Supply Chain Orientation: Refining a Nascent Construct

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

The purpose of this research is to refine the notion of *Supply Chain Orientation* (SCO) as originally posited by Mentzer et al. (2001) and Min and Mentzer (2004). Supply chain orientation is defined to be "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (Hult et al., 2008, p. 527). This orientation (management philosophy), when implemented, manifests as Supply Chain Management (SCM) within and across organizations.

The process of 'refining' supply chain orientation involved three stages: determining additional SCO factors / indicators beyond those already in existence, refining the total set of factors / indicators through factor analysis techniques, and associating the SCO concept to other SCM-related concepts. Determining additional SCO factors and the vetting of the existing SCO model was done through a qualitative method (structured interviews with industry experts). Analysis of the interview data resulted into two new SCO factors—SCM Capability and Measurement Propensity—being identified. The high accuracy / low generalizability nature of the interview process required an industry-wide survey in order to gather sufficient quantitative data for a meaningful analysis. The new SCO factors were developed into survey questionnaire measurement items.

An invitation to participate in a web-based, quantitative survey was e-mailed to executive at roughly a third of the manufacturing companies in Canada. The results of that data gathering exercise were analyzed in a multi-stage process. First, after removing 'motherhood statements' from the indicator set, an exploratory factor analysis (EFA) was conducted to determine the underlying structure of SCO. Three factors—Benevolence (Trust), Internal SCM Focus, and Partner Reliability—emerged through this process. This "refined" SCO construct was then subject to a rigourous confirmatory factor analysis (CFA) process.

The CFA process found the SCO factors to be reliable. A dependent variable, Supply Chain Operational Performance (SCOP) was found to be positively influenced by changes in SCO. SCO was found to be a unique strategic orientation through the literature review process and validated as its own construct through a discriminant validity process. SCO was determined to be a second-order reflective latent variable, and top management support was found to be an antecedent to SCO.

Of interest to SCM practitioners and academics, SCO was found to be statistically invariable between respondents who were or were not members of a SCM industry association. As well, SCO did not vary outside statistical bounds across the supply chain from ultimate supplier (Earth) to ultimate customer. However, SCO was found to be stronger

in companies that employed an “efficient” supply chain strategy (using the taxonomy of Lee (2002)) versus other generic strategies (like “agile” supply chain strategy).

The contributions of this research to academics include a parsimonious definition of SCO which meets the criteria of Wacker (1998), an operationalization of the Lee (2002) model, and additional evidence of the power of Parallel Analysis (PA) of Thompson (2004) in determining factors in an EFA. Supply chain orientation is an important theoretical ‘building block’ from which SCM theory can be built and through the refinement process, SCO was tied into the dynamic capabilities area of the larger resource-based view (RBV) theoretical framework.

Supply chain orientation was found to positively influence SCOP. The Council of Supply Chain Management Professionals reported that business logistics (SCM) costs in the United States alone in 2009 were 1.3 trillion dollars. Hence, improving upon the understanding of the mechanisms of supply chain management and its components can have substantial economic consequences.

Keywords

Supply Chain Orientation, Supply Chain Management, Strategic Orientations, Supply Chain Strategy.

Acknowledgments

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I'd also like to thank the many faculty members of my proposal defence and thesis defence committees. Proposal defence: Elizabeth Jewkes and Scott Jeffrey (UW ManSci), and Peter Hall from (UW Environmental Studies). Thesis defence: Elizabeth Jewkes and John Michela (UW ManSci), Howard Armitage (UW CBET), and especially Paul Larson, my external examiner from the University of Manitoba.

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Dedication

This thesis is dedicated to my strong and beautiful wife Shannon, and my loving children Callahan and Grayson. Thank you all for your love and support over the past seven years. Sometimes 'family time' was sacrificed for this research project—but I know you guys had fun swimming with dolphins in Florida while I toiled away here in a Waterloo winter. Other times, like this past hockey season, research was suspended to pursue the Great Canadian Pastime. Calli's Ravens' *Waterloo Cup* and Gray's Waterloo Wolves' *Record Trophy* medals (along with Mom's memories of those games) are proud accomplishments—a long time in the making and requiring the efforts of a lot of people—just like this document. Hopefully there has been enough balance. I can't thank you enough for your support and encouragement. Love,

— Dad the Basement Dweller.

P.S. I also want to acknowledge the love and support of my parents, Boyd and Shirley, who where there encouraging me through my many earlier academic triumphs on the way to getting me here.

P.P.S. A word of advice to future grad students who may have stumbled across this document. If you tell your kids they can get a dog once you're done your dissertation, actually finish your dissertation **before** getting the dog! Trust me. PhD is short for "puppy hampers dissertation." ☺

Table of Contents

List of Figures

List of Tables

List of Abbreviations

MO	Market Orientation
PA	Parallel Analysis
RBV	Resource-Based View
SCA	Sustained Competitive Advantage
SCM	Supply Chain Management
SCO	Supply Chain Orientation
SCOP	Supply Chain Operational Performance
SEM	Structural Equation Model
TOPM	Top Management Support

Chapter 1

Introduction

> *A supply chain is much like a river, with products and services flowing down it instead of water. Whether anyone recognizes the systemic, strategic implications of managing the water basin, the river still exists. Similarly, whether any company recognizes the systemic, strategic implications of the supply chain of which they are a part, it still exists. When one state through which the river flows recognizes the need for states above it in the water basin to conserve and preserve the water supply and recognizes its own need to do the same for states below it, the state has taken a systemic strategic orientation—the river equivalent of a* ***supply chain orientation.*** (Mentzer et al., 2001, p. 14; boldface emphasis added).

