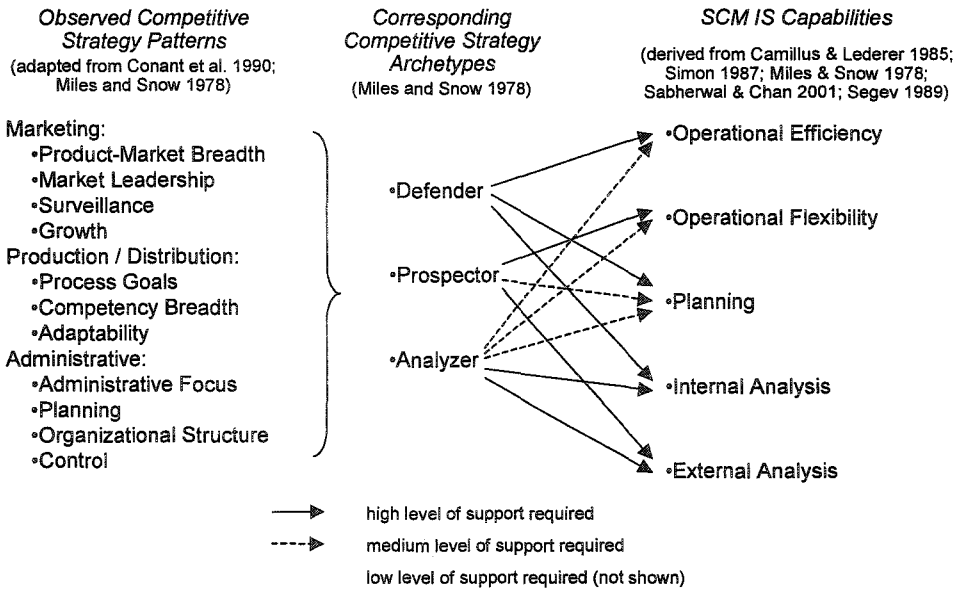

Figure 4.3 - Competitive Strategy and Level of Support for SCM IS Capabilities

The ideal level of support ratings were examined by a panel of three practitioners in senior supply chain management and consulting roles who confirmed the table had high face validity. Thus, returning to research question RQ3, the level of support a firm's SCM IS should provide for each of the five organizational capabilities can be determined from the firm's competitive strategy archetype using Table 4.11 or Figure 4.3.

4.5 Perceived Level of Support for SCM IS Capabilities

How should the level of support a firm's SCM IS provide for each organizational capability be assessed? *(RQ4)*

This question pertains to measuring the level of support a case's SCM IS provide for the SCM IS capabilities identified in the previous section. By comparing a case's ideal level of support for each capability (from Table 4.11) with the perceived levels (described in this section), a measure of the strategic fit of the case's SCM IS was obtained (described in Section 4.6.2).

The perceived level of support the firm's SCM IS provide for each SCM IS capability was assessed using a qualitative analysis of interview transcripts and archival documents and a review of results from a Likert-type questionnaire measure.

4.5.1 Qualitative Analysis of Level of Support for SCM IS Capabilities

Interview transcripts and archival documents were coded and analyzed to examine the level of support provided for each case's SCM IS capabilities. The codes outlined in Appendix D were used to identify patterns in the texts and determine the relative level of support each case's SCM IS provided for each SCM IS capability. The purpose of the qualitative analysis was to triangulate the findings from the questionnaire measures and to further explore the SCM IS capabilities constructs.

Pattern matching analysis was used to determine the relative level of support each case's SCM IS provided for: operational efficiency, operational flexibility, planning, internal analysis, and external analysis. For each capability for each case, the texts were coded and analyzed to determine whether the case's SCM IS provided relatively high or low levels of support as compared to SCM IS at the case's competitors (see Table 4.12).

For example, coded texts for Case B indicated many transactions were manually recorded in non-integrated spreadsheets and databases. Other coded passages described the difficulty of managing and accessing Case B's large volumes of specialized product information, which often reside in separate ERP and APS systems. Taken together, along with other qualitative evidence, a pattern emerged indicating Case B's SCM IS provided a relatively low level of support for operational efficiency when compared to the level of support that was likely to be provided by SCM IS used by the case's competitors. Since the ideal level of support for each capability was determined by a case's competitive strategies (which are relative to a case's competitors), the perceived level of support provided should also be measured *relative* to the case's competitors (Dess 1990).

Table 4.12 - Level of Support for SCM IS Capabilities from Qualitative Analyses

Case	Level of Support for SCM IS Capabilities	Example Evidence
A	Oper. Efficiency - High Oper. Flexibility - Low Planning - Medium Int. Analysis - Medium Ext. Analysis - Low	- Company-wide ERP with EDI links to indirect suppliers strengthens operational efficiency although the planning and analysis capabilities still require manual intervention. - "*By integrating information and sharing [it with our delivery partners] we've been able to drive out a lot of costs.*" - Support for operational flexibility appeared to be low: "*It's very rigid [although] it drives the discipline for efficiency and process.*" - Support for market scanning was considered to be poor compared to their competitors.
B	Oper. Efficiency - Low Oper. Flexibility - Low Planning - Low Int. Analysis - Medium Ext. Analysis - Low	- Heavy usage of ERP and APS systems; however, not well integrated and highly customized due to very high volume of data. - Many transactions managed only in non-integrated, non-automated spreadsheets and databases. - Well integrated electronically with several key suppliers and customers, but not in recent merger and acquisitions sites. - Internal analyses adequately supported although some difficulty in reconciling and collating information from multiple systems. - Projects to initiate collaborative planning and analysis with partners indicated planning and external analysis was insufficient.
C	Oper. Efficiency - Low Oper. Flexibility - Low Planning - Medium Int. Analysis - Low Ext. Analysis - Low	- *"The [SCM IS] is a bit of a hindrance when you consider all the time taken to set up new customers."* - "*They don't provide us with much more efficient processes.*" - *"We really need a more flexible system in place. [Instead, we] do a lot of [analyses] using spreadsheets or Access databases."* - Support for production planning was adequate as work orders and plans were easy to generate now that all sales orders were in the ERP. Desire for better "what-if" analyses was expressed.
D	Oper. Efficiency - Med. Oper. Flexibility - High Planning - Medium Int. Analysis - Low Ext. Analysis - Medium	- ERP system used to consolidate information and manage processes, but lack of tight integration between business units suggested only a moderate support for operational efficiency. - "*Flexibility is way more important for us. We have to be able to delete an order or make quick changes and override things just based on a meeting. It's not very sophisticated... Because of the lower [sales] volumes, it's more informal. It has to be flexible.*" - Lack of internal integration across the various IS suggests that support for internal analysis was low. - Lack of sophisticated forecasting capability led to huge inventory write-offs.
E	Oper. Efficiency - Med. Oper. Flexibility - Med. Planning - Medium Int. Analysis - Medium Ext. Analysis - Medium	- Multiple ERP systems across the company partially integrated with i2's Advanced Planning System. - Systems enabled contract manufacturers and selected suppliers to view order and demand information. - *"Some of our competitors have more sophisticated analytics. We have to customize our analysis on an as need basis using people to do this."*

4.5.2 Quantitative Analysis of Level of Support for SCM IS Capabilities

A multi-item questionnaire (see Appendix C) asked respondents to report the relative level of support their SCM IS provided for the organizational capabilities of: operational efficiency, operational flexibility, long-term planning, short-term planning, internal analysis, and external analysis. Respondents were asked how well their SCM IS provided support for each capability on a 5-point scale ranging from much lesser to much greater support than that of their competitors SCM IS. The average level and range of support reported by each respondent for a case is shown in Table 4.13. A value of 3.0 indicates that the SCM IS provide roughly the same level of support for a capability as the SCM IS of a case's competitors. Values higher than 3.0 indicate relatively high levels of support and values less than 3.0 indicate relatively low support.

Table 4.13 - Responses to SCM IS Capabilities Questionnaire

Case	Average Level (Range) of Support for IS Capabilities (1= much lesser support than competitors' IS, 5= much greater support than competitors' IS)					
	Operational Efficiency	Operational Flexibility	Long-term Planning	Short-term Planning	Internal Analysis	External Analysis
A[39]	4.0 (0.0)	2.0 (0.0)	2.8 (0.5)	2.5 (1.0)	3.3 (0.5)	2.3 (0.5)
B	2.0 (0.0)	2.3 (0.5)	2.3 (0.5)	2.3 (0.5)	3.0 (0.0)	2.3 (0.5)
C	2.3 (0.5)	2.5 (0.0)	2.5 (0.0)	3.3 (0.5)	2.0 (0.0)	2.0 (0.0)
D	3.0 (1.0)	3.5 (0.5)	3.0 (1.0)	2.8 (1.3)	2.0 (0.0)	3.0 (1.0)
E	3.3 (0.5)	3.3 (1.0)	3.0 (0.0)	3.5 (0.0)	3.3 (0.5)	3.0 (1.0)

As seen in Table 4.13, there was little variation between the responses for long-term and short-term planning for each case. The qualitative analyses from Section 4.5.1 and the empirically grounded investigation of relevant SCM IS constructs reported in Section 4.4.1 also found little to distinguish between these two constructs. Therefore, the long-term and short-term planning constructs were averaged and reported as a single planning construct[40], as shown in Table 4.14.

[39] Respondents indicated the level of support provided for SCM IS Capabilities for Case A business units A1 and A2 were the same as the firm uses the same SCM IS for all business units.

[40] Although the exploration of SCM IS capabilities described in Section 4.4.1 had difficulties differentiating planning and analysis capabilities, the results shown in Table 4.14 suggest that there may indeed be significant differences and hence the internal analysis, external analysis, and planning were retained as separate constructs.

Table 4.14 - Responses using Collapsed SCM IS Capabilities Constructs

Case	Average Level (Range) of Support for IS Capabilities (1= much lesser support than competitors' IS, 5= much greater support than competitors' IS)				
	Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis
A	4.0 (0.0)	2.0 (0.0)	2.6 (0.8)	3.3 (0.5)	2.3 (0.5)
B	2.0 (0.0)	2.3 (0.5)	2.3 (0.5)	3.0 (0.0)	2.3 (0.5)
C	2.3 (0.5)	2.5 (0.0)	2.9 (0.3)	2.0 (0.0)	2.0 (0.0)
D	3.0 (2.0)	3.5 (0.0)	2.9 (1.3)	2.0 (0.5)	3.0 (2.0)
E	3.3 (0.5)	3.3 (1.0)	3.3 (0.0)	3.3 (0.5)	3.0 (1.0)

4.5.3 Overall Assessment of Level of Support for SCM IS Capabilities

The findings from the quantitative measures were generally well corroborated by the findings from the qualitative analysis. Thus, Table 4.14 appears to be a valid and reliable assessment of the level of support each case's SCM IS provided for each of the capabilities. There were a few exceptions where the interviews provided much richer and nuanced responses than were obtainable in the relatively short questionnaire, as illustrated below.

As can be seen in Table 4.14, respondents for Case A generally felt that relative to their competitors, the level of support provided by their SCM IS for operational efficiency and internal analysis was high. Case A rated the level of support their SCM IS provided for the remaining capabilities as relatively low, especially for operational flexibility. These findings were corroborated by the qualitative analysis, which also helped explain some of the ratings. For example, a respondent noted that their SCM IS focused much more on efficiency than flexibility, which they considered a positive outcome since the inflexibility "*drives the discipline for efficiency and process.*"

Respondents for Case B felt their level of support for internal analysis was comparable to that of their competitors. However, the level of support Case B's SCM IS provided for the remaining capabilities was low relative to their competitors. These findings were corroborated by the qualitative analysis previously reported. The one exception is that the qualitative analysis did not find substantial evidence regarding operational flexibility specifically. Thus, the questionnaire responses for operational flexibility could not be corroborated, although responses for the other capabilities were well corroborated.

As shown in Table 4.14, Case C respondents indicated their SCM IS provided a relatively low level of support for each capability, especially for internal and external analysis. The qualitative analysis supported these findings. Although a centralized ERP system was used, respondents suggested its inflexibility often constrained the business processes rather than improving them. For example, a respondent noted:

> *The ERP is a bit of a hindrance when you consider all the time taken to set up new customers. Perhaps our system is a bit of overkill considering our small number of employees using it. We really need a more flexible system in place and do a lot of [analyses] using spreadsheets or Access databases.*

Respondents for Case D perceived their SCM IS provided a relatively high level of support for operational flexibility, a moderate level of support for operational efficiency, planning, and external analysis, and a relatively low level of support for internal analysis (see Table 4.14). These findings were well corroborated by the qualitative analysis.

Respondents for Case E generally felt their SCM IS provided similar levels of support for each capability as at their competitors. Thus, the level of support was moderate for each capability, relative to the case's competitors. These findings were generally corroborated by the qualitative analysis, which found that the level of support provided for each capability was felt to be similar to Case E's competitors. An exception to this was that one interviewee felt that their internal analysis capabilities were likely not as sophisticated as those of their competitors, although the average level reported in the questionnaires was 3.3 (slightly better than their competitors).

4.5.4 Answer to RQ4: Assessing Level of Support for SCM IS Capabilities

For the quantitative analysis, a Likert-type questionnaire was administered, using items from previously validated studies. Since a single instrument for measuring the various SCM IS capabilities does not already exist, items were adapted from several separate studies of IS capabilities (Bensaou 1997; Sabherwal and Chan 2001; Venkatraman and Ramanujam 1987; Zviran 1990). The level of support each case's SCM IS provide for the SCM IS capabilities was measured using a 5-point scale that asked respondents to rate the level of support their IS provides for each capability relative to the support they believe their competitors' information systems provide. The perceived level of support a case's SCM IS provided for each capability relative to the case's competitors gave an indication of whether that support was relatively high, medium, or low (Dess 1990). This could then be used to compare the perceived level of support with the theoretically ideal level of support the case's SCM IS provided for each capability.

The findings from the quantitative measures were generally well corroborated by the findings from the qualitative analysis (see Section 0). There were a few exceptions where the interviews provided more detailed and nuanced responses than were obtainable in the short questionnaire. However, feedback from the respondents indicated that measures appeared to give valid results which could be corroborated with qualitative evidence. The questionnaires were purposely kept short with only two items per construct for this exploratory study since the participants were also required to spend substantial time in interviews. However, more detailed questions may be required for future studies that do not have the benefit of triangulating with in-depth qualitative evidence. Future studies could obtain stronger indications of the reliability and validity of questionnaire items once a statistically significant sample was obtained.

In summary, based on the comparison of quantitative and qualitative results, the multi-item Likert-type questionnaire shown in Appendix C appeared to give a reliable and valid measure of the level of support a firm's SCM IS provide for each organizational capability. However, due to the complexity of the constructs involved, such questionnaires should be triangulated with qualitative evidence where feasible.

4.6 Strategic Fit of SCM IS

How should the strategic fit of the organizational capabilities supported by a firm's SCM IS be assessed? *(RQ5)*

The final research question pertains to how the overall level of strategic fit of a firm's SCM IS should be measured. A review of literature suggested measuring strategic fit using the distance each perceived capability is above or below an ideal level (Sabherwal and Chan 2001; Van de Ven and Drazin 1985; Venkatraman 1989a). However, before actual empirical evidence was collected, it was unclear whether this was the most appropriate method for this research problem, or whether other techniques would be better. It was also unknown whether such a quantitative approach would produce useful and valid results that could be corroborated by other measures. The purpose of this section is to examine the proposed quantitative approach to modeling the strategic fit of SCM IS and determine if the results were corroborated by other measures. The strategic fit of capabilities enabled by a case's SCM IS was assessed using the deviation of the perceived SCM IS capabilities from the theoretically ideal profiles for each case. This calculated value was also triangulated with results from a qualitative analysis of interview transcripts and a questionnaire measure.

4.6.1 Qualitative Analysis of Strategic Fit of SCM IS

Interview transcripts were coded and analyzed to examine the strategic fit of each case's SCM IS. The purpose of the qualitative analysis was to triangulate the findings from the quantitative measures of strategic fit and to further explore the strategic fit of SCM IS capabilities construct.

The codes outlined in Appendix D were used to identify patterns in the texts to help determine the relative level of strategic fit of each case's SCM IS. For example, a review of interview transcripts suggested that Case A1 perceived their SCM IS to have a good fit with their competitive strategies. One respondent noted:

> *They fit our needs at a basic level at this point. We just need to get a lot more of our contracts in line with longer term purchasing in order to really take advantage of [our SCM IS] backbone. It's enabling us to reduce costs which is one of the main drivers for us. So it fits quite well with our strategic needs.*

Results from the pattern analysis of the strategic of SCM IS for each case is outlined in Table 4.15. It is important to note that some texts exhibited evidence of strong strategic fit even though the case's SCM IS might have had relatively poor support for

some capabilities. For Case D, a respondent noted that the SCM IS were not well-integrated either internally or externally, which limited the support provided for operational efficiency and internal analysis. However, the respondent noted that this was not a significant limitation to their high-margin, low volume business, which places priority on flexibility (see Section 4.5.1). This finding was consistent with the developed model, which proposes that Case D, being a Prospector, would require a relatively high level of support for operational flexibility but a low level of support for operational efficiency and internal analysis (see Figure 4.3).

Table 4.15 - Strategic Fit of SCM IS from Qualitative Analyses

Case	Strategic Fit of Case's SCM IS	Example Evidence
A1	High	- *"[The SCM IS are] enabling us to reduce costs which is one of the main drivers for us. So it fits quite well with our strategic needs."*
A2	Low	- Repeatedly requested better systems for doing market scanning and competitive analysis. - Some frustration with poorly integrated custom developed applications.
B	Low	- Ongoing projects to integrate multiple ERP and APS systems and develop more collaborative planning capabilities. - Frustration with heavy usage of standalone spreadsheets and databases.
C	Low	- *"The [SCM IS] is a bit of a hindrance when you consider all the time taken to set up new customers."* - *"We really need a more flexible system in place."*
D	Medium	- *"I think they're pretty good."* - *"I think it's pretty efficient."* - *"I'm sure our contract manufacturers have everything totally integrated. But we don't need it as much."*
E	Medium	- *"The systems meet the minimum needs but there is room for ... improvements ... that would save a lot of time and money."* - *"These systems are great at gathering the information but there is very little intelligent use of the information gathered."*

The following excerpts illustrate how respondents for Case D apparently did not feel the lack of integration between different systems and departments was an issue for the firm. In the first excerpt, it is interesting that having to phone a different department to get the required information was not seen as a problem in the case's line of business:

> *I think they're pretty good, because anyone in any office in our company can get into the system and see what are the approved suppliers for a specific piece part.*

> *They can then call our global supply management to find out what is the current pricing on a specific piece part and they can get an idea for how much the design would cost. So I think it's pretty efficient.*
>
> *I'm sure our contract manufacturers have everything totally integrated. But we don't need it as much.*

Another indication of satisfactory levels of fit at Case D were that future plans did not include major projects to improve the capabilities of Case D's SCM IS. Asked about any plans to improve the strategic fit of Case D's SCM IS, a respondent suggested:

> *[In the future] it would probably stay the same as now. Because we aren't consumer high-volume... We're not the part of the corporation that is as demanding on our software.*

Furthermore, some responses indicated that the importance of higher levels of strategic fit of SCM IS capabilities may change over time. A respondent for Case E suggested recent market downturns were expected to lead to more focus both on reducing costs and on improving the strategic fit of the case's SCM IS:

> *Prior to the high tech meltdown in 2002, [achieving strategic fit with our SCM IS] was not the greatest priority. The greatest priority was getting the product out to market. When the market becomes saturated with competition and prices are driven down because components are available from a number of competitors, margins decrease and ... saving moving internally would become more of a focus. And in those times, measures to optimize the [SCM IS] would be more important.*

4.6.2 Quantitative Analysis of Strategic Fit of SCM IS

The quantitative analysis of strategic fit of SCM IS consisted of a two-item questionnaire and two different mathematical calculations of strategic fit. The calculated measures of strategic fit used results of the quantitative analyses previously described in other sections of this chapter.

4.6.2.1 Strategic Fit of SCM IS Questionnaire Items

To triangulate the findings from the qualitative analysis, Likert-type questionnaire item (see Appendix C) measured perceived strategic fit of the SCM IS capabilities for each case in the qualitative analysis[41]. The lack of existing questionnaire measures and small sample size precluded any assessment of the statistical significance of the results.

For Case A1, two respondents completing the questionnaire item on strategic fit of SCM IS both rated it high. For Cases A2 and B, one respondent rated it low and one rated it medium for an average rating of low-medium. For Case C, both respondents rated

[41] This questionnaire item was not created and given to the participants until the follow up interviews (rather than during the initial sampling) and therefore only two respondents per case were asked to respond to the question. A 5-point scale was used (1=very low, 2=low, 3=moderate, 4=high, 5=very high).

the strategic fit of their SCM IS low. For Case D, one respondent rated it low, while the other rated it high for an average rating of medium. For Case E, the two respondents completing the questionnaire item on strategic fit of SCM IS both rated it medium. As can be seen in Table 4.17 later in this chapter, although these results were far from statistically significant, they were corroborated by the findings of the qualitative analyses.

4.6.2.2 Strategic Fit of SCM IS using Absolute Profile Deviation

The strategic fit of the SCM IS for each case was initially calculated using the absolute profile deviation procedure (detailed in Section 3.3.1.4). For each case, the absolute deviation (distance) between the theoretically ideal and perceived levels of support for each capability (measured using a 5-point scale) was calculated. The average and range of responses for each respondent for a case is reported in Table 4.16. For example, for Case A1, the level of support provided by their SCM IS for operational efficiency equalled the level that previous studies determined would be theoretically ideal for that case's competitive strategy archetype. Similarly, the level of support for planning activities deviated by 0.9 (on a 5-point scale) from the theoretically ideal level.

Table 4.16 - Deviation of SCM IS Capabilities from Theoretically Ideal Levels

Case	Average (Range) of Absolute Deviation from Ideal Level (0.0 = perfect fit between perceived and ideal capabilities)					Average (Range) of Euclidean Distance
	Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis	
A1	0.0 (0.0)	0.0 (0.0)	0.9 (0.3)	0.8 (0.5)	0.3 (0.5)	1.2 (0.0)
A2	**1.0** (0.0)	**1.0** (0.0)	0.4 (0.8)	0.8 (0.5)	**1.8** (0.5)	2.4 (0.6)
B	**2.0** (0.0)	0.3 (0.5)	**1.0** (0.0)	**1.0** (0.0)	0.3 (0.5)	2.5 (0.1)
C	0.3 (0.5)	**1.5** (0.0)	0.6 (0.3)	0.0 (0.0)	**2.0** (0.0)	2.6 (0.0)
D	**1.0** (2.0)	0.5 (0.0)	**1.1** (0.3)	0.0 (0.5)	**1.0** (2.0)	1.9 (0.1)
E	**1.3** (0.5)	0.8 (1.0)	0.8 (0.0)	**1.3** (0.5)	**1.0** (1.0)	2.3 (0.5)

For each respondent, the Euclidean Distance of the profile deviations was also calculated, and the average and range of the Euclidean Distances reported in the final column. The lowest average Euclidean Distance values reveal the highest levels of strategic fit of SCM IS capabilities. Thus, from Table 4.16, Case A1 followed by Case D had the highest strategic fit of SCM IS, while Cases B and C had the lowest.

The bold values in Table 4.16 identify deviations between the theoretically ideal and perceived level of support for SCM IS capabilities of at least one scale unit. These highlight the largest gaps or misfits between the theoretically ideal and perceived level of support the case's SCM IS provide for each IS capability. Thus, Case B appeared to have a significant misfit in its support for operational efficiency, lesser misfits in support for

planning and internal analysis capabilities, and slight misfits in support for operational flexibility and external analysis. Similarly, Case D appeared to have the greatest misfits in support for planning, operational efficiency, and external analysis capabilities. Case E had the greatest misfits in support for operational efficiency, internal analysis, and external analysis.

These findings did not appear to be corroborated by many of the findings from the qualitative analyses of strategic fit (Section 4.6.1) or level of support for SCM IS capabilities (Section 4.5.1). For example, in the qualitative analyses, Case D respondents did not indicate the level of support provided by their SCM IS for operational efficiency was a concern. The apparent misfit shown in Table 4.16 was actually due to Case D rating the level of support their SCM IS provide for operational efficiency *better* than what the theoretical literature suggests is ideal for Prospectors such as Case D[42].

Similarly, the calculated value of strategic fit could not be corroborated for all cases with the level of strategic fit found from the qualitative analysis or the questionnaire item. Table 4.17 gives the level of strategic fit for each case using the absolute deviation from ideal calculation where <1 = high, 1-2 = medium, and >2 = low.

Table 4.17 - Strategic Fit of SCM IS Capabilities for each Case

Case	QUALITATIVE	QUANTITATIVE	
	Strategic Fit from Analysis of Interviews	**Strategic Fit from Questionnaire Item**	**Strategic Fit from Absolute Deviation from Ideal Calculation**
A1	High	High	Medium
A2	Low	Low-Medium	Low
B	Low	Low-Medium	Low
C	Low	Low	Low
D	Medium	Medium	Medium
E	Medium	Medium	Low

[42] Following the traditional operationalization of fit using absolute deviations (Van de Ven and Drazin 1985), misfits were initially modeled using absolute distance (greater or lesser) from ideal rather than as only when the observed level of support was *less* than the theoretically ideal level. Modeling strategic fit as absolute or Euclidean distances follows recommendations from several studies of strategic fit in the management and IS literature (e.g., Sabherwal and Chan 2001; Van de Ven and Drazin 1985; Venkatraman 1989a). There are limitations to the approach when used in future causal studies, such as the difficulty of testing for reliability and confounding components (Bergh and Fairbank 2002).

As can be seen in Table 4.17, the level of strategic fit for Case A1 was rated medium using the calculated value (1.2), although the qualitative analysis and questionnaire item indicated the rating should be high. Similarly, Case E was rated low using the calculated value (2.3), although the qualitative analysis and questionnaire item indicated the rating should be medium.

These discrepancies indicates the absolute deviation calculation gives incorrect results for cases where the SCM IS's level of support for a capability is greater than the theoretically ideal level. In the following section, the analysis was repeated while considering only the deviations *below* the ideal levels, rather than above or below.

4.6.2.3 Strategic Fit of SCM IS using Deviation below Ideal Levels

As the modeling of strategic fit of SCM IS using absolute values in this investigation did not appear to produce results that were corroborated by other sources of evidence, the strategic fit was re-calculated using only the distance that the perceived level of support for each SCM IS capability were below the theoretically ideal levels. Thus, if a perceived level of support was the same as or greater than the theoretically ideal level, then the deviation below the theoretically ideal level was zero.

The revised Euclidean distance was then determined by subtracting the perceived level of support for each IS capability from the theoretically ideal level, replacing it with zero if negative, and calculating the square root of the sum of the squared differences: distance = $\sqrt{\sum X_i^2}$, where X_i = (theoretically ideal level of support – perceived level of support) or zero if negative, for each *i* IS capability. Again, a lower distance implies a higher degree of strategic fit.[43]

Table 4.18 reports the recalculated values of Euclidean distance and the deviation of each perceived level of support that is *below* the theoretically ideal level. As shown in the table, Case B appeared to have a significant misfit in its support for operational efficiency and lesser misfits in support for planning and internal analysis capabilities, and *no* misfits in support for operational flexibility and external analysis. Similarly, Case D appeared to have the greatest misfit in support for external analysis and only a minor misfit in support for operational flexibility, while the other capabilities appeared to have the required level of support. Case E had the greatest misfits in support for external analysis followed by operational flexibility, while the other capabilities appeared to be well supported. These findings were well corroborated by the other measures previously described in this chapter.

[43] Future causal research employing either strategic fit operationalization should explicitly address the limitations of collapsing multidimensional constructs into a calculated value of strategic fit. Although the profile deviation approach enables a more holistic analysis (Venkatraman 1989a), it may be more statistically valid to analyze the effect of the individual components individually using multivariate analyses(Edwards 1992).

Table 4.18 - Deviation of SCM IS Capabilities below Theoretically Ideal Levels

Case	Average (Range) of Deviation *below* Ideal Level (0.0 = perfect fit between perceived and ideal capabilities)					Average (Range) of Euclidean Distance
	Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis	
A1	0.0 (0.0)	0.0 (0.0)	0.4 (0.8)	0.8 (0.5)	0.0 (0.0)	0.8 (0.8)
A2	0.0 (0.0)	**1.0** (0.0)	0.4 (0.8)	0.8 (0.5)	**1.8** (0.5)	2.2 (0.0)
B	**2.0** (0.0)	0.0 (0.0)	**1.0** (0.0)	**1.0** (0.0)	0.0 (0.0)	2.4 (0.0)
C	0.0 (0.0)	**1.5** (0.0)	0.1 (0.3)	0.0 (0.0)	**2.0** (0.0)	2.5 (0.0)
D	0.0 (0.0)	0.5 (0.0)	0.1 (0.8)	0.0 (0.0)	**1.0** (2.0)	1.1 (1.7)
E	0.0 (0.0)	0.8 (1.0)	0.0 (0.0)	0.0 (0.0)	**1.0** (1.0)	1.3 (0.0)

4.6.3 Overall Assessment of Strategic Fit of SCM IS

Findings on each case's strategic fit of SCM IS using the distance below ideal calculation had better corroboration with the qualitative analyses and questionnaire responses than results using the original absolute deviation calculation. Furthermore, after converting the calculated value of strategic fit of each case's SCM IS to the low-medium-high scale (where <1 = high, 1-2 = medium, and >2 = low), the revised calculation was better corroborated with the other measures, as can be seen in Table 4.19.

Table 4.19 - Strategic Fit of SCM IS Capabilities for each Case

Case	QUALITATIVE	QUANTITATIVE			OVERALL
	Strategic Fit from Analysis of Interviews	Strategic Fit from Questionnaire Item	Strategic Fit from Absolute Deviation from Ideal Calcul'n	Strategic Fit from Deviation Below Ideal Calculation	
A1	High	High	Medium	High	High
A2	Low	Low-Medium	Low	Low	Low
B	Low	Low-Medium	Low	Low	Low
C	Low	Low	Low	Low	Low
D	Medium	Medium	Medium	Medium	Medium
E	Medium	Medium	Low	Medium	Medium

In summary, the findings shown in Table 4.18 appear to give the most valid overall assessment of the strategic fit of the SCM IS for each case. A more detailed assessment of each case is provided in the case summaries in Section 4.7.

4.6.4 Answer to RQ5: Assessing Strategic Fit of SCM IS Capabilities

The approach of modeling the strategic fit of SCM IS using the amount the level of support for each SCM IS capability was *less than* the theoretically ideal level had better empirical support than by measuring the absolute deviation from the theoretically ideal level. A limitation of the original strategic fit calculation using absolute deviation was that information systems that provided a higher level of support than was theoretically "ideal" resulted in a lower strategic fit than IS whose perceived level of support matched the ideal level of support. This could theoretically be plausible since IS that are over-designed may be less satisfactory and thus fit less due to their complexity. However, this method led to results that were not well supported by the qualitative analysis.

In contrast, results using the revised method (modeling misfit as the level of support *less than* the theoretically ideal level) were well corroborated by qualitative evidence and a questionnaire measure. Feedback from the case study participants (discussed in Section 5.4) provided further evidence of the reliability, validity, and practical value of the developed theoretical model and resulting case study analyses. Future causal studies should further examine the reliability and validity of both profile deviation approaches.

4.7 Summary Case Study Reports

The following case study reports summarize the analyses of the findings for each case. The case reports and the theoretical model developed in this study were discussed with the most senior participant from each case to assess their veracity and usefulness. Following some minor edits requested for clarity, each participant consulted stated that the reports provided an accurate and informative description and analysis of their case. Participant feedback on the theoretical model developed is presented in Chapter 5.

4.7.1 Case A

Case A produces and distributes energy products primarily in Canada. As many of the products are produced and distributed by internal business units of the firm, Case A's supply chain is largely internal to the corporation. Relationships with external customers and suppliers are primarily for procurement of indirect materials such as MRO supplies, for distribution of goods using third party logistics (3PL) providers, or for sales to retail channels.

Throughout the firm, a centralized EDI-enabled ERP application is used for supply chain management, financial analysis, and procurement. For the corporate

business unit represented by Case A1, the SCM IS are primarily used for internal supply chain transactions, planning, and analyses, with some usage for external procurement transactions and analyses. For the retail business unit represented by Case A2, the SCM IS are used more for external market scanning, product pricing analyses, and managing relationships and transactions with retail dealers and 3PL providers.

From the qualitative and quantitative analyses in Section 4.2, Case A1 (the corporate business unit of Case A) strongly corresponds with Miles and Snow's (1978) archetypical profile of a Defender, although it also displayed some Analyzer characteristics in an average of 3 of the 11 dimensions of competitive strategy identified by Conant *et al.* (1990) and Miles and Snow (1978). The analysis of previous studies suggests a Defender's SCM IS should provide relatively high levels of support for operational efficiency, planning, and internal analysis, and relatively low levels of support for operational flexibility and external analysis (see Section 4.4.2).

In contrast, Case A2 (the retail business unit of Case A) strongly corresponds to Miles and Snow's (1978) Analyzer archetype in an average of 8.5 of the 11 dimensions. Previous studies suggest that an Analyzer's IS should provide a relatively high level of support for Internal and External Analysis and a medium level of support for the remaining capabilities.

As the competitive strategy archetype of Case A2 differs from Case A1, yet both business units share the same centralized corporate SCM IS, one would expect that the SCM IS fit the competitive strategies of one of the business units more closely than the other. Indeed, the deviation between theoretically ideal and perceived SCM IS capabilities was much higher for Case A2 than Case A1. In other words, the IS have a much higher strategic fit for Case A1 than Case A2. Table 4.18 suggests that for Case A2, the level of support the IS provide for operational flexibility and external analysis is significantly lower than the theoretically ideal levels for an Analyzer-type competitive strategy. However, Defenders do not require a high level of support for these capabilities, hence for Case A1, the IS met the theoretically ideal level of support for these two capabilities. For planning and internal analysis capabilities, there were slight deviations below the theoretically ideal levels for both Case A1 and A2. For operational efficiency, the IS provided the theoretically ideal level of support for both Case A1 and A2.

The qualitative analysis of interviews and archival documents corroborated the findings (reported in Table 4.18) for Case A1 and A2. For example, respondents for both Case A1 and A2 felt their IS provided the necessary support for cost controls and other requirements for operational efficiency. Respondents for Case A1 were satisfied with their IS and felt they supported their competitive strategies well. On average, the strategic fit was rated high. In contrast, the average rating of the strategic fit of SCM IS capabilities was only medium for Case A2. Respondents for Case A2 appeared to be less satisfied with their IS, possibly due to a belief that the IS were not designed to support the specific needs of their business unit. As a result, usage of *ad hoc* standalone IS and manual process workarounds were frequently required (such as manually reconciling and collating various spreadsheets). To meet Case A2's more specific needs, several IS have

been deployed which are poorly integrated with the rest of the firm's IS, resulting in additional manual information processing.

In summary, Case A's SCM IS appear to have adequate support for the capabilities required for the Defender-type competitive strategy of the corporate business unit (Case A1). However, for the retail business unit (Case A2), the level of support for operational flexibility and external analysis capabilities appear to be insufficient for their Analyzer-type competitive strategy. Thus, while Case A's centralized IS infrastructure fits well with the corporate business unit, it has a poor strategic fit for the retail business unit. This highlights the need for IS planners to ensure the various business units in a firm share the same competitive strategies before implementing a homogenous IS infrastructure across the firm.

4.7.2 Case B

Case B is a global contract manufacturer of electronic devices and components. Case B fulfils the various manufacturing, design, and supply chain management requirements that its clients desire to outsource. Although Case B tends to have long-term relationships and contracts with its large clients, there are typically several other global contract manufacturers that compete for the same clients.