Supply Chain Management (SCM), which had its genesis in the 1980s, is increasingly important and ubiquitous in the business management literature. Nearly two decades after its inception, one author noted that SCM is "the most practically and intellectually significant theme within current managerial and economic research" (New, 1997, p. 14). More recently, New and Westbrook (2004) claim that "There is no doubt that the emergence of Supply Chain Management (SCM) has been a major development in management thinking and practice" (p. v) and "supply chain management is a central theme of contemporary management" (p. 253). Additionally, "Effectively managing supply chains is vital to organizational success" (Ketchen and Hult, 2007, p. 573).

In addition to being vital to organizational success, effective supply chain management is important to gross domestic product. In Canada in 2001, supply-chain-related activities accounted for approximately $83-billion worth of gross revenue and employed over 700,000 people, excluding truck drivers (CLSC, 2005). More recent data from the

United States estimates supply-chain-related costs there are 1.3 trillion dollars—this includes effects from the recent global economic slowdown (Wilson, 2008). Yet for all its academic and economic importance, there is a paucity of supply chain management *theory* (New and Payne, 1995; New, 1997; Croom et al., 2000; Mentzer et al., 2001; Ho et al., 2002; Svensson, 2002; Chen and Paulraj, 2004a,b; Min and Mentzer, 2004; Li et al., 2006).

Responding to the calls for more theory development, Mentzer et al. (2001) published their seminal paper *Defining Supply Chain Management*. I refer to these authors' ideas as the "Tennessee School of Thought." The late Tom Mentzer (PhD, 1978) was the patriarch of this school, as he was either the chair of or a member of the doctoral committees of the other authors—all of whom completed their PhD graduate work at the University of Tennessee in the 1999–2001 timeframe.

The *Defining Supply Chain Management* paper, like some others before it, included a Supply Chain Orientation (SCO) management philosophy concept. However, unlike the earlier incarnations of SCO, the work of Mentzer et al. was the first to have an actual construct defined. The follow-up paper *Developing and Measuring Supply Chain Management Concepts* by Min and Mentzer (2004) developed the SCO construct further by developing a set of measurement items and operationalizing SCO. The latter paper concluded with a call for future research "to continuously refine the measurement scales and strengthen the findings of this study" (p. 84). The purpose of this thesis is to answer the call and accomplish exactly that—refine the nascent SCO construct.

Supply Chain Orientation Defined

For the purposes of this research, supply chain orientation is defined to be "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (Hult et al., 2008, p. 527). Section 2.1.3 in the literature review explains the logic for this choice of definition of SCO.

One implication of this definition is that either there is a predisposition to viewing the supply chain as an integrated entity—the so-called "SCO View"—or not. Companies that do not have this predisposition are said to hold an "Atomic View" of the supply chain. A company with an atomic view of the supply chain would view its suppliers and customers as strictly 'suppliers' and 'customers' and not as 'business partners.' Figure 1.1 illustrates these contrasting views.

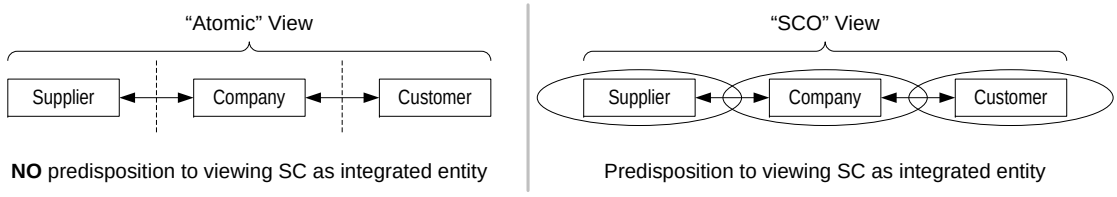


Figure 1.1: 'Atomic' versus 'Supply Chain Orientation' View of a Supply Chain

Research Question

A natural question that comes out of this definition of SCO is "is there a difference in the performance of a company with a predisposition to viewing the supply chain as an integrated entity—a supply chain orientation—versus a company without such an inclination?" Figure 1.2 depicts this research question.

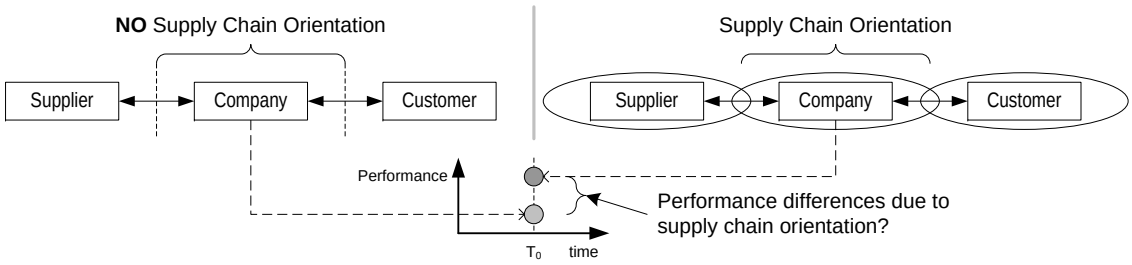


Figure 1.2: Research Question

Figure 1.2 shows a performance difference between the two companies; with the company having a supply chain orientation performing better. This is indeed the case as this research will conclude. However the bulk of this research will establish *why* this should be the case through the development of appropriate theory and hypotheses. In the process of addressing this research question, issues associated with a larger research problem will also be explored.

1.1 Research Problem

Supply chain orientation was conceptualized by Mentzer et al. (2001) as a means of separating the management *philosophy* of supply chain management from the management

activities of supply chain management. This approach designated SCO as the underlying philosophy with SCM as the physical implementation of that philosophy.

The original supply chain orientation idea was modified slightly by Min and Mentzer (2004) when they took SCO from a theoretical idea to its operationalization in an empirical study. At this stage, SCO was conceptualized as a second-order latent variable comprised of six dimensions (first-order latent variables): Benevolence, Commitment, Compatibility, Credibility, Cooperative Norms, and Top Management Support.