The SCM IS used by Case B have advanced capabilities for coordinating and optimizing the supply chain. However, the diversity of product lines, geographic dispersion of the facilities, and frequency of mergers and acquisitions has resulted in Case B having a large number of different SCM IS, which are not always well integrated.

Initially, the researcher suspected that the innovative nature of the products Case B manufactures would require Case B to have a Prospector (or at least Analyzer) competitive strategy type. However, from the analysis of qualitative evidence and questionnaire results, the competitive strategy patterns of Case B most resemble the profile of a Defender. There were some Analyzer-like patterns displayed, such as a more matrix-like administrative structure that is organized by product, customer, and function for different businesses. There were also some Reactor-like competitive strategy patterns exhibited, possibly a response to the perceived dynamism of the electronics manufacturing industry. Although this mix of Defender, Analyzer, and Reactor patterns in Case B's competitive strategies suggests there may be aspects of the strategies, processes, and structures that are not in alignment, the majority of the competitive strategy dimensions were consistent with a Defender-type strategy.

This somewhat surprising finding highlights the shortcomings of more simplistic contingency theories such as Fisher's (1997) suggestion that innovative products require flexible supply chains and commodity products require efficient supply chains. Although Case B's products appear innovative, the low operating margins suggest that a Defender-type strategy and focus on operational efficiency may be more appropriate in their case.

The analysis of previous studies suggests a Defender's SCM IS should provide relatively high levels of support for operational efficiency, planning, and internal

analysis, and relatively low levels of support for operational flexibility and external analysis. For Case B, it appeared the support the SCM IS provide for operational flexibility and external analysis was sufficient. However, the high level of support required for operational efficiency for a Defender was not currently being met. Although they have implemented several leading ERP and APS solutions from vendors such as SAP and i2, the high volume of transactions, relationships, and parts to manage for contract manufacturing operations makes the implementation of these SCM IS complex. For this reason, along with the difficulty in integrating disparate SCM IS from acquired businesses, Case B apparently has not yet achieved the high level of support for operational efficiency required for their Defender-type competitive strategy.

In addition, planning and internal analysis often required manual collation of information from non-integrated IS or *ad hoc* spreadsheets. However, improvements to better support these capabilities through more formal planning and analysis information systems were underway. A similar initiative to implement collaborative planning capabilities with Case B's suppliers and customers suggests that they are trying to address the gap in the planning and analysis capabilities of their information systems.

Thus, Table 4.18 suggests Case B's SCM IS appear to provide the theoretically ideal level of support required for operational flexibility and external analysis. However, the strategic fit of Case B's SCM IS can be improved by increasing the level of support the SCM IS provide for operational efficiency, planning, and internal analysis capabilities. It appears that Case B's SCM IS are poorly suited to a Defender-type strategy. This may be due to the fact that Case B inherited many of its systems from the parent company it was spun off from and from several companies it has acquired.

4.7.3 Case C

Case C designs and manufactures integrated circuits ("electronics chips") for use in electronics products that are manufactured by other firms. The relatively small size of the company Case C and the limited breadth of products has made it easier for them to deploy a fairly simple, integrated, and centralized SCM IS portfolio. Although there is interest in collaborative supply chain capabilities, the relatively low volume, high margin transactions have not required Case C to invest heavily in supply chain collaboration systems to date.

Analysis of qualitative evidence and questionnaires suggest that Case C's competitive strategy patterns strongly resemble those of a Prospector. However, Case C did exhibit some minor characteristics of each of the other Miles and Snow (1978) competitive strategy archetypes.

The case study evidence also suggests that Case C's SCM IS provide relatively low levels of support for each organizational capability, compared to their competitors. The internal and external analysis capabilities were rated particularly low in comparison to their competitors' SCM IS. However, previous studies suggest that Prospectors such as Case C only require relatively high levels of support for operational efficiency and

external analysis capabilities, medium levels of support for planning, and relatively low levels of support for operational efficiency and internal analysis capabilities.

As shown in Table 4.18, Case C can improve the strategic fit of its SCM IS by focusing on increasing the level of support they provide for operational flexibility and external analysis capabilities. Case C's SCM IS consisted primarily of a commercial ERP package that was implemented to improve operational efficiency and internal information sharing rather than operational flexibility or external analysis. However, the lack of strategic fit with Case C's Prospector-like competitive strategies may be the primary reason why Case C's users have been unsatisfied with the performance of their SCM IS and have had to rely heavily on the use of less automated information systems such as standalone spreadsheets and databases.

4.7.4 Case D

Case D is involved in the sales, service, manufacturing, and distribution of innovative high-end equipment for "long-haul" telecommunication networks. Case D outsources much of the product manufacturing to contract manufacturers and hence utilizes SCM IS primarily for order management and finance, rather than manufacturing and distribution.

A centralized SCM IS is used throughout the firm to aggregate demand for parts between the business units of the firm and manage purchasing. Although supply chain coordination and collaboration are important to Case D, it appears that the high margin and low volume transactions combined with very short product life cycles has limited the usage of highly automated SCM IS.

From the analysis of interviews, archival documents, and questionnaire data, Case D had competitive strategy patterns most similar to that of a Prospector. Informants for Case D described several Prospector-like behaviours such as a focus on product innovation and developing future markets and offerings. As highlighted by the qualitative evidence as well as the questionnaire results reported in Table 4.4, Case D exhibited several traits more characteristic of Analyzers and Defenders such as a high degree of competitive analysis and strict attention to cost controls.

Unlike the other cases which generally showed a strong correspondence with one of Miles and Snow's (1978) competitive strategy archetypes, Case D's competitive strategy type was more indeterminate. A possible explanation for this was Case D's relative immaturity as a business unit resulted in several dimensions of the competitive strategy not yet being in alignment or not yet forming an internally consistent

configuration[44]. Further investigation into the competitive strategy patterns exhibited by Case D and the other business units in the firm is warranted.

Since Case D was most like a Prospector in its competitive strategy patterns, previous studies suggest its SCM IS should provide a relatively high level of support for operational flexibility and external analysis capabilities, a medium level of support for planning, and relatively low levels of support for operational efficiency and internal analysis capabilities. Analysis of the qualitative evidence and questionnaires found that the level of support for external analysis provided by Case D's SCM IS were significantly below the theoretically ideal level for Prospectors and the operational flexibility capabilities were also somewhat below the theoretically ideal level. Although the low level of integration between the internal IS would normally hinder internal analysis capabilities, the theoretically ideal level of support for this capability is relatively low for Prospectors. Respondents also noted that the different business units function very autonomously. Together, this may explain why the low level of internal integration and internal analysis capabilities does not appear to be a significant problem worth addressing. Similarly, the Prospector-type strategy does not require the SCM IS to support a relatively high level of operational efficiency. Respondents noted that operational flexibility was a more important concern than operational efficiency.

As shown in Table 4.18, Case D needs to increase the level of support its SCM IS provide for external analysis in order to improve their strategic fit. Case D's SCM IS were primarily commercial ERP and APS packages that were traditionally designed to improve operational efficiency and internal information sharing (Kumar 2001) and that only recently have begun to include more sophisticated capabilities for external information analysis and coordination.

The lack of fit for external analysis capabilities is expected to hinder Case D's Prospector-like competitive strategy. Indeed, Case D's parent firm recently suffered large inventory write-offs due in part to an inability to coordinate supply and demand information with its supply chain partners. The firm is currently making large investments in collaborative SCM IS to address the shortcomings of their external analysis capabilities.

4.7.5 Case E

Like Case D, Case E sells, services, manufacturers, and distributes equipment for "long haul" telecommunication networks. Case E also outsources product manufacturing to contract manufacturers including Case B. However, the proportion of manufacturing

[44] Miles and Snow (1978) proposed the Defender, Prospector, Analyzer, and Reactor archetypes were the only internally consistent configurations of competitive strategies they found but acknowledged that other viable configurations were possible beyond those they studied. It is possible the hybrid nature of Case D's competitive strategy type is another configuration that is viable for their competitive environment. Longitudinal studies of the effectiveness of such hybrid competitive strategy types would be required to confirm whether Case D has a viable hybrid strategy type or whether its competitive strategy dimensions are not internally consistent (i.e., not in alignment with each other).

outsourced by Case E is less than Case D. Although Case E's SCM IS are used primarily for order management and finance, manufacturing and distribution functionality is used more extensively than at Case D. In addition, Case E generally has a larger product and geographic range than Case D and has operated the business for a much longer period.

Case E uses a variety of SCM IS including several different ERP systems, which are partially integrated with i2's SCM IS. Separate order management, finance, and product lifecycle management IS are used to manage order fulfilment, product development, customer service, and market intelligence. There is some integration with customers and suppliers; however, the information exchanged is limited mostly to capturing customer requirements and aggregating purchase orders.

Analysis of qualitative evidence and questionnaires indicates Case E's competitive strategy patterns strongly resemble those of Miles and Snow's (1978) Prospector archetype. Respondents for Case E mentioned many Prospector-like behaviours such as a focus on product innovation, speed to market, and research and development. Case E appears to be willing to take risks by investing in or acquiring new businesses in order to quickly enter and dominate new markets.

For Prospectors, analysis of previous studies suggests that its SCM IS should provide a relatively high level of support for operational flexibility and external analysis capabilities, a medium level of support for planning, and relatively low levels of support for operational efficiency and internal analysis capabilities. Analysis of the qualitative evidence and questionnaires found that the level of support for external analysis provided by Case E's SCM IS were significantly lower than the theoretically ideal level. Respondents generally felt their SCM IS provided similar organizational capabilities as those of their competitors. However, some respondents suggested that their competitors' SCM IS likely have better support for analytics and that Case E currently has to manually compile many analyses using *ad hoc* queries and spreadsheets.

As shown in Table 4.18, the level of support for internal analysis met the theoretically ideal level for Case E. However, support for operational flexibility and external analysis capabilities appeared to be insufficient. A respondent noted that although Case E's SCM IS were adequate when economic conditions were very favourable, the need for improving the ability to integrate and analyze information become more apparent during the recent economic downturn. This suggests strategic fit may be more important in lean economic times than in periods of robust profitability.

Case E's SCM IS consisted primarily of packaged and custom-built ERP and APS software that traditionally have not been designed for the external analysis or operational flexibility capabilities required by Case E's Prospector-type strategy. It is expected that Case E's lagging operational performance can be greatly improved by implementing IS that better fit their competitive strategies (Cragg *et al.* 2002; Henderson *et al.* 1996).

4.8 Chapter Summary

This chapter described the findings from the multiple case studies used to develop the theoretical model described in Chapter 5. The findings were generated from an analysis of qualitative and quantitative evidence and a comparison with previous studies, where appropriate. Each of the sections in this chapter addressed a different aspect of the conceptual framework and research questions outlined in Figure 4.1.

Looking at each of the questionnaires used to examine a case's competitive strategy patterns and SCM IS capabilities, the results were generally well corroborated with the findings from the qualitative analyses. While the qualitative analyses revealed richer insights into the constructs and context for each case, the questionnaire measures appeared to yield a thorough analysis in a much shorter time. Now that it has been demonstrated the findings from the questionnaire measures could be corroborated with rich empirical evidence, the measures are sufficiently grounded in theoretical and empirical support to be used in larger scale surveys where their results can be analyzed using statistical techniques.

The results of quantitative analyses of the level of supply chain integration for each case appeared to be corroborated by the qualitative evidence. However, both methods found little differentiation between each case's overall level of supply chain integration. Each case was determined to be somewhere between the Internal Integration and Linked Network level of supply chain integration. Although there was more differentiation when looking separately at each case's supply chain strategies, processes, performance measurement, and decision-making structure, there was little differentiation at the overall level. Since there was little that distinguished between each case's overall level of supply chain integration, the evidence suggested that a firm's overall level of supply chain integration currently does not play a significant role in modelling the strategic fit of a firm's SCM IS. The level of supply chain integration would play a more significant role in future studies if more firms achieve higher levels of integration and further differentiate themselves from other firms.

An exploratory study of SCM IS capabilities and a review of prior studies was conducted to determine the theoretically ideal level of support a firm's SCM IS should provide for each capability, based on the firm's competitive strategy archetype. These SCM IS capabilities included: operational efficiency, operational flexibility, planning, internal analysis, and external analysis.

To assess the strategic fit of a case's SCM IS, the differences between the level of support for each capability reported for a case were compared with the theoretically ideal levels. Although there was little support found for using the original absolute deviation calculation, the findings from modeling the strategic fit of a case's SCM IS using the amount the level of support for each SCM IS capability was *less than* the theoretically ideal level were well corroborated by other qualitative and quantitative measures. However, limitations of profile deviation approaches in general require future causal studies to explicitly test the statistical validity and reliability of the proposed strategic fit operationalization and its component constructs (Bergh and Fairbank 2002).

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter discusses the conclusions and implications of the study. It begins by incorporating the answers to each of the research questions into a theoretical model of strategic fit of IS capabilities. The developed model is grounded in both the conceptual framework described in Chapter 2 and the empirical analyses described in Chapter 4. The empirical analyses are also used to explore the operationalization of the model for use in assessing strategic fit of Supply Chain Management Information Systems capabilities.

Following discussion of the developed model, participant feedback on the model and case study analyses is presented, in order to assess the reliability, validity, and usefulness of the findings. The chapter concludes with a discussion of the implications of the developed model for both practitioners interested in examining strategic fit of their IS and for researchers interested in further development or confirmation of the theoretical model.

5.2 Developed Model of Strategic Fit of IS Capabilities

As described in the first two chapters, the goal of this study was to help firms understand and assess the strategic fit of their SCM IS, or more specifically, the strategic fit of the organizational capabilities supported by their SCM IS. The research was motivated by a lack of theoretical basis for understanding how the strategic fit of a firm's SCM IS can be conceptualized and measured.

The objective of this dissertation was to develop an empirically supported and operationalizable theoretical model of the strategic fit of SCM IS. This objective was met by answering the research questions (RQ1-RQ5) in the previous chapter. Each research question focused on a different aspect of the development of a theoretical model of the strategic fit of SCM IS capabilities. The findings for each question are integrated into the theoretical model described below.

Based on the conceptual framework outlined in Chapter 2 and the exploratory empirical findings described in Chapter 4, a theoretical model of strategic fit of IS capabilities was developed. The theoretical model described below integrates configurational theories of emergent competitive strategy patterns and IS capabilities for understanding and assessing the strategic fit of IS capabilities using a profile deviation approach.

The model proposes that, first, a firm's emergent competitive strategy patterns can be used to derive the theoretically ideal level of support IS should provide to enable

various organizational capabilities[45]. Next, an assessment of the strategic fit of a firm's IS capabilities can be made by comparing the theoretically ideal and perceived level of support the IS provide for each capability.

Previous studies have conceptualized the fit between two multi-dimensional constructs (such as ideal and perceived IS capabilities profiles) using the absolute or Euclidean distance deviation between the multi-dimensional profiles (Sabherwal and Chan 2001; Van de Ven and Drazin 1985; Venkatraman 1989a). However, the results described in Section 4.6.2 suggest the strategic fit of IS should be operationalized using the deviation the perceived values are *below* the ideal values rather than the deviation above or below, as is the case in the traditional absolute deviation operationalizations. Thus, as shown in Figure 5.1, the developed model of strategic fit of IS capabilities indicates that a lack of strategic fit occurs where the perceived level of support is less than the ideal level of support for a capability.

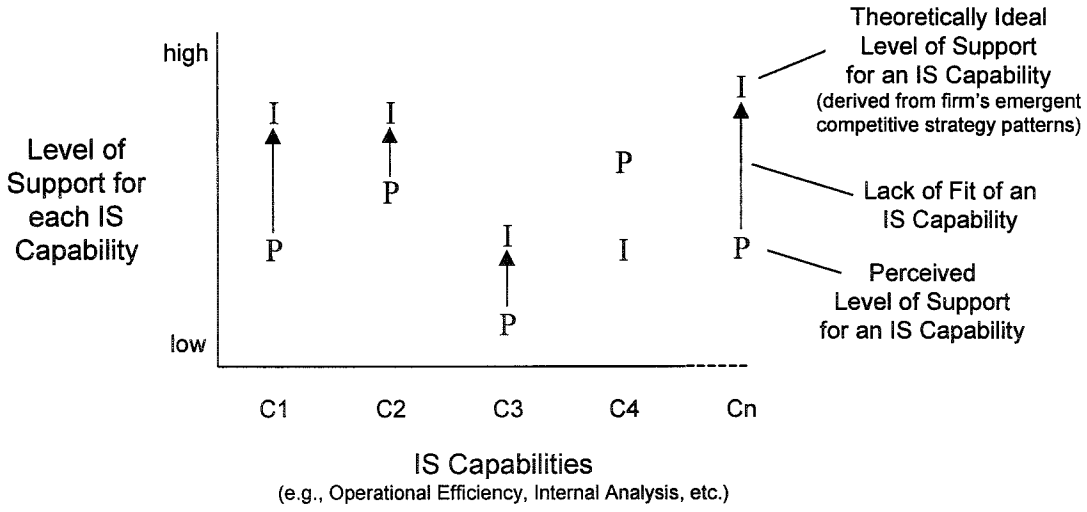

Figure 5.1 - Developed Model of Strategic Fit of IS Capabilities

An *IS capability* is defined here as an organizational capability enabled by a firm's information systems. Examples of IS capabilities might include long-term planning or operational efficiency. The specific IS capabilities to be used in the model are dependent on the type of IS, as illustrated in the example in Section 5.3.

A firm's *theoretically ideal level of support for an IS capability* is the relative level of support (e.g., high, medium, or low) that current theory suggests IS should

[45] Contrary to the conceptual framework, the evidence described in Section 4.3 did not support the use of a firm's level of supply chain integration for deriving theoretically ideal SCM IS capabilities.

provide for an IS capability. The model describes how a firm's ideal level of support IS should provide for each IS capability is determined from the firm's emergent competitive strategy patterns. A firm's *perceived level of support for an IS capability* is a measure of the relative level of support that the IS studied provides for an IS capability.

The following subsections describe how first the theoretically ideal level of support for each IS capability can be derived from a firm's emergent competitive strategy patterns and then how the strategic fit can be assessed using the deviation between the ideal and perceived IS capability profiles.

5.2.1 Deriving Theoretically Ideal Level of Support for an IS Capability

A firm's competitive strategy patterns potentially contain an unmanageable number of dimensions which could be used to derive the ideal level of support the IS should provide for an IS capability. Fortunately, competitive strategy typologies exist (e.g., Ansoff 1965; Miles and Snow 1978; Porter 1985) which can reduce this large number of dimensions into a manageable number of configurations. These normative configurations or *archetypes* have been used in numerous studies that examine the association of the archetype with other constructs, such as different IS strategies (e.g., Sabherwal and Chan 2001).

Miles and Snow's (1978) competitive strategy typology is one of the most common typologies used in strategy and IS studies due to: its simultaneous treatment of strategy, structure, and process; its support from empirical studies; and its predictive utility (Conant *et al.* 1990; Croteau and Bergeron 2001; Doty *et al.* 1993; Gimenez 1999; Hambrick 1983; Shortell and Zajac 1990; Zahra and Pierce 1990). It has been widely validated in empirical studies of strategic fit (Doty *et al.* 1993; Hambrick 1983; Miles *et al.* 1978) including investigations of the strategic fit of IS organizational structures (Gupta *et al.* 1997; Tavakolian 1989) and IS strategies (Camillus and Lederer 1985; Sabherwal and Chan 2001).

Miles and Snow's (1978) typology identifies three archetypical configurations known as Defenders, Prospectors, and Analyzers. Each archetype displays unique patterns of responses to 11 dimensions of competitive strategy including: product-market breadth; market leadership, surveillance, and growth; process goals; competency breadth; infrastructure adaptability; administrative focus; planning; organizational structure; and control.

Miles and Snow's (1978) descriptions of Defenders, Prospectors, and Analyzers are very detailed and multi-faceted. However, overall, the archetypes can be seen to exhibit competitive strategies patterns focusing on operational efficiency, innovation, and risk minimization, respectively. Miles and Snow's (1978) studies identified an additional strategic type known as Reactors, but since these firms do not appear to have a consistent strategy, the Reactor archetype is usually omitted from most studies using the Miles and Snow typology (Doty *et al.* 1993), including this one.

Any chosen typology or configurational theory has limitations in the selective treatment of the research variables and their theorized relationships. Although studies have supported many of Miles and Snow's (1978) propositions individually, the simplifications used in describing configurational theories often result in ambiguities in interpreting the models and operationalizing the constructs. Critics of Miles and Snow (1978) point out that few firms are pure Defenders, Prospectors, or Analyzers. Indeed, empirical studies by Doty *et al.* (1993) have clarified that the Miles and Snow (1978) classifications should be interpreted as *ideal* configurations that are internally aligned and consistent. A more thorough analysis would measure the degree of deviation from each of these ideal archetypes as well as the individual dimensions that do not correspond with the ideal archetype. However, in many studies, it is deemed sufficient to characterize a firm at a high level according to the archetype to which it most closely corresponds.

Using the proposed model, consistent competitive strategy patterns can be identified for a firm and used to determine the Miles and Snow's (1978) competitive strategy archetype to which the firm most closely corresponds (Conant *et al.* 1990). One could then use existing studies of the ideal IS capabilities for that archetype to determine the theoretically ideal level of support IS should provide for each IS capability. Grouped together, the ideal level of support for each IS capability forms an ideal IS capabilities profile.

5.2.2 Strategic Fit as Deviation between Ideal and Perceived Capabilities Profiles

The perceived level of support for each IS capability can be measured and compiled into a perceived IS capabilities profile. Comparing the deviation between the ideal and perceived capabilities profiles gives an indication of the strategic fit of the IS capabilities. Van de Ven and Drazin (1985) recommend operationalizing strategic fit as the Euclidean distance between the theoretically expected and the perceived capabilities profiles for each firm. The degree of strategic fit is the deviation (Euclidian distance) between the theoretically ideal and perceived level of support that the IS provide for each IS capability. The distance would be determined by subtracting the perceived level of support for each IS capability from the theoretically ideal level and calculating the square root of the sum of the squared differences:

$$\text{distance} = \sqrt{\sum_i \left[(\text{theoretically ideal level of support}) - (\text{perceived level of support})\right]_i^2},$$

for each *i* IS capability. A lower distance implies a higher degree of strategic fit.

However, results of the empirical analyses described in the previous chapter supported modeling the distance as the amount the perceived level of support was *below* the ideal level, not the amount above or below as indicated by the above equation. Thus, the distance should instead be determined by subtracting the perceived level of support for each IS capability from the theoretically ideal level, replacing it with zero if negative, and calculating the square root of the sum of the squared differences:

distance = $\sqrt{\sum X_i^2}$, where X_i = (theoretically ideal level of support – perceived level of support) or zero if negative, for each *i* IS capability. Again, a lower distance implies a higher degree of strategic fit.

For example, if the level of support for each of the capabilities of a firm's IS matched or was greater than the theoretically ideal levels for that firm's emergent competitive strategy patterns, then the distance would be zero and the strategic fit would be perfect. However, if theory predicted a firm's IS should have a higher level of support for a capability, yet the firm's IS has low levels of support for a capability, the distance would be greater and hence the fit would be lower.

5.3 Operationalizing the Strategic Fit of IS Capabilities Model for SCM IS

The following section demonstrates the operationalization of the preceding theory of the strategic fit of IS capabilities to model the strategic fit of the capabilities enabled by a specific type of IS — Supply Chain Management Information Systems (SCM IS).

In Chapter 4, an analysis of qualitative evidence identified the following SCM IS capabilities to be of particular relevance to the study of SCM IS: operational efficiency, operational flexibility, planning, internal analysis, and external analysis. Previous empirical studies were then analyzed to develop the theoretically ideal level of support SCM IS should provide for each capability, according to the Miles and Snow (1978) competitive strategy archetype of the firm (see Table 4.11).

To determine the strategic fit of SCM IS capabilities for a case's SCM IS, the firm's theoretically ideal and perceived (implemented) SCM IS capabilities profiles can be compared (see Figure 5.2). In Steps 1 and 2, the case's competitive strategy patterns are measured and used to determine the archetype they most closely resemble. The evaluation of measures described in Section 4.2.2 found the 11-dimension measure of a firm's emergent competitive strategy patterns adapted from Conant *et al.* (1990) gave a reliable indication of the correspondence of a firm with the Defender, Prospector, and Analyzer archetypes. The results of the evaluation of measures also recommended triangulating the results with the Miles and Snow's (1978) paragraph-type measure (and with additional qualitative evidence if feasible).

In Step 3, the firm's competitive strategy archetype can be used to derive the theoretically ideal levels of support the firm's SCM IS should provide for each capability (see Figure 4.3, which is a graphical summarization of Table 4.11). The theoretically ideal levels of support for each capability can then be converted to a numerical scale where "medium" corresponds to the centre point on the 5-point Likert Scale (e.g.,

Low=2.0, Medium=3.0, High=4.0)[46]. For example, Case A2's competitive strategy patterns corresponded most closely to those of an Analyzer (see Chapter 4). From Figure 4.3, the ideal level of support Case A2's SCM IS should provide for operational efficiency, operational flexibility, planning, internal analysis, and external analysis capabilities is medium, medium, medium, high, and high, respectively. Using the above numerical scale, the theoretically ideal SCM IS capabilities profile for the firm would therefore be [3.0, 3.0, 3.0, 4.0, 4.0].

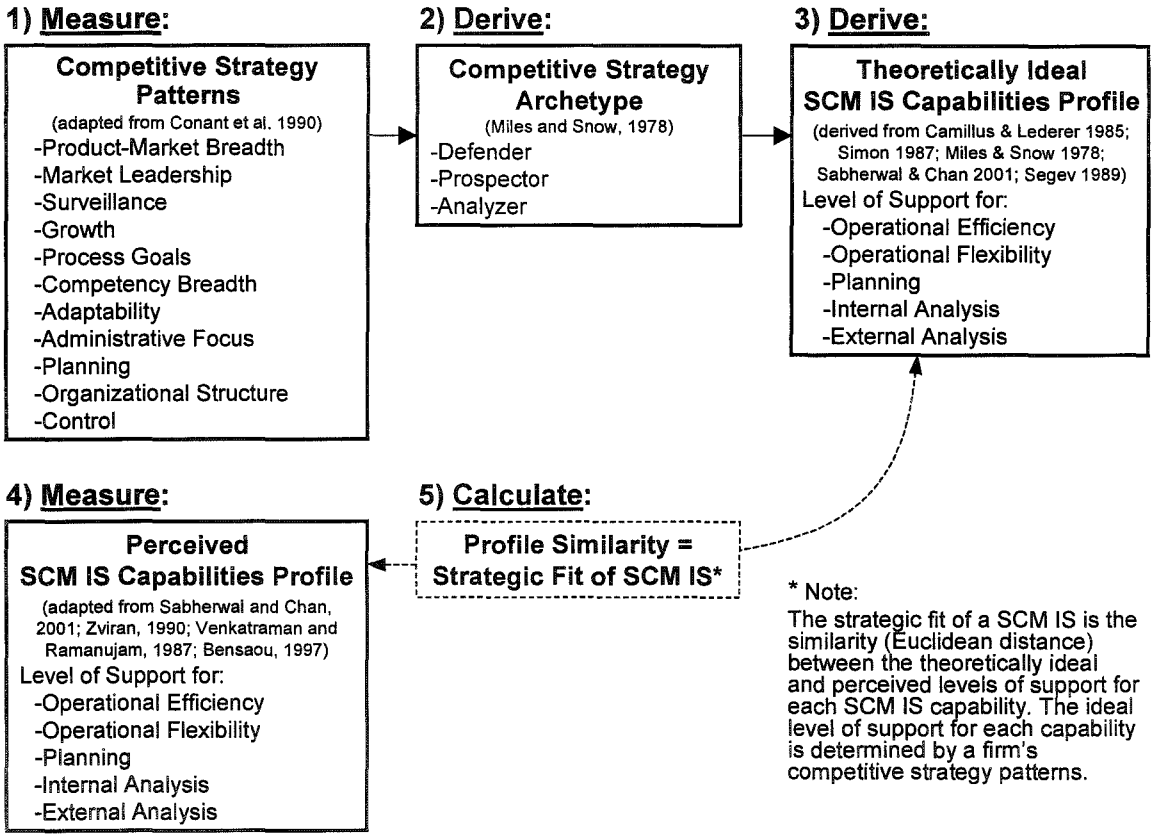

Figure 5.2 - Operationalized Model of Strategic Fit of SCM IS Capabilities

[46] A 5-point scale was used on the questionnaires for consistency with existing measures, although a 3-point scale was desired for the analysis of deviation. If a questionnaire respondent indicated the level of support for a capability was "to the same degree" as at the firm's competitors (3 on the 5-point scale), the observed level of support was rated "medium." Similarly, for responses of "to a much lesser degree" or "to a somewhat lesser degree" (2 or 3 on the 5-point scale), the observed level of support is "low." For responses of "to a somewhat greater degree" or "to a much greater degree" (4 or 5 on the 5-point scale), the observed level of support is "high."

In Step 4, the perceived level of support the case's SCM IS provide for each SCM IS capability can be measured using the same numerical scale for comparison with the ideal values. As described in Chapter 4, a 5-point Likert-type multi-item questionnaire was adapted from existing measures taken from studies of various IS capabilities (such as Bensaou 1997; Sabherwal and Chan 2001; Venkatraman and Ramanujam 1987; Zviran 1990). The questionnaire asked respondents to indicate the level of support their SCM IS provided for each capability relative to the level provided by their competitors' SCM IS. For example, respondents were asked "compared to our competitors' systems, our SCM IS provide the flexibility to adapt to unanticipated changes" (a measure of operational flexibility adapted from Venkatraman and Ramanujam 1987). The respondent would respond with a rating of 1 to 5, where 1= to a much lesser degree than their competitors and 5 = to a much greater degree than their competitors. Each of the respondents answers can then be averaged to create the perceived SCM IS capabilities profile for the case. For example, the perceived SCM IS capabilities profile for Case A2 was [4.0, 2.0, 2,6, 3.3, 2.3].

Finally, in Step 5, by comparing the ideal and perceived SCM IS capabilities profiles, one could get an indication of the areas of misfit. The deviation the perceived capabilities are below the ideal levels is found by subtracting the observed capabilities levels from the ideal levels and recording a zero if the result is negative. In the preceding example, the perceived capabilities profile [4.0, 2.0, 2,6, 3.3, 2.3] subtracted from the ideal profile [3.0, 3.0, 3.0, 4.0, 4.0] results in a deviation of [0.0, 1.0, 0.4, 0.7, 1.7]. This indicates a significant gap exists for the second and fifth SCM IS capabilities (support for operational efficiency and external analysis) and lesser gaps exist for the third and fourth capabilities listed (planning and internal analysis). This suggests there is a lack of fit between the case's competitive strategies and their SCM IS primarily in the areas of operational efficiency and external analysis. Similarly, there appears to be sufficient strategic fit for operational efficiency, and a lesser degree of fit for planning and internal analysis.

If desired, a numerical calculation of the overall strategic fit of the SCM IS capabilities could be obtained taking the Euclidean distance between the two profiles. For Case A2, the overall level of strategic fit (where zero is perfect fit) would be:

$$\text{distance} = \sqrt{\left[(0) + (3.0-2.0) + (3.0-2.6) + (4.0-3.3) + (4.0-2.3)\right]} = 2.1$$

The Euclidean distance calculation of strategic fit is optional, but as shown in Table 4.18, can be useful for comparing the overall strategic fit between several cases. It is also important for future studies which may attempt to further validate the strategic fit of IS capabilities model by comparing the overall strategic fit of multiple cases with performance-related variables. For example, future studies could examine whether the Euclidean distance measure of strategic fit is associated with higher supply chain performance. Such studies may also examine using of a weighted Euclidean distance calculation rather than treating each capability as equally important. These considerations are discussed further in the limitations section.

5.4 Participant Feedback

Following a review of the models and analyses with the interview participants, semi-structured interviews were conducted to gather feedback on the developed model. The questions addressed the validity and usefulness of the model, as outlined in the feedback session interview protocol in Appendix G.

5.4.1 Validity of Theoretical Model and Case Study Reports

The participants suggested the theoretical model and the case analyses appeared to be very valid — in other words to have strong face validity (Trochim 2000).

> *A1-1: I think it's very valid. The framework that you supply is very easy to understand across a firm both in the business and in the IT world. You've spoken to both business and IT within the corporation who have been able to relate to what you have put together — knowing that we've also contributed to it. And you've walked me through the results of the research and it correlates with what I would think the outcome would be.*

> *B1-1: I think it is valid. It seems to be consistent with what I would expect.*

The most senior participant for each case was also given the opportunity to comment on the case study analyses that were generated using the theoretical model. As discussed in the previous section, the participants verified the validity of the analyses and made comments that generally corroborated the findings. For example, feedback corroborated the finding that Case D had a significant gap in their SCM IS's support for external analysis:

> *D1-1: Yes, it's quite accurate. We certainly do external analysis, but [we don't] have a formal or a specific group that formally does it in a very organized way. I think that as compared to [our competitors, we are] less structured or organized in the way that we evaluate externally — like what businesses they get into... And I don't think [we have] as methodical a system for doing that as [our competitors].*

5.4.2 Usefulness of Theoretical Model and Case Study Reports

Each of the participants found the case study analyses and the theoretical model used to generate the analyses to be useful for examining and understanding their competitive strategies, SCM IS capabilities, and the fit between the two. There were no negative comments about the developed model, although one respondent (B1-1) believed that similar models were already available:

> *B1-1: Although [other] frameworks may exist, [your] suggested courses of action and areas of exploration could be valuable either for action or at least for discussion — to argue or prove why or why not.*

In general, the respondents indicated the model yielded very interesting results:

A1-1: The outcome of [our retail and corporate business units having] two different [competitive strategy] types was a very interesting way of looking at things and looking at why [our retail] business is different and why it has different needs. Because the retail business [Case A2] has always said "we just need this" [even though these needs are not] necessarily aligned with the operational efficiency that the Defender archetype [of Case A1] demands.

E1-2: I think it's very useful. I think the underlying philosophy of a company determines how it organizes itself and where it allocates its resources. So, for a company like [Case E], they pride themselves in providing everything to everyone. And if that's your underlying philosophy then you're more likely to develop more sophisticated computer systems to coordinate between all your different initiatives. So you're basically trying to provide a product for every conceivable need and that's probably going to require a bit more sophisticated systems ideally.

The participants seemed especially interested in the ability to analyze and describe their competitive strategies using Miles and Snow's (1978) Defenders, Prospectors, and Analyzer archetypes and the underlying dimensions of competitive strategy. The participants were asked if they found the analysis of their competitive strategy type useful for IS planning:

B1-1: Yes. Possibly these [competitive strategy analyses] are already being used [in our IS department].

E1-2: If you're looking at the different models for the company — I guess you've got Prospector, Analyzer, and Defender — I think it's important to distinguish between those three types of companies. For example, in the case of [Case E], I think that the underlying philosophy or business [strategy] type, really does determine what type of computer systems you [need]. To organize the company for different levels of efficiency [in each business unit], you need different types of computer systems [in each business unit]. Conversely, for [Case D], given that they are more of a hybrid [strategy type] — but mainly a Prospector — they require different computer systems based on their philosophy. If your philosophy is to be first into the market and do a little less analysis up front, you'll do a little bit less data collection and you'll take more risks, hoping that you're going to get a big reward by getting in early ...then you're going to need less sophisticated [external analysis capabilities in your] computer systems. And I think that [competitive strategy type] determines what type of computer systems you [need].

A1-1: I think it's very useful. But I think you also have to revisit [the strategic analysis] from time to time to ensure that it's still valid with respect to your place in the market. We are [currently] leaders in the market, but others are closing in upon us and we have to ensure that we've got the right strategy in place for our place in the market.