The research of Min and Mentzer (2004) ended with a call to "refine the suggested indicator variables, add additional indicator variables, and further investigate the relationships among the SCM-related concepts" (p. 84). This research answers that call, hence its title "Supply Chain Orientation: Refining a Nascent Construct."

Research using existing constructs takes one of two approaches: applying a concept in a novel context (e.g., the application of Entrepreneurial Orientation to university departments per Todorovic (2004)), or the re-examination of an existing construct in its current context. This research falls into that latter category and is not unprecidented. Tom Mentzer, one of the authors making the call for future SCO research, has done similar refinement work in the past by developing improvements to the Kohli et al. (1993) Market Orientation (MARKOR) scale (Matsuno et al., 2000). The rationale for the SCO re-conceptualization is detailed in §2.6.

The three branches of the call for future research—additional indicators, refined indicators, and relationships to other concepts—will be discussed in turn, along with other theoretical considerations to expand and strengthen our understanding of SCO. This refinement process is illustrated in Figure 1.3.

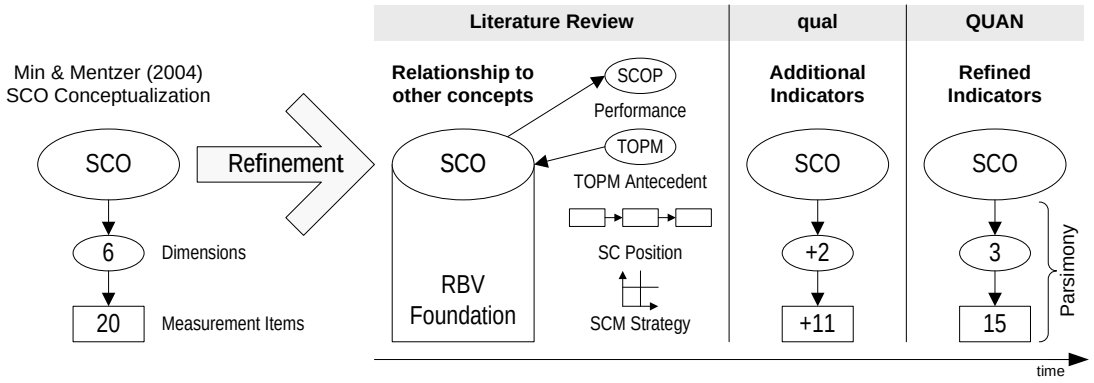


Figure 1.3: Process for Refining the Supply Chain Orientation Concept

1.1.1 Additional Indicators

Min and Mentzer (2004) hoped that future research would "add additional indicator variables" (p. 84). The qualitative interviews designed for this research (§3.2.2) were intentionally created to be open-ended in order to elicit comments to expand the nature of SCO. Through the analysis of interviews I conducted with SCM experts, two additional concepts—a propensity for measurement and supply chain management capability—were found to be important additional components of a supply chain orientation that were not present in the initial SCO design.

Items to measure these new concepts were developed (§3.2.5). However, as Churchill (1979) notes, "After the item pool is carefully edited, further refinement would await actual data" (p. 68). The actual data came in the form of a quantitative survey. The factor analysis applied to this data revealed a new SCO factor titled Internal SCM Focus—which includes indicators from both Measurement Propensity and SCM Capability. The same factor analysis approach was applied to the measurement items of the Min and Mentzer (2004) SCO instrument.

1.1.2 Refined Indicators

The process of refinement for this research is described in the Methodologies chapter and the outcomes are discussed in the Findings chapter. The key refinement tool, factor analysis, is "the most commonly used analytic technique for data reduction and refining constructs" (Hinkin, 1995, p. 974). From the six dimensions of Min and Mentzer (2004) and the two additional dimensions revealed through my exploratory research, I conclude my analysis with a compact three-factor SCO model encompassing Internal SCM Focus, Benevolence, and Partner Reliability as the key components of supply chain orientation.

The process of refining eight possible SCO factors into a set of three also resulted in a more succinct, parsimonious subset of 15 measurement items from an initial set of 31. Parsimony is a virtue of 'good' theory as advocated by Wacker (1998). Hence given the choice between two SCO constructs—the six factor Min and Mentzer (2004) model and the three factor model of this research—the more parsimonious one would have higher virtue than the more complex one. Table 5.1 in the Conclusions chapter summarizes the complete set of Wacker's virtues of good theory with the findings of this research.

Wacker also advocates that good theory have "internal consistency"—that all relationships are identified and adequately explained. The work of Mentzer et al. (2001) and Min and Mentzer (2004) *assumed* that SCO was a second-order reflective latent construct; no rationale was provided for this assertion. This research addresses this assumption directly and finds that it is indeed a valid assumption.

The refinement of SCO through this research also addresses the Uniqueness and Abstraction virtues of Wacker. This is accomplished by setting supply chain orientation within the well established 'resource-based view' of the firm. This is a contrast from the Mentzer et al. SCO concept which was not tied into other strategic management theoretical frameworks.

1.1.3 Relationships to Other Concepts

The third prong of the Min and Mentzer (2004) research call, to "further investigate the relationships among the SCM-related concepts" (p. 84), is primarily focused on the research question posed previously—what are the 'performance implications' of adopting a supply chain orientation? The impetus for understanding the impact on performance is eloquently captured by Lumpkin and Dess (1996) who note "Those in strategic management are concerned with the performance implications of management processes, decisions, and actions at the level of the firm" (p. 151). One of the decisions senior managers make is the choice of which 'orientation(s)' or management philosophies to pursue, thus understanding the performance implications of adopting a SCO is critical in the decision making process to pursue a SCO or some other orientation(s).

This research refines the notion of 'Business Performance' from Mentzer et al. (2001) and Min and Mentzer (2004) into a more SCM-foused measure of Supply Chain Operational Performance (SCOP). Section 2.6.4 details the rationale for this. As my analysis found, there is support for the hypothesis that a positive relationship between SCO and SCOP exists.