In summary, the analyses generated from the model were not especially surprising to the case participants. The greatest benefit of the developed model appeared to be in guiding the analysis and communication of the firms' competitive strategies and the resultant SCM IS capabilities that would best support those strategies:

> *A1-1: I think it confirms a lot of what I and a number of my colleagues have been thinking. But it puts it in a nice framework to be able to have the IT people [and] business people down to the lowest level of corporation understand the link [between strategy and IS] and understand what it is that we're trying to achieve.*

The model also appears to be useful in helping ensure that firms' IS are aligned with their competitive strategies, especially in large firms that may have numerous IS initiatives underway that may not always be in alignment:

> *A1-1: I would stress that, especially in large firms, that a framework such as yours is useful because —say in our case, we've got ... over 600 IT professionals that are spread across the organization supporting all different types of business units within the company... And I think your framework helps to ensure that we're all marching in the same direction... You do need to do that detailed functional requirement work, but continue to go from the detail to the big picture, using your framework to ensure that, at a corporate level, we're all aligned.*
>
> *Interviewer: So you could see this type of analysis feeding into an enterprise-wide architecture or some other kind of planning document to guide people?*
>
> *A1-1: Yes. Absolutely.*

In general, the model and resultant analyses had strong face validity as seen in the participant's comments attesting to its ability to accurately reflect their situation. It also appeared to have strong reliability as seen in corroboration of findings from multiple sources of data.

Perhaps the greatest benefit of the developed model was its usefulness in aiding the analysis and communication of a firm's competitive strategies and SCM IS capabilities to different stakeholders throughout the organization. As a participant noted, this should help ensure the various IS initiatives in a firm are aligned with the organization's competitive strategies.

5.5 Implications for Theory

Previous studies have theorized the importance of aligning competitive strategies with the capabilities of IS (Henderson *et al.* 1996; Luftman 2001; Papp 2001), although these theoretical models have not been developed to a detailed enough level to be operationalized for specific types of IS (Ciborra 2000). Studies that have been operationalized have focused on high-level dimensions of strategic fit, such as the fit between competitive strategies and IS strategies strategic alignment between competitive strategies and IS strategies (Gupta *et al.* 1997; Kearns and Lederer 2001; Sabherwal and Chan 2001).

One reason the dominant rational models of strategic fit (e.g., Papp 2001) have not been operationalized at a more detailed level is the lack of differentiation between *intended* and *realized* or *emergent* competitive strategies, which creates measurement issues. The rational models generally assume that one could ask management what their competitive strategies are and implement IS whose capabilities support those strategies. Measurement difficulties arise because a firm's actual patterns of strategic behaviour (their realized strategy) are often different from their stated or intended strategies (Clarke 2001; Conant *et al.* 1990). Similarly, IS evaluation studies have tended to focus on the functions the information systems are designed to provide, rather than the IS capabilities that emerge from the interplay between intended and realized implementations of the IS (Markus and Robey 1998; Truex *et al.* 1999). Another limitation of the existing models of fit is the traditional focus on reductionist bivariate relationships (e.g., Fisher 1997) or contingency theories (e.g., Shah *et al.* 2002), rather than more holistic multi-dimensional configuration theories (e.g., Sabherwal and Chan 2001).

This dissertation addresses the limitations of the existing theories by developing a theoretically and empirically grounded model of strategic fit of IS capabilities, which has been operationalized for the study of SCM IS specifically. The major theoretical contribution is that it integrates and extends existing theories of strategic fit of IS to the more detailed level of specific IS capabilities. The study demonstrates how conceptualizing competitive strategies and IS capabilities as emergent patterns of activity, rather than intended designs, leads to results that have strong validity, reliability, and usefulness. Furthermore, the configurational approach for modeling competitive strategy, IS capabilities, and the fit between the two had strong theoretical support (Doty *et al.* 1993; Meyer *et al.* 1993; Venkatraman 1989a) and led to a richer and more holistic analysis of the cases studied.

The case study analyses also found weaknesses in the traditional operationalization of strategic misfits as the absolute deviation between perceived and theoretically ideal values. There was much stronger empirical support for modelling misfits using the amount the perceived level of support for each capability was less than the ideal value (rather than greater or less than). In extreme cases of "overkill" (where the level of support provided for a capability is much greater than the theoretically ideal value), the added costs of complexity may lessen the strategic fit of a firm's IS; however, further study of this phenomena would be required.

Taken together, the conceptualization of competitive strategies and IS capabilities as emergent patterns, the use of a configurational approach, and the integration of rich empirical evidence with established theories resulted in a well grounded model of strategic fit of SCM IS capabilities to be developed. This newly developed theoretical model can be used to obtain a more realistic, reliable, and useful assessment of the strategic fit of a firm's SCM IS.

For researchers and practitioners, this study contributes an empirically supported theory of SCM IS capabilities to the body of knowledge that provides an interdisciplinary systems approach to determining the ideal capabilities provided by a firm's SCM IS. The

developed model clarifies, synthesizes, and extends research on Miles and Snow's (1978) strategic archetypes and its usage in guiding IS planning and decision-making. Although the model has been operationalized specifically for studying SCM IS, it could be adapted for use in other strategic IS domains in future studies.

5.6 Implications for Practice

The case studies yielded several interesting findings which have implications for practice. Cases A1 and A2 demonstrated how two business units in a firm may exhibit very different competitive strategy patterns, even though the firm may intend to align each business unit with a single corporate competitive strategy. Case A's centralized IS infrastructure clearly fit one of the business unit's emergent competitive strategies much more than the others. This highlights the importance of detecting differences in emergent competitive strategies if a firm wishes to implement a homogenous information system across the firm.

Case B demonstrated how a lack of fit between a firm's competitive strategies and their IS can easily arise when the IS are inherited from a parent company or through mergers and acquisitions. Different business processes, structures, and cultures in the new entity may result in emergent competitive strategy patterns that are very different from the firm's previous competitive strategies, resulting in a lack of strategic fit.

Findings from Case C suggested that poor strategic fit is associated with low levels of user satisfaction. Although further research is needed to assess the causal relationship, this suggests firms should attempt to improve the strategic fit of their IS when trying to improve user satisfaction.

Case D highlighted how the strategic fit of SCM IS and even the SCM IS themselves may be more important to businesses with relatively high volumes of transactions and low profit margins. Similarly, Case E suggested the importance of both often increase over time as profit margins decrease.

The model and measures developed in this dissertation can provide firms with several alternatives for assessing and improving the strategic fit of their SCM IS. As a first step, firms could use the measures to assess the capabilities of their SCM IS and determine what areas should be improved. The firms would need to make their own assumptions about what the ideal level of support for each capability should be. Using the competitive strategy measures can also add further value to this analysis process by enabling the firms to assess their competitive strategy patterns and use the developed model to determine what the theoretically ideal levels should be. The firms would use the questionnaire measures to determine whether they are most similar to the Defender, Prospector, or Analyzer competitive strategy archetype, and derive the ideal level of support for each capability using Figure 4.3.

Using the developed model, practitioners will gain a better understanding of how to analyze their emergent competitive strategy patterns and IS capabilities and assess the fit between the two. This analysis helps organizations communicate their competitive

strategies and IS capabilities and focus on improving areas of misfit. Using this model to analyze the strategic fit of their firm's SCM IS, practitioners are able to reduce risks in IS planning and improve the successfulness of their SCM IS implementations. Numerous studies indicate that improving the strategic fit of IS can greatly improve a firm's performance (Cragg *et al.* 2002; Henderson *et al.* 1996). However, this study is the first to develop an operationalizable model that enables firms to assess and improve the strategic fit of a specific type of IS — supply chain management information systems.

This study also demonstrates how the developed theoretical model of strategic fit of IS capabilities can be operationalized for use with a specific type of IS, such as SCM IS. This more detailed modeling of the strategic fit of IS can help firms minimize their risks by ensuring that their chosen systems fit their emergent competitive strategies. The model has the potential to quickly highlight areas of misfit between a firm's IS capabilities and emergent competitive strategies, enabling corrective actions to be taken.

A strength of the developed theoretical model of strategic fit of IS capabilities is that it enables the fit of a firm's IS to be determined based on a number of IS capabilities simultaneously, rather than by focusing on discrete bivariate constructs. Thus, firms can develop a more holistic or systems-oriented analysis of the strategic fit of their IS using multidimensional profiles rather than being limited to studying various dimensions individually and ignoring their interrelationships. For example, Fisher (1997) advocates that firms configure their SCM IS for either operational efficiency or flexibility, whereas the qualitative evidence from this study suggests that firm's frequently need their IS to support a number of often contradictory capabilities simultaneously. As the case study evidence indicates, not only do firms differ on the level of support their SCM IS should provide for operational efficiency and operational flexibility, but they also have varying requirements for supporting planning, internal analysis, and external analysis capabilities.

The developed model provides a way for firms to analyze their competitive strategies and determine the level of support their SCM IS should provide for these strategies. Practitioners will gain a better understanding of their emergent strategic activities as well as the areas to focus on to improve the strategic fit of their IS. For IS evaluation and selection, rather than choosing to implement an information system because a competitor has had success with it, firms can analyze how the capabilities of the IS will fit each dimension of their competitive strategy. Ultimately, the model should further the understanding of the strategic fit of IS capabilities and assist firms in ensuring that their chosen systems have a closer fit with their unique competitive requirements.

5.7 Implications for Research Methods

The findings from this study have several implications on research methods for building empirically grounded theory. First, the results highlight the importance of exploratory research before applying pre-existing theories, methods, and measures to new areas such as the study of supply chain management information system capabilities. For example, this study examined Venkatraman's (1989b) widely used STROBE measure of competitive strategy dimensions and found the results of the quantitative measure could

not be corroborated by findings from in-depth interviews. One reason was that although Venkatraman's (1989b) "analysis" construct may have been valid in the context of the original study, it failed to distinguish between internal and external analysis, which was very important in the context of supply chain management. Thus, this study demonstrated the importance of obtaining rich qualitative evidence to fully explore the constructs and their dimensions, prior to operationalizing them using a quantitative measure.

Similarly, the study demonstrated how properly constructed quantitative measures can greatly reduce the inherent difficulty of analyzing large volumes of qualitative evidence. Through an iterative process of theory development, pilot testing of alternative questionnaire measures, and comparison with qualitative evidence, this study explored and developed the theoretical constructs and generated parsimonious questionnaire measures whose results were well corroborated with the qualitative evidence. While a statistically significant sample size would provide further evidence of the validity and reliability of the measures, the corroboration with qualitative evidence suggests that the measures developed have a higher likelihood of providing valid and useful results in a broader study.

The study also has implications on the use of case study methods for developing theory. Over the years, there has been a variety of case study methods proposed and their strengths and limitations have been widely debated. This study draws primarily on Eisenhardt's (1989) methodological recommendations for building theory from case study research. Eisenhardt (1989) in turn synthesized the recommendations from several sources including Yin (1994), Miles and Huberman (1994), and Glaser and Strauss (1967). This study follows Yin's (1994) case study tradition, but also incorporates recommendations for rigorously collecting and analyzing qualitative data (Miles and Huberman 1994) and building empirically grounded theories (Eisenhardt 1989; Strauss and Corbin 1998). Creswell's (2003) recommendations are followed for strengthening research using both qualitative and quantitative measures, although the measures used in this study are for exploratory rather than confirmatory purposes.

The analytical technique of determining strategic fit by calculating the Euclidean distance between theoretically ideal and reported configurations has several strengths and weaknesses. As Van de Ven and Drazin (1985) and Sabherwal and Chan (2001) report, the approach enables a more holistic rather than reductionist analysis of the relationship between multidimensional constructs. Such a systems perspective would be infeasible if a study were to focus on the many interacting relationships and factors individually (Venkatraman 1989a). The configuration approach can "offer richer insights by focusing on parsimonious and relatively homogenous groups rather than diverse concepts" (Sabherwal and Chan 2001, pg. 20).

As Kaplan and Maxwell (1994) note, any study that requires evidence to be converted from qualitative to quantitative formats may result in the loss of context or alternative explanations of the findings. For this reason, qualitative analyses have been used in this study to allow the validity of the quantitative findings to be further examined within their real world context and to seek out and analyze alternative explanations.

Characterizing firms using a competitive strategy typology involves an implicit assumption that the strategy is stable over a period of time or at least at the time it is measured. In reality, strategies are often in a state of transition and the level of fit may be only accurate for the time it was measured. On the other hand, Gimenez (1999) notes that numerous studies such as Hambrick (1983) and Zahra and Pierce (1990) have shown that the Miles and Snow (1978) classifications show relatively stable *patterns* of strategic behaviour over time. Indeed, the strength of the Miles and Snow (1978) typology is that even though companies may profess to have different strategies at different times, their patterns of behaviour relative to their competitors is relatively stable. Defenders usually exhibit Defender tendencies for relatively long periods until there is a market upheaval. Firms that do exhibit extremely unstable strategic patterns are accounted for by the Reactor classification. A further implicit assumption is that a higher level of strategic fit is better. This applies to most firms; however, for Reactors strategic flexibility is likely more important than achieving a high strategic fit at a point in time (Snow and Hrebiniak 1980). Thus, this study may be more useful for strategic decision-making for Defenders, Prospectors, and Analyzers, than for Reactors.

There are likely interdependencies between some of the research variables. For example, the level of supply chain integration likely depends in part on the organization's competitive strategy. Hambrick (1983) notes that Prospectors are unlikely to have a high level of integration with their partners compared to Defenders and Analyzers, although there is insufficient empirical evidence to support this assertion. However, since the primary aim is to explore the variables of interest rather than to measure their effects, the focus is on uncovering these interdependencies rather than trying to statistically control for them.

Finally, since "strategy is a relative phenomenon" (Hambrick 1983, pg. 8), the responses to the questionnaires will somewhat be driven by the contextual environment of the firm. As much as possible, companies from similar environments were chosen for this study, for example, Canadian manufacturing firms from the electronics industry. Selecting firms from a single industry and country is less problematic in this exploratory study as the focus is on exploring the different aspects of the theory in firms that are otherwise similar. However, in future confirmatory studies with larger samples, it will be more useful to look at cross-industry differences and control these differences using techniques such as normalizing the scores by industry (Sabherwal and Chan 2001).

5.8 Limitations

As in other case studies, the findings can be generalized to a developed theory, but not necessarily to other specific cases (Strauss and Corbin 1998; Yin 1994). The case study sample was selected purposively to explore preliminary theories of strategic fit of SCM IS, rather than to decisively test any hypotheses. While the evidence gathered was useful in developing a theoretical model, the small sample size did not allow any sophisticated statistical or qualitative analyses to be performed. However, the theoretical model is now sufficiently developed to facilitate future confirmatory research using a

larger sample size. The positive feedback from the participants suggests the developed model is both useful and valid and is likely to yield yet more insights with further investigation.

A further limitation of the case study methodology is its reliance on researcher interpretation in analyzing the findings. However, this weakness is mitigated by using a rigorous methodology as described in Chapter 3. Several recommendations were followed to ensure that the conclusions are supported by the evidence and not the biases of the researcher (Eisenhardt 1989; Klein and Myers 1999; Lee 1989). A formal case study protocol (see Appendix B) and database was used to ensure that procedures are followed consistently and an audit trail is created to allow the findings to be traced back to the evidence. Multiple researchers and case study participants reviewed the evidence and findings to check for inaccuracies or researcher bias. The questionnaires used were adapted from several previously validated studies, which increases the validity of the findings while contributing different perspectives on the constructs. Multiple alternative questionnaires were examined to determine which had the strongest reliability and validity. Objectivity was also ensured through triangulation of multiple data sources, constant comparisons and pattern matching between the theories and data, and searching for rival explanations (Eisenhardt 1989; Jick 1983; Sawyer 2001; Strauss and Corbin 1998; Yin 1994).

The data analysis methods were informed by exemplary studies from the IS field. The qualitative analysis followed Reich and Benbasat (1996; 2000), while the quantitative analysis largely followed Sabherwal and Chan (2001). A limitation of the Euclidean distance calculation (whether using absolute deviation or amount below the ideal level) was that support for each capability is assumed to be of equal importance to the strategic fit of the IS capabilities. Further refinements of the equation could accommodate alternative assumptions, including the assignment of different weights to each of the IS capability scores. Regardless, the Euclidean distance calculation is more useful for future studies that compare the overall strategic fit between multiple cases. For individual cases, obtaining a calculated level of strategic fit is less important than highlighting the IS capabilities that fall significantly below the theoretically ideal levels.

A limitation of developing a measurement model of strategic fit is that it necessarily only reflects the strategic fit of a firm's IS at a point in time. However, a firm's competitive strategies are constantly evolving (Mintzberg 1978) and thus may frequently change in a highly dynamic environment (Ciborra 1991; Yetton *et al.* 1995). In such cases, enabling strategic flexibility may be more important than achieving strategic fit for a limited period of time (Ciborra 2000; Knoll and Jarvenpaa 1994).

Furthermore, the theoretically ideal level of support for each capability is derived from the Defender, Prospector, and Analyzer competitive strategy archetype a firm most resembles. For firms that exhibit competitive strategy patterns that are hybrids of the archetypes, their theoretically ideal values should be some combination of the theoretically ideal values for the archetypes involved. As a first approximation, the

maximum of the ideal value for each capability could be used[47]. However, further investigation of such models would be required.

5.9 Future Research

The goal of the study is to *explore* SCM IS capabilities rather than confirm any presumed relationships. However, several interesting relationships between the constructs were observed, which require further study to determine if they are generalizable phenomena or anomalies of the specific cases. For example, a respondent from Case A appeared to suggest operational efficiency was of lower importance to their business unit because of the high product margins and low transaction volumes, while other business units within the same firm place higher importance on support for operational efficiency. If confirmed, this relationship would support Fisher's (1997) efficiency-innovativeness theory, but would suggest that implementing a single supply chain management information system that fits the requirements of the entire firm would be infeasible. Such complexities require further study, as there are significant implications for the selection and implementation of enterprise-wide SCM IS. Similarly, future studies should look at the relationships between the SCM IS capabilities highlighted in the model with measures of organizational performance. While the relative importance of each IS capability is expected to vary according to a firm's strategies (Henderson *et al.* 1996), these relationships and contingencies require further study.