Finally, as SCO relates to other SCM concepts, this research also considers:

- A change in the role of Top Management Support (TOPM) from being a dimension of SCO to TOPM being *an antecedent* to SCO.
- The position of the company within the supply chain continuum and its relationship to SCO. And,
- The relationship between SCO and the 'generic' supply chain management strategies of Lee (2002).

These relationships will be formalized as hypotheses in §1.3 below, after the background to the research. Following that, a justification for the research and the research methodology will be outlined. Finally the scope and limitations of the research will be detailed.

1.2 Background to the Research

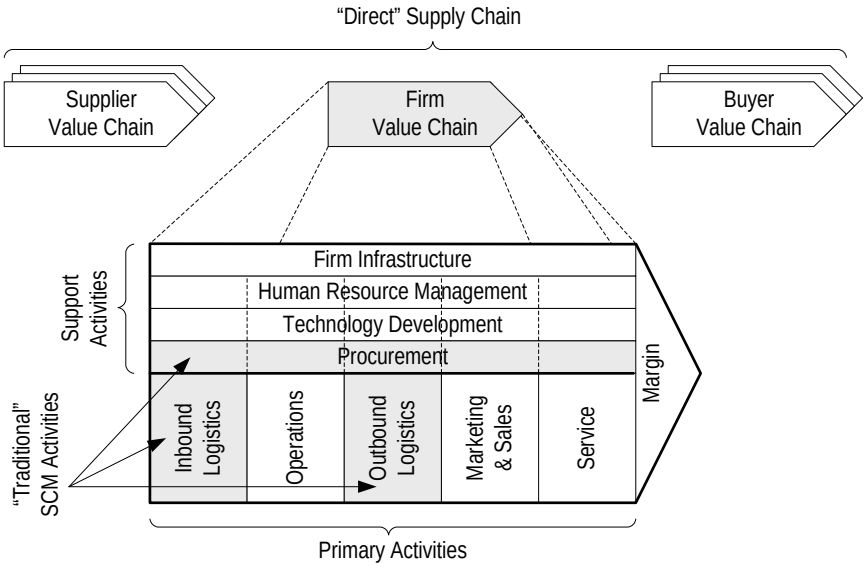
Strategic management is concerned with determining how firms can first achieve and then sustain competitive advantage (Teece et al., 1997). One means of achieving Sustainable Competitive Advantage (SCA) is through the adoption of SCM practices. To wit, "Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance" (Li et al., 2006, p. 107). Supply chain orientation is a management philosophy, the implementation of which is supply chain management, which in turn is a source of sustainable competitive advantage. Hence, an improved understanding of SCO can lead to improvements in SCA.

Michael Porter is arguably the most cited strategic management thinker of this age. His elegant value chain model (Figure 1.4) weaves strategic management ideas into a supply chain management fabric. He opens his value chain discussion with this idea: "Every firm is a collection of activities that are performed to design, produce, market, deliver, and support its product" (Porter, 1985, p. 36). In addition to being supply chain orientated in its language, this view is consistent with the Resource-Based View of the firm (RBV). RBV asserts that a firm is a collection of resources that allow it to achieve competitive advantage (Penrose, 1959). RBV is the focus of the discussion of theory in §2.3.1. Note that the terms *firm*, *company*, and *organization* are used interchangeably in this thesis.

Porter contends that the understanding of competitive advantage requires looking well beyond the firm. This is best exemplified by his 'five-forces model'. Five-forces requires examining the firm in the context of the industry in which it competes and takes into consideration the relative strengths of suppliers, buyers, substitutes, and new entrants, as well as the nature of the industry (i.e., how intense is the inter-firm rivalry?).

A value chain or supply chain model also requires examination beyond the confines of the company. For example, supply chain modeling requires examination upstream of the firm to its suppliers and downstream of the firm to its customers. Even within the confines of the company the supply chain model applies—the internal production department has its suppliers (a corporate procurement function) and its customers (the marketing and sales function). A strategic business unit (SBU) must establish which departments are its internal suppliers and which are its internal customers in order to work with them in an integrated fashion.

Finally, Porter argues that "The linkages between suppliers' value chains and a firm's value chain provide opportunities for the firm to enhance its competitive advantage" (p. 51). This is not a *zero sum game*—a situation in which one party gains at the other's expense—but rather a symbiotic relationship where both firms can benefit. Thus SCA



Adapted from Porter (1985)

Figure 1.4: Porter's Value Chain

can be improved for both the firm and its suppliers through SCM, as "It is often possible to benefit both the firm and suppliers by influencing the configuration of suppliers' value chains to jointly optimize the performance of activities" (Porter, 1985, p. 51).

Supply chain management is a strategy that firms can leverage to improve and sustain their competitive advantage over the long term. Furthermore, supply chain management is the implementation of the supply chain orientation management philosophy. Thus, this research is concerned with understanding overall corporate strategy—the choice of a strategic orientation like supply chain orientation—as viewed through a supply chain management 'lens.'

1.3 Research Problem and Hypotheses

The research problem for this thesis is framed in terms of seeking to understand Supply Chain Orientation for the purposes of development of supply chain management theory. This understanding is developed through the addition and refinement of the SCO indicators, and the relationship between SCO and other related concepts.

A later discussion (§2.1.3) will detail how supply chain orientation is a management philosophy, the *implementation* of which is supply chain management. Figure 1.5 depicts the relationship between supply chain orientation, supply chain management, and performance—in this case, supply chain operational performance (SCOP).