Future research should also measure a firm's SCM IS capabilities and their association with supply chain performance. Quantitative measures of supply chain performance should focus not only on costs or prices, but on supply chain wide metrics such as total supply chain costs, assets performance, responsiveness, flexibility, and reliability measures (Supply-Chain Council Inc. 2002). However, none of the three firms in this study were willing to provide such metrics as they were either too sensitive or they were unable to produce such measures from their current systems. It may be more feasible to gather intermediate measures such as satisfaction with the SCM IS.

Future studies should address methods of determining the relative importance of each of the SCM IS capabilities in the model. For some firms, the operational efficiency and flexibility dimensions may be more important in determining fit than in others. There may also be interrelationships between the capabilities, which require further investigation. Some researchers might be inclined to see efficiency and flexibility as contradictory requirements, although at a business unit or firm level, this is not necessarily true. For example, some businesses may require high operational efficiency for some processes and high operational flexibility for others (Reddy 2001a). At the business unit level, it would appear to have requirements for a high level of support for both efficiency and agility. While the model has not yet been used to probe the

[47] For example, since the theoretically ideal level of support for operational efficiency is high for Defenders and medium for Analyzers, the theoretically ideal level for a firm with competitive strategy patterns that are somewhat Defender-like and somewhat Analyzer-like would be high (since the maximum of high and medium is high).

inconsistencies that are found within and between business units, it should provide a significant foundation for future investigations.

Although it is grounded in previous theoretical and empirical research, the validity and utility of the model described should be confirmed in future large sample statistical studies. Future research should also measure the association between a firm's strategic fit of IS capabilities and measures of organizational performance.

5.10 Conclusion

Models of fit between information systems (IS) capabilities and competitive strategy have been proposed and debated for over two decades. However, limitations of many of the theories employed have hindered the development of detailed operationalizable models suitable for exploring the strategic fit of the capabilities of specific types of IS.

The goal of this dissertation was to develop a theoretical model of the strategic fit of IS capabilities that can be operationalized for specific IS. The intent of the model was to help firms understand and assess the strategic fit of the IS capabilities for their specific IS. These goals were accomplished through the integration of existing theories with empirical evidence from a multiple case study of five manufacturing organizations.

Chapter 2 identified shortcomings with existing theories of strategic fit of IS capabilities. It then described the desired attributes of the new theory to be developed in this study, which included a more holistic analysis that conceptualizes strategy as emergent patterns rather than intended designs. Chapter 2 described a conceptual framework as well as the research questions to be addressed in fully exploring and operationalizing the model. Concepts such as configurational theory, the resource based view of the firm, and emergent strategies and capabilites — all of which are underutilized in current IS literature — were used to ground the framework theoretically.

Chapter 3 explained and justified the chosen multiple case study research methodology. The chapter described the rigorous procedures followed to collect, analyze, and triangulate evidence from a variety of sources to develop further understanding and insights into the research constructs. The methods were characterized as largely being a largely positivist and deductive exploratory multiple case study investigation.

Chapter 4 described the results of the qualitative and quantitative data analyses. First, it showed how a case's competitive strategy patterns and level of supply chain integration could be assessed. Next, the chapter described how each case's emergent competitive strategy patterns could be used to derive their ideal IS capabilities. Finally, Chapter 4 demonstrated how the strategic fit of a firm's IS can be modeled as the deviation between the ideal and perceived IS capabilities profiles.

Several important findings emerged from the case study investigations. First, questionnaire measures of competitive strategy patterns and SCM IS capabilities were identified whose results were well corroborated by the qualitative evidence from the

cases. The study explored alternative operationalizations of competitive strategy and SCM IS capabilities and developed a questionnaire measure that is well suited to further examination of strategic fit of a firm's IS.

Second, the overall level of supply chain integration was found to be very similar between each of the cases studied and hence its role in modeling strategic fit was not significant to this study. Although the supply chain integration construct warrants further examination, it did not appear to be a strong determinant of the strategic fit of a case's SCM IS.

Third, an analysis of qualitative evidence suggested SCM IS capabilities should be modeled according to the support a firm's SCM IS provide for: operational efficiency, operational flexibility, planning, internal analysis, and external analysis. This finding brings clarity to the problem of finding an appropriate set of constructs for distinguishing between the organizational capabilities supported by various SCM IS.

Fourth, the empirical results strongly supported modeling strategic fit as the amount the perceived level of support for each SCM IS capability is *less than* the theoretically ideal level. This approach had better empirical support than the more common approach of modeling strategic fit as the absolute deviation between the perceived and theoretically ideal levels.

This study found existing conceptualizations of strategic fit of IS capabilities to have shortcomings when applied to the strategic fit of capabilities of specific IS rather than to the IS strategy level. This dissertation developed a theoretical model of the strategic fit of IS capabilities through the integration of configurational theories of emergent competitive strategy patterns and IS capabilities. The model is sufficiently developed to enable further refinement and operationalization for the study of specific types of IS.

The analysis of existing studies and new empirical evidence described in Chapters 2 and 4 resulted in the model of strategic fit of IS capabilities described in Section 5.2. The developed model indicates the strategic fit of a firm's information systems can be determined by comparing the perceived level of support the firm's IS provide for various organizational capabilities with the theoretically ideal levels of support the firm's should provide. The theoretically ideal levels of support the IS should provide for each capability are derived from the firm's competitive strategy archetype, which in turn can be determined from an analysis of their competitive strategy patterns.

Section 5.3 describes how the developed model can be operationalized for the study of SCM IS specifically. Using the results of the analyses of Chapters 2 and 4, it demonstrates how the level of support a firm's SCM IS provides for various organizational capabilities can be operationalized, measured, and compared with the theoretically ideal levels.

This study provides a theoretical basis for investigating the fit between competitive strategy patterns and SCM IS capabilities. An approach for identifying the theoretically ideal level of support for SCM IS capabilities required for a firm is

described. The model was developed from an analysis of the literature and examined through an exploratory case study of five manufacturers. However, given the newness of the model proposed, further replication studies are clearly required.

In summary, the theoretical model of strategic fit of IS capabilities developed can provide researchers and practitioners with a holistic yet parsimonious model for understanding and assessing the fit of a firm's IS with their emergent competitive strategies. The model contributes to the body of knowledge by integrating theories of strategic fit, emergent competitive strategy, and information system capabilities. As demonstrated in the theoretical development and empirical analysis, it is well supported both by previous theoretical and empirical studies and by the findings from the empirical analysis conducted in this study.

The case studies demonstrated how the developed theoretical model can be operationalized for studying a firm's SCM IS and their fit with the firm's competitive strategies. The theoretical model of strategic fit of IS capabilities is also sufficiently developed to be operationalizable for studies of other types of information systems. The aim of this study was to explore the constructs rather than statistically confirm their relationships. However, it is hoped that the insights generated in this dissertation will enable further research and understanding of how firms can improve the strategic fit of their information systems.

CHAPTER 6: REFERENCES

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APPENDIX A - GLOSSARY AND ACRONYMS

Advanced Planning and Scheduling (APS): Optimizing the allocation and scheduling of resources across a supply chain. Also used to denote real-time supply chain planning optimization systems from vendors such as i2 or Manugistics. APS algorithms are usually more sophisticated than those found in ERPs, which typically run in batch mode rather than real-time.

APS: see Advanced Planning and Scheduling

Axial Coding: Determining linkages and relationships between categories and subcategories of data. Term used in grounded theory and other qualitative methodologies.

Build-to-Order: Manufacturing of a customized product or service after a customer's exact specifications are received rather than build-to-stock.

Build-to-Stock: Manufacturing of a standardized product to be inventoried based on anticipated customer needs.

Bullwhip Effect: A term used to describe the phenomenon that the further away from the consumer an inventory buffer is, the more demand variability that inventory buffer will have to address.

Case Study: A research strategy that focuses on gathering quantitative and/or qualitative evidence from informants to empirically explore or examine a theory in a real-world setting. Evidence is typically gathered through interviews, observations, and archival documents. As statistical controls are usually not used, researcher must take care to not let biases in interpretations distort findings.

Collaborative Planning, Forecasting and Replenishment (CPFR): An industry initiative focused on improving the partnership between manufacturers and distributors / retailers through shared information (see www.cpfr.org).

Continuous Replenishment (CRP): The practice of partnering between distribution channel members that changes the traditional replenishment process from distributor-generated purchase orders, based on economic order quantities, to the replenishment of products based on actual and forecasted product demand.

CPFR: see Collaborative Planning, Forecasting and Replenishment

CRP: see Continuous Replenishment

EDI: see Electronic Data Interchange

EEAI: see Extended Enterprise Application Integration

EERP: see Extended Enterprise Resource Planning

ERP: see Enterprise Resource Planning

Electronic Data Interchange (EDI): The computer-to-computer transmission of business information between trading partners. The information should be organized in

standard file formats or transaction sets following guidelines administered by the standards body. Standards have been developed for all regular business-to-business communication including purchase orders, invoices, shipping notices, and funds transfer. By eliminating the clerical, mailing and other costs associated with paper-based information, EDI reduces costs, time delays and errors.

Enterprise Resource Planning (ERP): Commonly used to referred to enterprise software that integrates finance, purchasing, production, sales, and distribution functions in a centralized data store.

Extended Enterprise Application Integration (EEAI): The use of middleware to integrate software applications between two or more enterprises.

Extended Enterprise Resource Planning (EERP): The application of ERP systems to coordinate processes and transactions between firms. Also known as ERP II.

eXtensible Markup Language (XML): A protocol for defining how the data in a document can be tagged to identify the fields the data should represent. Users of XML must still agree upon a data schema which identifies the meaning of the tags and which tags and values are valid. However, unlike EDI formats, the location of the data in the document does not matter, as long as it is properly tagged.

Grounded Theory Method: A specific qualitative coding technique (see Strauss and Corbin 1998) that identifies key categories and themes surrounding a phenomenon of interest.

ICT: see Information and Communication Technology

Information and Communication Technology (ICT): Application of modern communications and computing technologies to the creation, management and use of information.

Information Systems (IS): Information resources organized for the collection, processing, maintenance, transmission, and dissemination of information, in accordance with defined procedures, whether automated or manual.

Interpretivism: An underlying philosophical research perspective which assumes reality is socially constructed through language, consciousness and shared meanings. Under this perspective, researchers attempt to understand a phenomenon under investigation through meanings that people assign to them.

Interorganizational Information System (IOS): An information system that allows information flow between two (or more) business partners. Alternatively abbreviated as IIS or IOIS.

Inventory Turnover / Inventory Turns: The number of times that an inventory cycles or "turns over" during a year. A frequently used method to compute inventory turnover is to divide the average total inventory level into the annual cost of sales.

IOS: see Interorganizational Information System

IS: see Information Systems

Lead Time: 1. A span of time required to perform a process (or series of operations). 2. In a logistics context, the time between recognition of the need for an order and the receipt of goods

Maintenance, Repairs, and Operations (MRO)*:* goods or services used as indirect supplies for maintenance, repair, or administrative operations in a firm, rather as than as direct components of a created good or service. Examples of MRO items for an automobile manufacturer might include manufacturing equipment and office supplies.

Manufacturer: In supply chain studies, usually considered the producer of a good *or a service* as the differences between the two can often be ignored.

MRO: see Manufacturing, Repairs, and Operations

Open Coding: A procedure utilized in the grounded theory method and other qualitative methodologies where the researcher names and categorizes a phenomenon through close examination of field data.

Point-of-Sale (POS): Typically denotes an application for collecting sales information at the point of sale. POS data is often sent to a centralized office to determine when to reorder inventory and for sales history and forecasting.

POS: see Point-of-Sale.

Positivism: An underlying philosophical research perspective which assumes reality is objective and can be described by measurable properties independent of the researcher.

Safety Stock: A quantity of stock planned to be in inventory to protect against demand fluctuations or out-of-stock situations.

Sales Forecast: A projection of future retail sales for a given time period and location, (ideally) created by combining point of sale (POS) data, seasonality, causal information and planned events.

SCM: see Supply Chain Management

SCM IS: see Supply Chain Management Information Systems

Selective Coding: A procedure utilized in grounded theory method and other qualitative methodologies where the researcher identifies the core category of the study and systematically relates it to other major categories identified by the research.

Strategic Fit: How well something supports a firm's competitive strategies.

Supply Chain: A grouping of suppliers, customers, distributors, and other partners who have agreed to jointly deliver a specific set of products and/or services to a consumer (end-customer). Sometimes used in other studies to identify only supply processes but more commonly used for both supply and demand processes and as a synonym to *value chain* (see www.suppply-chain.org).

Supply Chain Coordination: see Supply Chain Management.

Supply Chain Collaboration: The coordination of a firm's supply chain partners with emphasis on plans and procedures jointly developed by the key partners.

Supply Chain Integration: The coordination of a firm's strategies, processes, systems, and performance measures with those of its partners. Unlike "collaboration," integration can be driven by one partner and does not require joint cooperation. The similar term "supply chain maturity" is avoided, as it implies a higher level of integration is better, which may not be correct in all cases.

Supply Chain Management (SCM): The coordination of material, information, financial transactions, and decisions among a firm's suppliers, customers, distributors, and their partners. Synonyms and variations of supply chain coordination include: *supply chain management, -integration, -collaboration; value chain management.*

Supply Chain Management Information Systems (SCM IS): Enterprise or interorganizational information and communication technologies used to coordinate supply chain information internally and externally. As with ERPs, the classification of a specific ICT as a supply chain management information system is somewhat subjective.

Vendor-Managed Inventory (VMI): The supplier is responsible for managing and replenishing inventory held at their customer's location under contracted terms.

VMI: see Vendor-Managed Inventory

XML: see eXtensible Markup Language

APPENDIX B - CASE STUDY PROTOCOL

Plan for Conducting Case Studies of the Strategic Fit of Supply Chain Management Information Systems

Purpose:

The purpose of this study is to develop a conceptual model of the strategic fit of supply chain management information systems (SCM IS) for a doctoral dissertation by Tim McLaren of the DeGroote School of Business of McMaster University. Information will be gathered on the current and anticipated future strategic fit of a business' SCM IS and used to develop theories and survey instruments.

Benefits to Participant:

The goal of this study is to help firms ensure that their SCM IS fit their competitive strategies and supply chain environment. The conceptual model and questionnaires developed should help firms better analyze and improve the strategic fit of their supply chain systems. The findings and detailed analyses and recommendations will be shared with the participants prior to and after completion of the study

Procedures:

The information gathered includes the interviewee's perceptions of:

A. How a business positions itself to compete in its industry;
B. How closely integrated the business is with other members of its supply chain;
C. The organizational capabilities of the business' current and desired SCM IS;
D. The level of satisfaction management has with their current SCM IS; and
E. How well the current SCM ISs fit the business' needs.

This information will be collected through completion of a multiple choice questionnaire and through a semi-structured interview. The interview duration is 30-60 minutes and the questionnaires require an additional 10-15 minutes. The interviews will be used to validate and further explore the issues in the questionnaires and will be used to probe future plans for the firm's SCM IS.

Confidentiality:

As detailed in the attached consent form, the information gathered in this interview is related to high-level strategic patterns of behaviour that is generally available in other public documents. NO proprietary information on specific tactics or competitive secrets will be gathered or retained and the identities of all people or firms will be thoroughly disguised and will not be released under any circumstances.

The participant will have the opportunity to review and correct or withhold the case report following the interview. This information will not be used further without written confirmation from the participant that it is accurate and does not include information that could identify any participants or firms in the study.

Interview Protocol:

A. Competitive Strategy Type

How does the organization position itself to compete in its industry? What type of competitive strategy does this represent (e.g., Defender, Analyzer, Prospector, or Defender?).

Sources of Data:

-Financial Reports, letters to shareholders, investor communications, etc.
-Previous case reports, interviews, newspaper and magazine articles.
-Strategic Plans (if not confidential)
-Senior Managers
-Consultants who have worked for company

A1) What are the major market(s) the firm uses SCM IS in?

PROBES:

- Products?
- Customers?
- Suppliers?
- Competitors?
- Relative importance of each market?

A2) Are there significant differences in competitive strategy type or SCM IS capabilities between different business units in the firm or is it homogeneous? (If it is not homogeneous, describe the business unit this interview covers).

A3) Describe the competitive forces which operate most strongly in the unit's market and how the unit responds to them.

PROBES:

- Substitute Products
- Customer Power
- Supplier Power
- Rivals
- New Entrants

A4) What types of strategies does the organization use to compete in their market?

PROBES:

- Do you know the type of competitive strategy that is currently used?
- What are unit's competitive advantages, strengths, focuses?
- How would you rate unit in operational efficiency, product innovation, and customer intimacy?
- Are products and services diverse or specialized? innovative or well-proven?

- How much scanning of environment and competitors?
- How much time and effort spent planning versus execution?
- How flexible or static are the strategies? business partnerships?
- How risk averse is the organization?
- Is decision-making centralized? hierarchical? organized by product?

B. Supply Chain Integration

How important is supply chain management and integration to the performance of the firm? How closely integrated is the firm with other members of its supply chain?

Sources of Data:

-Web site documentation (e.g., supplier/customer portals, electronic markets, EDI)
-Financial Reports, letters to shareholders, investor communications, etc.
-Previous case reports, interviews, newspaper and magazine articles.
-Strategic Plans (if not confidential)
-Organizational charts (for reporting structure for supply chain management group)
-Senior Managers
-Consultants who have worked for company

B1) How important is optimizing the performance of the firm's supply chain to the overall performance of the firm?

PROBES:

- Who is responsible for supply chain coordination in the firm?
- What metrics are gathered for measuring supply chain performance?

B2) Are there significant differences in the level of supply chain integration between different business units in the firm or is it homogeneous? (If it is not homogeneous, describe the business unit this interview covers).

B3) Are there significant differences in the level of supply chain integration between the Plan, Make, Source, and Deliver supply chain processes? If so, describe them.

B4) How important is internal and external integration to your supply chain performance?

PROBES:

- Who is involved in decisions regarding integration/coordination?
- What metrics are gathered for measuring integration effectiveness?
- How important is having sustainable long-term relationships or shared benefits?

B5) How closely integrated is the unit with other members of its supply chain?

PROBES:

- What is the current focus of integration efforts? What information, processes, and systems are involved?

- Has internal integration been achieved? How? Benefits and problems?
- Has external integration been achieved? How? Benefits and problems?
- How are decisions made between business units or supply chain partners? Are decisions made jointly or dictated by one party?
- How are performance of and benefits to the partner measured? Who defines and measures the metrics?
- To what degree is outsourcing used? How are outsourced processes managed?
- How formal and inclusive is the strategic planning for the supply chain? Is there a strategic plan? Who creates it? How useful is it?

B6) What is the desired level of integration with other members of the supply chain?

PROBES:

- What improvements will be made this year? Next Year? In five years?
- How easy will it be to achieve these improvements?

C. Capabilities of the Supply Chain Management Information Systems

What types of SCM IS are used and/or anticipated to be used? What are the current and desired organizational capabilities of the SCM IS?

Sources of Data:

-Web site documentation (e.g., supplier/customer portals, electronic markets, EDI)
-Previous case reports, interviews, newspaper and magazine articles.
-System documentation
-Senior Managers
-Consultants who have worked for company

C1) What types of SCM IS are used and/or anticipated to be used in the organization?

PROBES:

- What is their purpose? What processes do they support?
- What is the information sharing mechanism? Messages? Portals? Jointly shared systems?
- What technologies are used? EDI? Email? XML? ERP? eMarketplaces?
- How quickly are the SCM IS evolving new functionality?

C2) What has motivated the use of the current and/or anticipated SCM IS?

PROBES:

- How was the system proposed / championed? Internal or partner?
- Is the system a response to what competitors are doing?

C3) What are the organizational capabilities of the current and anticipated SCM IS? (e.g., support for efficiency, flexibility, planning, analysis, process coordination, etc.)

PROBES:

- How do the SCM IS support the firm's objectives?
- Which SCM IS provide which capabilities? How integrated are they?
- Do the capabilities address short-term or long-term time periods?
- Are the capabilities focused on internal or external processes?

C4) How do these capabilities compare with those provided by competitors' SCM IS?

PROBES:

- How much do you know about your competitors' systems?
- To what degree do you expect to maintain or gain a competitive advantage with your current or planned SCM IS?

D. Management's Satisfaction with the SCM IS

How satisfied is management with their current SCM IS?

Sources of Data:

-Senior Managers

-Consultants who have worked for company

D1) To what degree have the current SCM IS met management's expectations?

PROBES:

- Are there outstanding benefits that are still expected to be achieved?
- Have expectations been revised? Why?
- What future plans are there for increasing satisfaction with the SCM IS?

D2) How satisfied is management with the current SCM IS?

PROBES:

- Is the system considered a success or failure? Why? What caused this?
- How has the successfulness of the system been determined?
- What recommendations would management give for selecting and implementing the systems if they were to do it all over again?

D3) How satisfied is management with the current strategy for supply chain coordination?

PROBES:

- How clear and feasible is the strategy?
- How should things be done differently to improve the performance of the supply chain?

E. Strategic Fit of the SCM IS
How well do the current SCM ISs fit the firms' needs?

Sources of Data:
-Senior Managers
-Consultants who have worked for company

E1) How well would you say the systems fit your business needs?
PROBES:
- How well are the SCM ISs aligned with your strategies?
- How well do they support your supply chain?
- Examples?

E2) How important is it that you have systems that fit your business needs or is that even a priority?
PROBES:
- Why or why not?

APPENDIX C - QUESTIONNAIRES

C.1 Multi-Item Scale For Measuring Competitive Strategy Types

The following measure is adapted from Conant *et al.* (1990); see notes following measure.

For the following 12 multiple-choice questions, please read the statement carefully and circle the response that best matches your organization. Answer each question before reading the following question.

Please respond according to the CURRENT state of your organization, rather than the *desired* state. Responses are confidential; respondent and organization names will not be disclosed.

If you have any difficulties responding to any of the questions, please provide your comments so that we may improve the questionnaire.

1. *Entrepreneurial - product-market focus.*
In comparison to our competitors, the products and services that we provide to our customers are best characterized as:
   (a) More innovative; continually changing; and broader in scope. (P)
   (b) Fairly stable in certain markets while innovative in other markets. (A)
   (c) Well focused; relatively stable; and consistently defined throughout the marketplace. (D)
   (d) In a state of transition, and largely based on responding to opportunities or threats from the marketplace or environment. (R)

2. *Entrepreneurial - market leadership.*
In contrast to our competitors, my organization has an image in the marketplace as one which:
   (a) Offers fewer, selective products and services that are high in quality. (D)
   (b) Adopts new ideas and innovations, but only after careful analysis. (A)
   (c) Reacts to opportunities or threats in the marketplace to maintain or enhance our position. *(R)*
   (d) Has a reputation for being innovative and creative. *(P)*

3. Entrepreneurial – market surveillance.
The amount of time my organization spends on monitoring changes and trends in the marketplace can best be described as:
   (a) Lengthy: We are continuously monitoring the marketplace. *(P)*
   (b) Minimal: We really do not spend much time monitoring the marketplace. *(D)*
   (c) Average: We spend a reasonable amount of time monitoring the marketplace. *(A)*

(d) Sporadic: We sometimes spend a great deal of time and at other times spend little time monitoring the marketplace. *(R)*

4. Entrepreneurial - market growth.
In comparison to our competitors, the increase or losses in demand that we have experienced are due most probably to:

(a) Our practice of concentrating on more fully developing those markets that we currently serve. *(D)*
(b) Our practice of responding to the immediate needs of the marketplace. *(R)*
(c) Our practice of aggressively entering into new markets with new types of product and service offerings. *(P)*
(d) Our practice of assertively penetrating more deeply into markets we currently serve, while offering new products and services only after a very careful review of their potential. *(A)*

5. Engineering - process goals.
One of the most important goals in this organization in comparison to our competitors is our dedication and commitment to:

(a) Keep costs under control. *(D)*
(b) Analyze our costs and revenues carefully to keep costs under control and to selectively generate new products and services or enter new markets. *(A)*
(c) Insure that the people, resources, and equipment required to develop new products and services and new markets are available and accessible. *(P)*
(d) Make sure that we guard against critical threats by taking whatever action is necessary. *(R)*

6. *Engineering - competency breadth.*
In contrast to our competitors, the competencies (skills) that our managerial employees possess can best be characterized as:

(a) Analytical: their skills enable them to both identify trends and then develop new product or service offerings or markets. *(A)*
(b) Specialized: their skills are concentrated into one, or a few, specific areas. *(D)*
(c) Broad and entrepreneurial: their skills are diverse, flexible, and enable change to be created. *(P)*
(d) Fluid: their skills are related to the near-term demands of the marketplace. *(R)*

7. *Engineering - infrastructure adaptability.*
The one thing that protects my organization from competitive failure is that we:

(a) Are able to carefully analyze emerging trends and adopt only those that have proven potential. *(A)*
(b) Are able to do a limited number of things exceptionally well. *(D)*
(c) Are able to respond to trends as they arise even though they may possess only moderate potential. *(R)*
(d) Are able to consistently develop new products and services and new markets. *(P)*

8. *Administrative - administrative focus.*
More so than many of our competitors, our management staff tends to concentrate on:
(a) Maintaining a secure financial position through cost and quality control measures. *(D)*
(b) Analyzing opportunities in the marketplace and selecting only those opportunities with proven potential, while protecting a secure financial position. *(A)*
(c) Activities or business functions which most need attention given the opportunities or problems we currently confront. *(R)*
(d) Developing new products and services and expanding into new markets or market segments. *(P)*

9. *Administrative - planning.*
In contrast to many of our competitors, my organization prepares for the future by:
(a) Identifying the best possible solutions to those problems or challenges that require immediate attention. *(R)*
(b) Identifying trends and opportunities in the marketplace which can result in the creation of product or service offerings which are new to the marketplace or which reach new markets.*(P)*
(c) Identifying those problems that, if solved, will maintain and then improve our current product and service offerings and market position. *(D)*
(d) Identifying those trends in the industry that other firms have proven possess long-term potential while also solving problems related to our current product and service offerings and our current customers needs. *(A)*

10. *Administrative - organizational structure.*
In comparison to our competitors, the structure of my organization is:
(a) Functional in nature (i.e., organized by department — marketing, accounting, personnel, etc.). *(D)*
(b) Product- or market-oriented (for example, business units are organized by product or market and handle functions like marketing and accounting internally). *(P)*
(c) Primarily functional (departmental) in nature; however, a product- or market-oriented structure does exist in newer or larger product or service offering areas. *(A)*
(d) Continually changing to enable us to meet opportunities and solve problems as they arise. *(R)*

11. *Administrative - control.*
Unlike many of our competitors, the procedures my organization uses to evaluate our performance are best described as:

(a) Decentralized and participatory encouraging many organizational members to be involved. *(P)*
(b) Heavily oriented toward those reporting requirements which demand immediate attention. *(R)*
(c) Highly centralized and primarily the responsibility of senior management. *(D)*
(d) Centralized in more established service areas and more participatory in newer product or service areas. *(A)*

Instrument Notes:

Test-retest reliability of Conant *et al.*'s (1990) original scale items 1 to 11 and the overall instrument are:

1	2	3	4	5	6	7	8	9	10	11	Overall Instrument
.63	.73	.72	.62	.82	.75	.67	.70	.66	.73	.56	0.74

The letters in brackets identify the response characteristic of a: *(D)* = Defender, *(P)* = Prospector, *(A)* = Analyzer and *(R)* = Reactor. These letters and the item titles are for description and analysis purposes only and were removed from the final instrument.

The 11 scale items comprising the instrument correspond to the 11 competitive strategy dimensions in the Miles and Snow (1978) typology. The above items are organized by the adaptive cycle dimension, however the order the questions were given to the respondents was 1,5,8,7,4,2,10,3,9,11,6 in order to decrease the risk of recency effects of related items and hypothesis guessing.

The wording of the items have been slightly adapted to remove Conant *et al.*'s (1990) specific references to health management firms (HMOs) and services. For example, this study uses "products and services" instead of "services" and "our competitors" instead of "other HMOs." It the respondents to compare their firms with their competitors recognizing that competitive strategy is a phenomenon that is relative to other competitors in an industry (Hambrick 1983).

C.2 Paragraph-type Scale For Measuring Competitive Strategy Types

This measure is from Miles and Snow (1978) and is used as an alternative measure to the preceding 11 item scale developed by Conant *et al.* (1990). See note following measure.

Please circle the paragraph below that most closely describes your organization's competitive strategy.

Type I) A firm with this type of strategy typically operates within a broad product-market domain that undergoes periodic redefinition. The organization values being "first in" in new product and market areas even if some of these efforts prove not to be highly profitable. The organization responds rapidly to early signals concerning areas of productivity, and these responses often leads to a new round of competitive actions. However, a firm with this type of strategy may not maintain market strength in all of the areas it enters.

Type II) A firm with this type of strategy does not appear to have a consistent product-market orientation. The organization is usually not as aggressive in maintaining established products and markets as some of its competitors, nor is it willing to take as many risks as other competitors. Rather, the organization responds in those areas where it is forced to by environmental pressures.

Type III) A firm with this type of strategy attempts to locate and maintain a secure niche in a relatively stable product or service area. The organization tends to offer a more limited range of products or services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often a firm with this type of strategy is not at the forefront of developments in the industry — it tends to ignore industry changes that have no direct influence on current areas of operations and concentrates instead on doing the best job possible in a limited area.

Type IV) A firm with this type of strategy attempts to maintain a stable, limited line of products or services, while at the same time moving out quickly to follow a carefully selected set of the more promising new developments in the industry. The organization is seldom "first in" with new products or services. However, by carefully monitoring the actions of major competitors in areas compatible with its stable product-market base, the organization can frequently he "second in" with a more cost-efficient product or service.

Note: to reduce hypothesis guessing and biasing the responses with the Miles and Snow (1978) competitive strategy type names, the names were replaced with Type I-IV and the order the paragraphs are traditionally presented in was changed. The Type I in this study is a Prospector, Type II is a Reactor, Type III is a Defender, and Type IV is an Analyzer.

C.3 Level of Supply Chain Integration

Notes: The following measure is adapted from Moncrieff and Stonich (2001).

In the instrument used in this study, the number of the description was replaced with letters to reduce the tendency to self-report a higher number (Dillman 1978). Levels 1, 2, 3, and 4 represent the Functional Focus, Internal Integration, Linked Network, and Integrated Network levels of supply chain integration, respectively. Level 5, which is Optimized Network, is not included in the measure since in a much wider study no firms were found that currently consistently operate at that level (Moncrieff and Stonich 2001). In this measure, any such firms would therefore be identified as Level 4 companies (which have also shown to be rare).

The following instructions preceded the instrument:

> "For the following items, please circle the description that best matches your organization for the given supply chain dimension.
>
> Please respond according to the CURRENT state of your organization, rather than the *desired* state.
>
> Responses are confidential; respondent and organization names WILL NOT BE DISCLOSED.
>
> If you have any difficulties responding to any of the questions, please provide your comments so that we may improve the questionnaire."

1. For our Supply Chain Strategy:

(a) Each department or business unit has a separate supply chain strategy. There is little coordination of strategies across enterprise or supply chain.
(b) A formal enterprise-wide supply chain management strategy exists but there is no formal strategy for external partners.
(c) A formal enterprise-wide supply chain management strategy exists including an internally developed formal strategy for external partners.
(d) A Formal supply chain-wide supply chain management strategy exists that was jointly developed with external supply chain partners.

2. For managing the Performance of our supply chain:

(a) Supply chain performance is measured predominantly at functional / departmental level.
(b) Supply chain performance is measured predominantly at the company, process, and diagnostic levels.
(c) Supply chain performance metrics are defined internally and there is joint performance monitoring and correction with external partners.
(d) Supply chain performance metrics are jointly defined, monitored, and corrected with external partners.

3. For managing the business Processes in our supply chain:

(a) Processes tend to be managed within discrete departments or functions. There is little cross-functional or inter-enterprise process management.
(b) Processes are often company-wide and are managed at both the functional and cross-functional process levels. There is little inter-enterprise process management with supply chain partners.
(c) Core processes are managed internally. Outsourcing is used for most non-core processes. Information is frequently shared with external partners.
(d) End-to-end process management, coordination, and collaboration with strategic partners is used for most processes. Alignment of business objectives and processes is done with each strategic partner.

4. For high level Decisions regarding our supply chain, major decisions are usually made by a committee:

(a) Without representatives from each of our production, finance, logistics, and information technology areas.
(b) With representatives from each of our production, finance, logistics, and information technology areas, but without external partners.
(c) With representatives from each of our production, finance, logistics, and information technology areas, and external partners (who may observe and provide input, but do not have a final say in decisions).
(d) With representatives from each of our production, finance, logistics, and information technology areas, and external partners (who usually have a final say in decisions).

The following items for the Plan, Source, Make, and Deliver processes were used in the initial pilot tests but were discarded in further studies as the responses added little additional information over what was gathered in the preceding Overall process items:

SCOR Model Dimension		**Evidence for Level of Supply Chain Integration**
Plan	Demand Planning	1. Primarily departmental demand planning with little aggregation. 2. Demand planning aggregated across company. 3. Demand information exchanged electronically with partners and aggregated internally. 4. Joint demand planning performed with partners using supply chain-wide demand data and marketing plans.
	Supply Planning	1. Departmental supply planning with little aggregation. 2. Company-wide supply planning and coordination. 3. Supply information exchanged electronically with partners and governed by performance agreements. 4. Joint supply and capacity planning performed with partners using supply chain-wide supply data and marketing plans.
Deliver	Deliver Process Management	1. Few formal processes documented for order management, channel rules, product delivery, or invoicing. 2. Internal processes documented for order management, sales, product delivery, and invoicing. 3. Processes and standards documented and monitored for internal and external deliver processes and partners. 4. Formal standards and service level agreements (differentiated by service provider, customer, and product) documented and monitored.
	Order Management, Logistics & Invoicing	1. Standalone order management, logistics, and invoicing processes and systems for each department. 2. Company-wide integrated order management, logistics, and invoicing systems (for example, ERP system). 3. Integrated information systems with *periodic* electronic order and delivery updates available to strategic partners. 4. Integrated information systems with *real-time* electronic order and delivery updates available to strategic partners.

SCOR Model Dimension		Evidence for Level of Supply Chain Integration
Source	Source Strategy	1. No formal sourcing strategy exists. 2. Formal sourcing strategy with frequent monitoring. 3. Formal sourcing strategy with frequent monitoring and formal agreements with strategic suppliers. 4. Formal sourcing strategy and agreements plus mutual measurement and alignment of business objectives with strategic suppliers.
	Commodity & Spend Management	1. Primarily informal sourcing processes with purchasing agreements developed within each department. 2. Cross-functional commodity management teams and formal company-wide sourcing processes predominate. 3. As (2) above plus electronic procurement for commodity sourcing. 4. As (3) above plus joint process improvement initiatives with suppliers and electronic access to supply information.
	Supplier Development & Management	1. Supplier relationships poorly monitored, documented, and prioritized. 2. Supplier relationships, monitored, documented, and prioritized internally. 3. Monitoring and adjustment of supplier performance performed jointly with strategic suppliers. Metrics definition developed internally. 4. Performance metrics definition, monitoring, and adjustment performed jointly with strategic suppliers. Collaborative product development with suppliers.
	Sourcing Organization & Infrastructure	1. Departmental purchasing with few electronic procurement tools. 2. Predominantly use purchasing or ERP systems for company-wide purchasing coordination and monitoring. 3. Predominantly use purchasing systems linked to supplier catalogues for electronic procurement and spend management. 4. Predominantly use electronic procurement or ERP systems that are integrated with supplier's available-to-promise information.