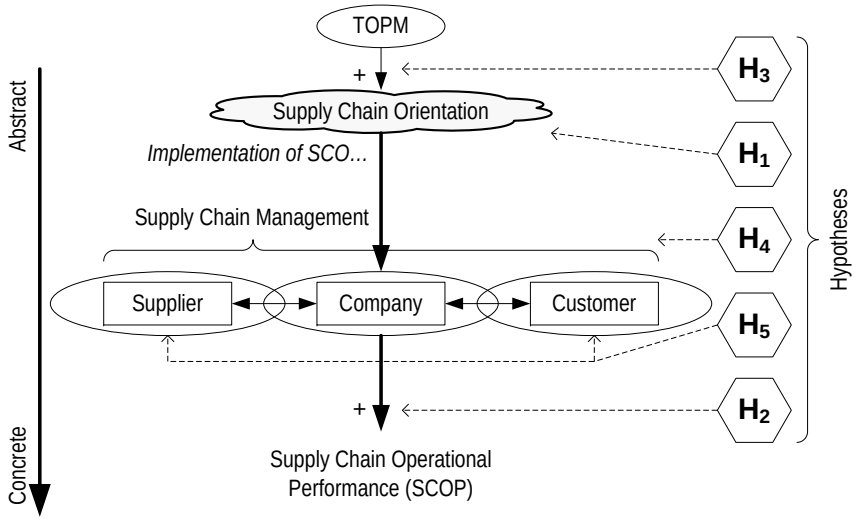


Figure 1.5: SCO Model and Research Hypotheses

Using the language of simple regression, SCO is the independent variable and SCOP is the dependent variable. More correctly though, SCO and SCOP are latent variables (as discussed in §2.4), hence their nature should be phrased in the language of structural equation modeling. That is, SCO is an exogenous construct, while SCOP is an endogenous construct (Hair et al., 2006).

Five hypotheses labeled H_1 through H_5 appear in hexagons on the right side of Figure 1.5 and address various parts of the SCO model. Section 2.7 goes into greater detail about the development of these hypotheses and their wording, but for purposes of introducing this research:

- H_1 concerns the nature of the SCO construct. It is hypothesized that SCO is a reflective second-order latent variable. Past research had *assumed* this to be the case; the research addresses it as its first hypothesis.

- H_2 concerns the nature of the SCO $\rightarrow$ SCOP relationship. It is hypothesized that SCO is positively related to SCOP.

- H_3 concerns the nature of the role of Top Management Support (TOPM). In the current Min and Mentzer (2004) framework, TOPM is a first-order factor in a reflective relationship with SCO—that is, SCO → TOPM. This thesis will argue that TOPM is in fact an antecedent to SCO. Moreover, the TOPM → SCO relationship is positive in nature.

- H_4 considers SCO across the 'extended' supply chain. Figure 2.2 in §2.1.1 illustrates this supply chain definition. This research hypothesizes that SCO does not vary significantly across the supply chain; that is, the level of SCO near the source of ultimate supply—the Earth—is similar to the level of SCO at manufacturers, distributors, retailers, and others in the supply chain, including the final end consumer. Finally,

- H_5 considers the uncertainties associated with supply and demand. The model of Lee (2002) (discussed below in §1.6.1) was used to assess which generic supply chain strategy (i.e., effective, agile, responsive, or risk-hedging) an organization may employ to address those business environment uncertainties. It is thought that the level of SCO should not vary significantly by generic supply chain strategy.

Chapter 4 contains the findings from the analysis required to address these hypotheses. It was found that there was support for all of the hypotheses *except* H_5. That is, the SCO construct does have the hypothesized latent structure, there is a positive relationship between SCO and SCOP, top management support positively influences SCO, and that the level of SCO does not vary across the supply chain.

Hypothesis H_5 was not supported. My research revealed that the level of SCO was found to be higher in supply chains that required an 'efficient' supply chain strategy compared to those where an 'agile' strategy was called for. These conclusions and implications of all these findings are discussed in greater detail in Chapter 5.

1.4 Justification for the Research

The justification for this research is made on several practical and theoretic grounds. As mentioned in the second paragraph of this chapter, supply chain costs in the United States alone were over a trillion dollars in 2008. A year earlier—before the global financial crisis—U.S. logistics costs exceeded 10% of gross domestic product (GDP) (Wilson, 2008). Thus adopting a SCO, implementing it as SCM, and realizing a positive impact on SCOP—even a very small fraction of savings—could have a large net economic benefit when thought of globally.

The benefits need not be purely economic. An unstated assumption is that SCM is beneficial to society as a whole, not just to companies who practice it. New (1997) tries to ensure that SCM is seen within its societal context, saying that "the flow of goods through the supply chain is the lifeblood of the modern world" (p. 17). He then links SCM to the process of consumption, questions who benefits and who does not, and provides context for the emerging "green" supply chain field of study. In an article dissecting the impact of the globally-sourced components of an iPod, the authors show there are economic benefits for the countries where components and labour are sourced (Linden et al., 2007; Varian, 2007). What is not addressed is what happens to these same components post-consumption, when an iPod becomes e-waste.

Efficiencies which result in a savings of fuel or result in less waste also have societal benefits beyond the cost of the fuel or material. As New and Westbrook (2004) argue, "Participants in a chain are ethically intertwined with the other participants, and buyers in particular will share some responsibility for the actions of suppliers" (p. 271). Hence 'benevolence' may extend beyond "a firm's belief that its partner is interested in the firm's welfare" (Min and Mentzer, 2004, p. 65) and result in a more ethical treatment for all actors in a supply chain.

The original manifestation of the SCO concept by Mentzer et al. (2001) was 'stand alone'—it was not set within a larger strategic management theoretic framework. This research seeks to correct this oversight—enlarging the theoretical base of the SCO concept by placing it within the resource-based view of the firm. This will allow future researchers to better leverage the SCO construct for supply chain research. Moreover, it increases the generalizability of the resource-based view, making RBV a stronger theory. As Wacker (1998) argues, "Current theory cannot be replaced unless the new theory is superior in its virtues" (p. 365). Hence the existing Mentzer et al. (2001) / Min and Mentzer (2004) conceptualization of SCO should only be superseded by theory and ideas from this research if this new SCO conceptualization proves superior per Wacker's framework.