SCOR Model Dimension		**Evidence for Level of Supply Chain Integration**
Make	Make Strategy	1. Make-to-stock practices with limited profitability analyses predominate. 2. Mix of make-to-stock and make-to-order practices with rudimentary profitability analyses. 3. Primarily make-to-order practices with scheduling based on profitability analyses. 4. Lean manufacturing and flexible product configuration practices predominate.
	Production Scheduling	1. Manual or rudimentary Material Requirements Planning (MRP) or Master Production Scheduling (MPS) practices predominate. 2. ERP-based optimization of internal scheduling and inventories. 3. Customer-driven Advanced Planning and Scheduling (APS) practices predominate. 4. Primarily use customer-driven Advanced Planning and Scheduling system linked electronically with customer and supplier systems.
	Inventory Management	1. Standalone inventory control systems with periodic reconciliation. 2. Company-wide inventory control system integrated with internal financial and order management systems. 3. Integrated inventory control system with *periodic* inventory information available electronically to strategic partners. 4. Integrated inventory control system with real-time inventory information available electronically to strategic partners.

C.4 SCM IS Capabilities and Satisfaction

Since an instrument for measuring this construct did not already exist, this study combined items from pre-existing and previously validated measures as shown in the footnotes.

Evidence of Support For	**"My perception is that compared to our competitors' supply chain Information Systems (IS), ..."**
Operational Efficiency	1. Our IS improve the efficiency of our day-to-day business operations[1]. 2. Our IS provide timely information for cost control.[2]
Operational Flexibility	3. Our IS provide the flexibility to adapt to unanticipated changes.[3] 4. Our IS make it easy to switch to another supplier or customer to supply or purchase the same product or service[4].
Long-term Planning	5. Our IS facilitate *long-term* strategic business planning.[1] 6. Our IS help us model possible future outcomes of alternative courses of action.[1]
Short-term Planning	7. Our IS provide us with the data we need to support our day-to-day decision-making.[1] 8. Our IS provide information to improve the allocation of scarce resources.[2]
Internal Analysis	9. Our IS enable us to develop detailed analyses of our present business situation.[1] 10. Our IS provide reliable information on the organization's financial situation.[2]
External Analysis	11. Our IS assist us in setting our prices *or value proposition* relative to the competition.[1] 12. Our IS provide information on competitive products and services.[2]
Internal Process Coordination	13. Our IS support effective coordination across functions (e.g., marketing, manufacturing) and product lines.[1] 14. Our IS integrate information in production planning and control.[2]
External Process Coordination	*15.* Our IS enable us to develop stronger links with suppliers *or customers.* [1] 16. Our IS enhance our ability to negotiate with our suppliers *or customers.* [1]

Notes:

1 adapted from Sabherwal and Chan (2001); the words in italics were added for clarity.
2 adapted from Zviran (1990).
3 adapted from Venkatraman and Ramanujam (1987).
4 adapted from Bensaou (1997).

In addition, a Likert-type questionnaire item measured the perceived strategic fit of the SCM IS capabilities for each case. This questionnaire item was used to provide a parsimonious measure for triangulation with the qualitative evidence and the Euclidean Distance calculation of strategic fit. The item suited the purposes of providing further corroboration for this exploratory investigation, but should be statistically validated if used in future confirmatory studies. Similarly, a final questionnaire item examined the perceived importance of strategic fit of SCM IS capabilities for each respondent:

17. ...the degree to which the capabilities of our supply chain information systems support our business needs is...

    very low low moderate high very high

18. ...the importance of having the capabilities of our supply chain information systems support our business needs is...

    very low low moderate high very high

To reduce hypothesis guessing, the instrument used did not list the dimension name (e.g., Operational Efficiency). It also presented the items in a randomized order: questions 8, 12, 5, 1, 16, 3, 9, 6, 2, 10, 13, 4, 11, 16, 7, 14, 17, 18. The respondents were asked to compare their SCM IS capabilities with those of their competitors by completing each statement. A 5-point scale was used with 1 = to a much lesser degree, 2 = to a somewhat lesser degree, 3 = to the same degree as, 4 = to a somewhat greater degree, 5 = to a much greater degree.

The following instructions preceded the questionnaire items:

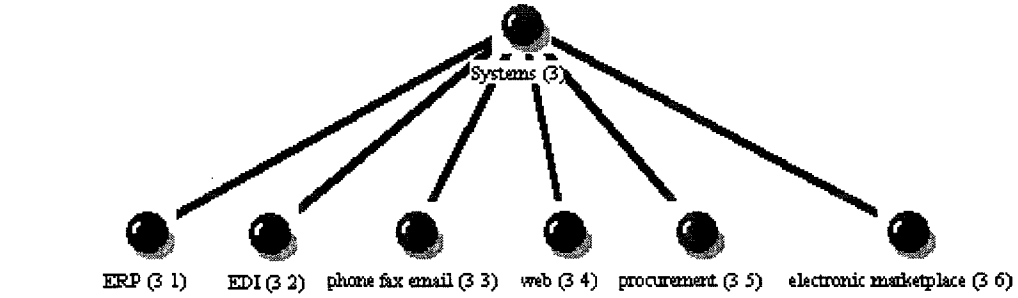
"For each of the following 18 numbered items, circle the response below each item that best completes the statement.

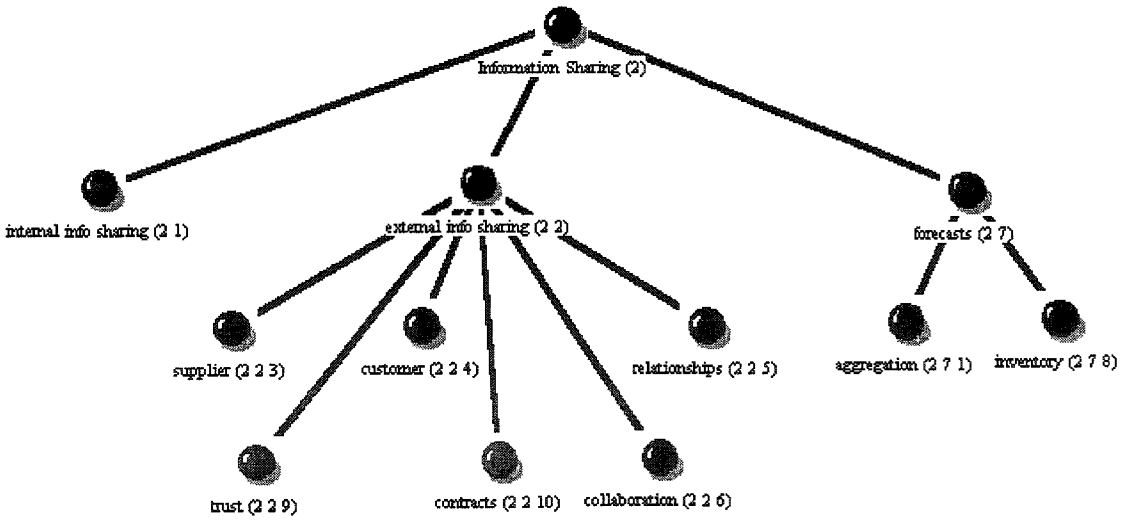
Responses are CONFIDENTIAL; respondent and organization names will not be disclosed.

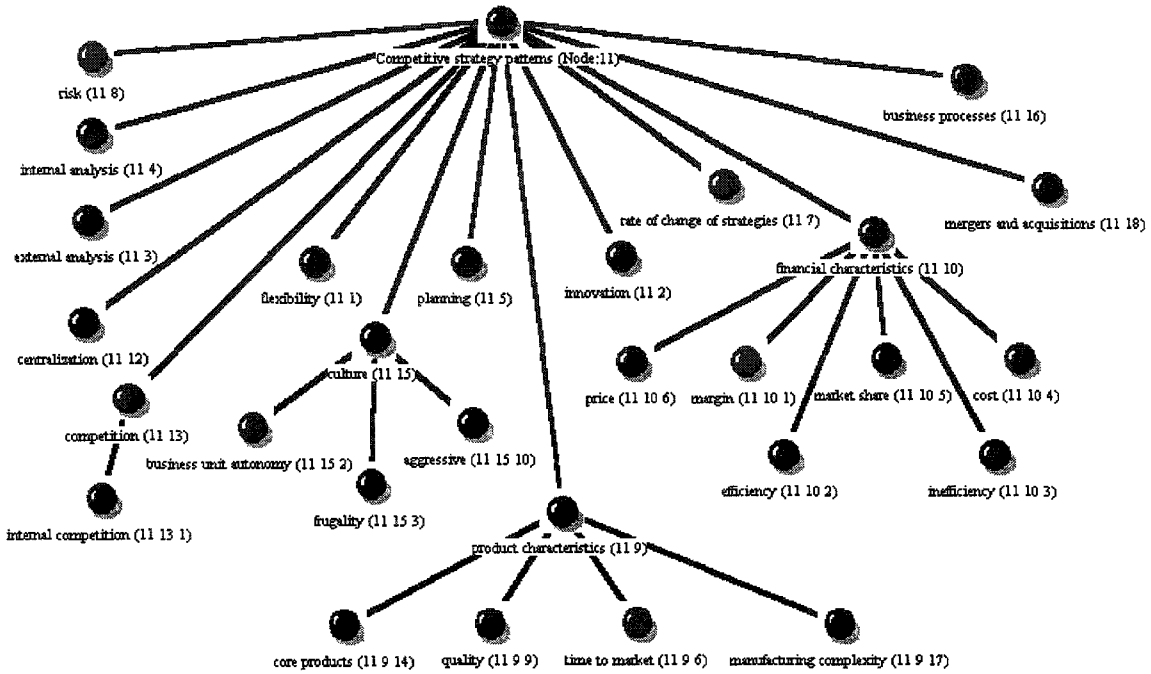
If you have difficulties responding to any of the statements, please provide your comments."

APPENDIX D - FINAL CODES USED IN QUALITATIVE ANALYSES

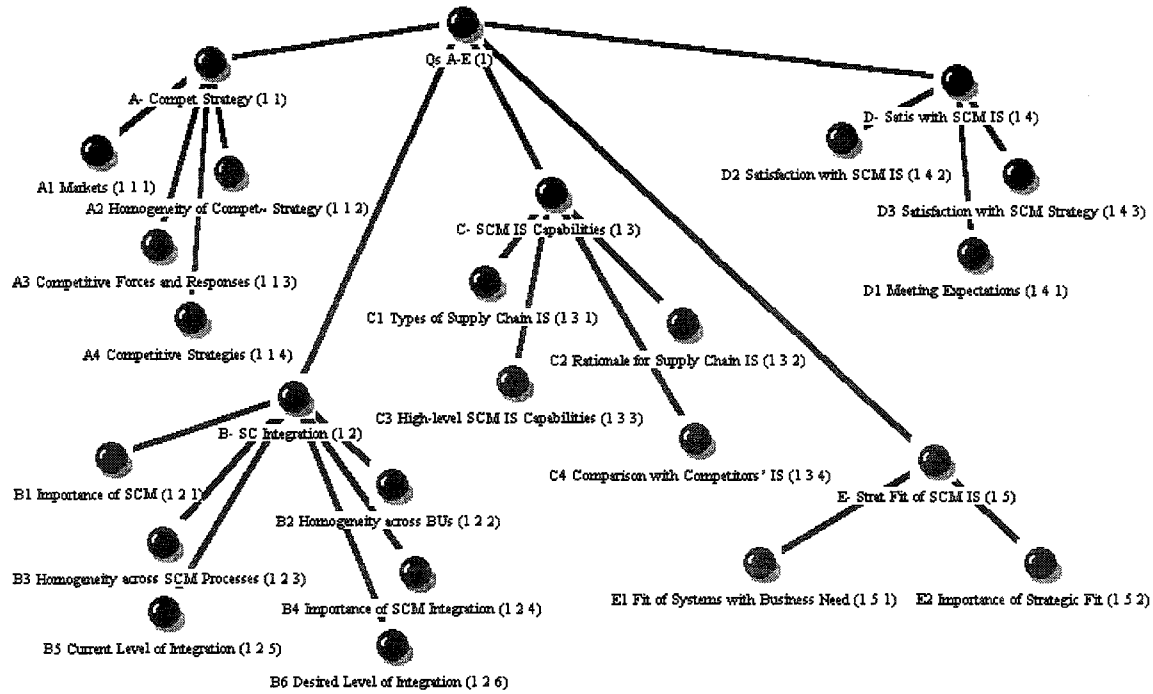
An iterative open coding process (Miles and Huberman 1994; Strauss and Corbin 1998) was used to identify and analyze the patterns in the interview transcripts and archival documents. As the coding and analysis proceeded, the codes were subsequently organized into categories and subcategories. Three major categories emerged, which included codes related to information systems, information sharing, and competitive strategy patterns. The coded passages in the documents were then used to analyze evidence on each firm's competitive strategy patterns, level of supply chain integration, and information system capabilities. The final categories and codes are shown below:



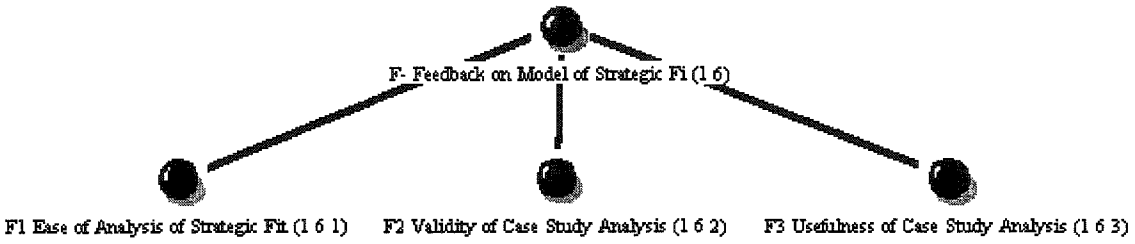




In addition, the interview transcripts were coded by each question in order to facilitate text retrieval for pattern matching and analysis:



The transcripts from the follow up interviews gathering feedback on the developed model and analyses were similarly coded by question:



APPENDIX F - DETAILED EVIDENCE ON SCM IS CAPABILITIES

Case	Operational Efficiency	Operational Flexibility	Planning	Analysis	Process Coordination
B	**High** "We focus more on cost control compared to our competitors" "big volumes of low margin [transactions] so they are more reliant on [efficient systems]"	**Medium** "less of a focus than our competitors" "at the last minute [the customer] changes the way a component works, we have to be flexible enough to change the design and retool."	**Short-term: High** "We tend to only solve those problems which will service our existing customers, unfortunately, but at times we do try to identify future and long-term trends" **Long-term: Medium** "every 9-18 months a new condition hits which confuses or conflicts with the plan"	**Internal: High** "We analyze our costs and revenues carefully to keep costs under control" **External: Medium** "The amount of time spent on monitoring trends in the marketplace is sometimes minimal and sometimes lengthy."	**High** "...examples include [use of] SAP, EDI and web-based portals" "Siloing can be an issue"

Case	Operational Efficiency	Operational Flexibility	Planning	Analysis	Process Coordination
D	**High** "For the company it's very important because we sell a lot of units...[But in my business unit,] it's an expensive product... the logistics systems don't need to be as good."	**High** "Flexibility is way more important [than automation], we have to be able to make quick changes and override things just based on a meeting."	**Short-Term: Low** "We just arbitrarily decide what the demand is going to be for the next quarter." "For things like planning and analysis, our IS are not a competitive strength" **Long-Term: Low** "For our business, I don't think these systems would make much of an impact"	**Internal: Low** "For things like planning and analysis, our IS are not a competitive strength" **External: High** "In knowing what the customers need I would say [we're] probably best [in the industry]" "We have better systems [than our competitors] for information on competitive products"	**Internal: High** "[Purchasing] drives down the price they pay for the piece parts by consolidating all of the demand of all the business units" "An ERP was implemented to remove the functional stovepipes" **External: High** "We do a lot of collaboration with our key suppliers." "...moving towards sharing demand and forecasts with suppliers"

Case	Operational Efficiency	Operational Flexibility	Planning	Analysis	Process Coordination
E	**High** "When the market becomes saturated ...margins decrease and saving money internally is more of a focus"	**High** "We could be dissatisfied with our supplier and change suppliers overnight... there is not very much business-to-business systems set up"	**Short-Term: High** "With a company of this size, a reliable order processing and production planning system is imperative." **Long-Term: Low** "These systems are great at gathering the information but unfortunately, there is very little intelligent use of the information gathered"	**Internal: High** "There's not very much integrated analytics in our systems" "Collating the data for analysis and reporting purposes requires an exceptional expenditure of time and effort" **External: High** "Responding to the requirements of the customers is highly important and also leading the customers in the next generation of products"	**Internal: Medium** "There is some aggregation that the purchasers do, but I'm not certain that it crosses business units." "various ERP systems used in different business units" **External: Medium** "The suppliers will enter [specifications] into our systems so our designers see which parts are available"

APPENDIX G - INTERVIEW PROTOCOL FOR FEEDBACK SESSIONS

F. Feedback on Model of Strategic Fit of SCM IS

How useful and valid is the theoretical model and the case study analysis?

Sources of Data:
-Senior Managers

Prior to the feedback interview, the theoretical model developed in this dissertation and the summary case study reports is reviewed with the participants. The following questions are used to gain feedback on the usefulness and validity of the model developed. Examples of questions to probe the responses are also listed below.

F1) Before you reviewed the analysis provided by the researcher, how easy or difficult was it for you to ensure that your current SCM IS fit your strategic needs?

PROBES:

- What tools, models, or theories do you use in your current IS planning and analysis?
- How sufficient are your current models for explaining or analyzing IS planning and analysis decisions?

F2) How **valid** is the analysis provided by the researcher on your competitive strategies, SCM IS capabilities, and the strategic fit of your SCM IS?

PROBES:

- How accurate a portrayal of your situation is the case report?
- Do you agree with the findings about capabilities that need improvement?
- Were there any surprises or "ah-hahs" that resulted from the analysis?

F3) How **useful** is the case study analysis and the theoretical model for understanding and analyzing your situation — your competitive strategies, SCM IS capabilities, and the strategic fit of your SCM IS?

PROBES:

- Can it help explain your situation better or easier?
- Will it help future IS planning or analysis?
- Do you find it useful to think of your competitive strategies using the Defender, Prospector, and Analyzer archetypes?
- Is it useful to focus on the organizational capabilities enabled by your IS (e.g. operational efficiency, internal analysis, etc.) instead of on the functional requirements of your IS?