Chen and Paulraj (2004a) observe: "While research on various supply chain relationships has been growing, there has not been a comprehensive approach to construct development and measurement" (p. 136). Construct development and construct measurement is at the heart of theory construction (Venkatraman, 1989; Forza, 2002; Chen and Paulraj, 2004a).

Theory entails more than mere constructs. Constructs form the basis of theory, but they need to exist in a defined domain. How the constructs are interlinked (dependent, independent, or moderating roles) is critical as well. An explanation of why one would expect to see the relationships between the constructs is part of the theory-building process. Finally, the theory should have some predictive capabilities (Forza, 2002; Wacker,

2004). As Handfield and Melnyk (1998, p. 321) assert, "without theory, it is impossible to make meaningful sense of empirically-generated data, and it is not possible to distinguish positive from negative results."

The goal of this research is to improve our understanding of the SCO concept for use in future supply chain management research. To meet this goal, the SCO construct will be 'refined' and set into a larger RBV context. Possible implications of reaching this goal can be found by looking at comparable literatures. For example, if one looks to Market Orientation (MO)—shown in §2.2.3 to be an analogous but different strategic orientation from SCO—one can see the future downstream potential of the SCO concept in supply chain management research.

Market orientation, as it was initially conceived, was concerned with the performance of the firm. Once that was established, researchers began to use the MO concept to examine the impact of individuals within the firm (e.g., Schlosser, 2004), to examine non-traditional "marketplaces" like hospitals (e.g., Raju et al., 1995), and to examine the impact of MO as well as SCO across organizations (e.g., Min et al., 2007). Analogous implications for this research may be drawn. For example, what happens if a hospital has predisposition toward viewing its supply chain as an integrated entity? Would the staff shift focus from merely keeping procurement costs down to considering their work in terms of the hospital's end product—a healthy patient? This research contributes to the SCM literature in much the same way as MO did for marketing—by providing a parsimonious, yet robust, set of constructs and a model that can be used to further develop related theory.

This research can also be justified from its methodological contributions as well. Where most of the methodological ground for this research has been well trodden, the Parallel Analysis (PA) approach to factor retention in the exploratory factor analysis phase is utilized in this research in sharp contrast to the more traditional Kaiser eigenvalues greater than 1.0 (K1) or "scree plot" criteria in wide use today. As Hayton et al. (2004) describe, "Parallel analysis is one of the most accurate methods of deciding the appropriate number of factors to retain and yet is rarely used in the management and organizational research literature" (p. 200). Two methods (Hayton et al. (2004) and Thompson (2004)) are compared in §4.3.2, with the stronger Thompson PA method being chosen and utilized.

In conclusion there are a number of criteria upon which to justify this research: potential economic impact, societal impact, theory building and SCM research impact, and methodological innovation. The next section provides an overview of the general research methods this thesis used in this thesis.

1.5 Methodology

Chapter 3 is dedicated to the research methods; this section provides a brief summary. The methodological approach to this research is best described as a continuous "Exploration → Confirmation" spiral that becomes increasingly detailed as the spiral approaches the final Conclusions stage. Figure 1.6 illustrates this iterative research approach. In addition to the main Exploration and Confirmation phases, two Analysis and two Synthesis sub-phases are also included. Key deliverables for this research are shown in boldface type in the figure.

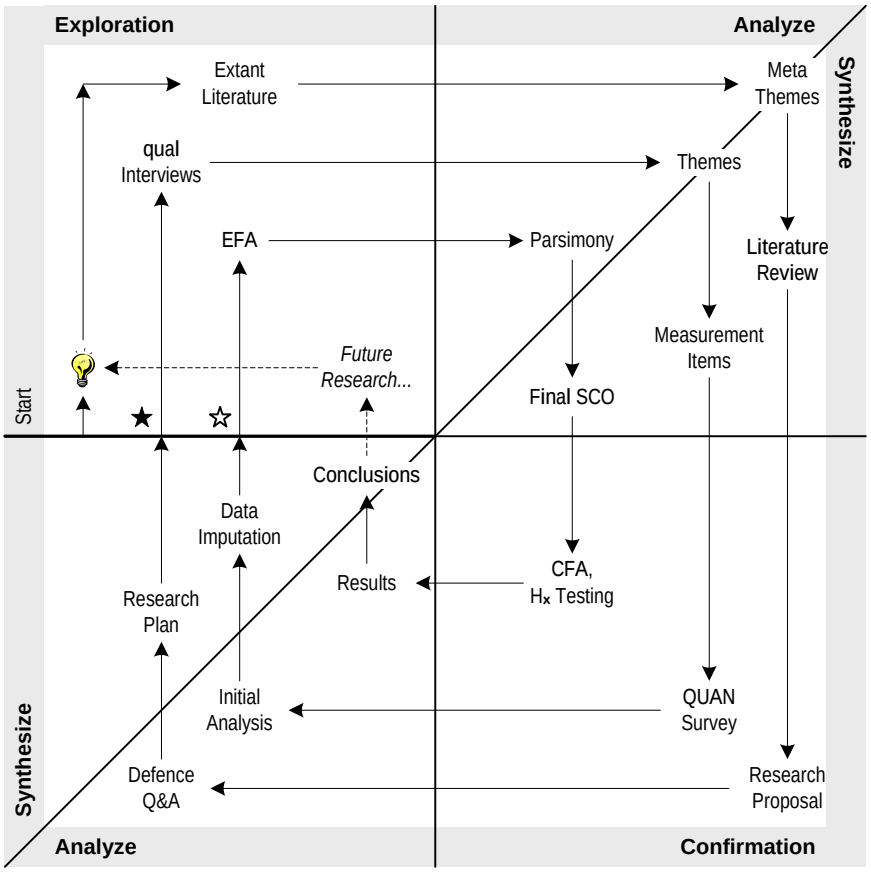


Figure 1.6: Research Approach

The initial pass through the Exploration → Confirmation spiral depicts the research question development stage. The scope of this research begins at the black star (★) indicating the start of the second pass through the spiral.

The second pass represents the $\boxed{\text{qual}} \rightarrow \boxed{\text{QUAN}}$ mixed methods approach advocated by Creswell (2003) for this sort of study. The boxes around the qual / QUAN qualifiers are retained for consistency with Creswell's notation. The $\boxed{\text{qual}}$ (qualitative) phase used structured interviews with industry experts as its main research methodology, while the $\boxed{\text{QUAN}}$ (quantitative) phases relies on a large scale internet-delivered survey. The rationale for using a mixed methods approach is detailed in §3.1 where Figure 3.1 depicts the $\boxed{\text{qual}} \rightarrow \boxed{\text{QUAN}}$ relationship in a linear fashion. The two key deliverables of this Exploration → Confirmation spiral pass are the nine interviews and the data they reveal, the final survey instrument, and the 227 usable responses from the completed survey.

The third and final pass through the spiral starting at the white star (☆), delineates the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) stages of the post-survey quantitative analysis. The results of these analyses appear in §4.3 and §4.4 respectively. The EFA deliverable resulted in the final parsimonious set of SCO factors and measurement items. The CFA validated the EFA findings, which in turn set the stage for the testing of the hypotheses developed in §2.7. From these results, conclusions and implications are drawn which form the bulk of Chapter 5.

1.6 Research Scope

The scope of this research is limited to the examination of supply chain orientation in continuous, long-term supply chains associated with Canadian-based for-profit enterprises, either public or privately held. Although there may be a strong SCO associated with a humanitarian logistics effort like Haiti earthquake relief, this would be considered out of scope on all the criteria listed.

Since SCO is a strategic-level concept, a senior decision maker in the organization should perform the examination of SCO within their organization. To obtain the requisite data for managerial research of this sort, one needs to use data collection methods that address the *Seven Rs of Logistics Research*: "...contacting the right person with the right information at the right time in order to ask the right questions using the right instrument for the collection of the right data at the right cost" (Williams Walton, 1997, p. 217).

In the case of the exploratory qualitative interviews, the 'right persons' to connect with were contacts I had maintained from my years in industry. Other contacts were recruited from these initial contacts. Although one limitation could be the number of interviews conducted, after nine interviews no substantially new data was being generated. This is consistent with the findings of other researchers (e.g., Romney et al., 1986; Guest et al., 2006).

Section 3.2 describes the methodological considerations related to the interviews. In terms of geographic scope, interview participants had a range of responsibilities from regional (i.e., Ontario) to national to continental and international expertise. In terms of supply chain management scope, manufacturing, automobile assembly, and third-party logistics providers for perishable, non-persishable, and commodity products were represented. From these two perspectives, there was adequate coverage of various supply chain situations and geographic reach; no limitations were found.

After comparing various data collection techniques (i.e., mail surveys, telephone surveys, and face-to-face interviews), across various factors (e.g., cost, success in avoiding item non-response, bias, etc.), Williams Walton concludes that when considering telephone surveys are the most appropriate method of addressing the *Seven Rs of Logistics Research*. While that may be true, the most popular method in SCM research is the mail survey (Mentzer and Kahn, 1995; Williams Walton, 1997; Larson and Halldorsson, 2004; Larson and Poist, 2004; Kotzab, 2005). Instead of using paper and post, the 'mail survey' method for this research relied on e-mailed survey invitations and web-hosted survey tools. 'Mail survey' or 'e-mail survey' both connote a single expert respondent completing a survey on their own time without guidance from the researcher other than what was communicated in the survey invitation, the only difference is the medium in which the messages are carried.

In terms of Williams Walton's *Seven Rs*, the right person with the right information for this research is a senior executive (e.g., President, CEO, General Manager) from a Canadian-based manufacturing company. Section 3.3.1 describes the issues regarding "single informant" responses, while the next section discusses the choice of manufacturing companies over other industries that employ SCM practices. The Canadian-only criteria reduces complexity in terms of potential amount of data to consider and bias introduced by laws and customs of other nations.

The rationale for the choice of Canadian-based manufacturers was tradition and relative simplicity. Tradition in the sense that supply chain management is typically associated with a transformation process: supplies of raw materials arrive, the company transforms them through a manufacturing process into a finished good and this is shipped to a customer. Mentzer et al. (2001) refer to this as a direct supply chain. A study of other supply chains like groceries for example, would introduce additional complexities (i.e., seasonality of stock, stock which perishes at differing rates, stock turnovers which are sensitive to advertising and marketing, some stock which is managed with a Vendor Managed Inventory (VMI) approach and other stock which is not, and so forth). A study of manufacturers would be less complex.

1.6.1 Diversity of Target Demographic

As will be discussed, the results of this research suggest that industry association membership and supply chain position may not be a source of differences in SCO. However, these results may not be generalizable beyond the context of Canadian-based manufacturers. Within the scope of this research though, there was considerable diversity among responding organizations. This section discusses this diversity.

Instead of using a convenience sample as Min and Mentzer (2004) did when they surveyed the membership of the Council of Supply Chain Management Professionals (CSCMP), the choice was made to sample a broad range of manufacturers regardless of industry association membership. As the results of §4.8.1 demonstrate, there was no difference in supply chain orientation between respondents that identified with association membership and those who did not.

The first part of the literature review (§2.1.1) defines the term "supply chain" and the contexts (extended, direct, and internal) in which the term is used. The extended supply chain extends from the Earth and extraction industries (as 'ultimate supplier') through to the 'ultimate customer' with seven positions described. Respondents to the survey placed their companies in all seven positions across this continuum. Analyzing the data revealed there was diversity among manufacturers with respect to supply chain position. As the results of §4.8.2 demonstrate, there was no difference in supply chain orientation between respondents across the various positions in the supply chain.

There was also diversity in terms of generic supply chain strategy. The seminal *Aligning supply chain strategies with product uncertainties* article by Lee (2002) describes four generic supply chain strategies (i.e., efficient, agile, risk-hedging, and responsive) based upon the company's supply- and demand- uncertainties. The manufacturing companies surveyed had considerable diversity in terms of their uncertainty criteria and were well represented in all four strategy groups. Figure 4.12 illustrates this diversity. One of the interesting findings of this research (see §4.8.3) is that there *is* a statistically significant difference in SCO among the four strategies.

1.7 Conclusion

This chapter was designed to define the key concept under consideration—supply chain orientation—introduce the research question, the larger research problem, and the five hypotheses of this thesis. The background to the problem, namely strategic management and Porter's 'value chain' conceptualization was discussed. After justifying this research from a number of perspectives, an overview of the iterative Exploration → Confirmation

methodology was presented. Finally the scope of the research was explained. With these foundations in place, our attention turns to the extant strategic and supply chain management literatures.

Chapter 2

Literature Review

> *Furthermore, researchers are calling for future logistics research to have a stronger theoretical foundation and to focus on theory testing research, while still maintaining relevance to practitioners.*
> —Garver and Mentzer (1999, p. 33)

As Wacker (1998) argues, theory is "made up of four components, (1) definitions of terms or variables, (2) a domain where the theory applies, (3) a set of relationships of variables, and (4) specific predictions (factual claims)" (p. 363). This literature review chapter will follow that general framework. First, the key terms of this research—supply chain, supply chain management, and supply chain orientation—will be formally defined after a detailed review of the literature chronicling their evolution. Once these terms are defined, they will be set into context within the larger "strategic orientations" literature. Finally, relationships between the terms and outcome predictions of these relationships will be hypothesized.

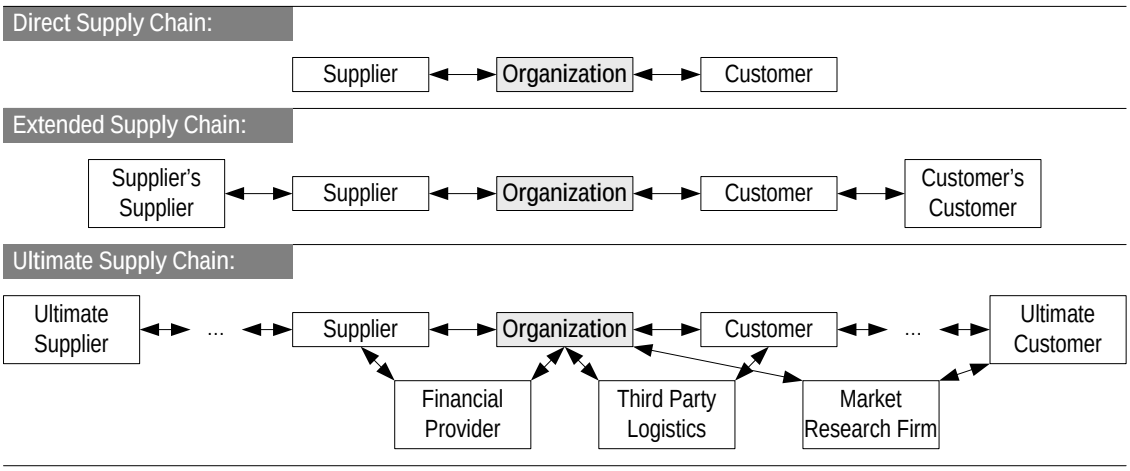
2.1 Definition of Key Terms

A recent analysis by Stock et al. (2010) found 166 unique definitions of "supply chain management" in the academic literature. Settling on the most appropriate SCM definition for this research is one purpose of this section. Before getting to a definition of supply chain *management* however, this section will first develop the formal definition of "supply chain." In moving from supply chain to supply chain management there is an increase in breadth and level of abstraction of the terms. The same is true as the discussion moves from the definition of supply chain management to the definition of supply chain orientation to conclude this section.

2.1.1 Supply Chain

As New (1997) points out, there are three meanings of supply chain that dominate discussion on the topic: "(1) the supply chain from the perspective of an individual firm (as in "ZipCo's supply chain"); (2) a supply chain related to a particular product or item (such as the supply chain for beef, or cocaine, or oil); and (3) "supply chain" used as a handy synonym for purchasing, distribution and materials management" (p. 16). This research is concerned with the first meaning—from an individual firm's perspective.

Within an individual firm's perspective however, there remains an issue of scope. This is described by Ayers (2006) who notes that "Any discussion of the supply chain can legitimately be broad or narrow, depending on the perspective of the "definer" and the interests of those involved in the conversation" (p. 3). Mentzer et al. (2001) enumerate three types of supply chains from the very narrow "direct supply chain" to the very broad "ultimate supply chain." These supply chains are depicted in Figure 2.1.



Source: Figure 1 from Mentzer et al. (2001)

Figure 2.1: Direct, Extended, and Ultimate Supply Chains

A number of points regarding the supply chains of Figure 2.1 need to be made. First, the linear depictions of supply chains are a necessary simplification of the actual complex supply *network* structure found in the field (e.g., Lambert and Cooper, 2000). An instance of a bona fide three-entity "direct supply chain" likely does not exist, however the direct supply chain model is compact and has excellent explanative properties. One may also get the impression that an organization is part of a direct supply chain *or* an extended supply chain *or* an ultimate supply chain. In fact, as Mentzer et al. (2001) note, "any one

organization can be part of numerous supply chains" (p. 4). One implication of this is that some supply chains in the company's supply chain portfolio may be well established and of considerable breadth and maturity while other supply chains may only be in an early stage of their development.

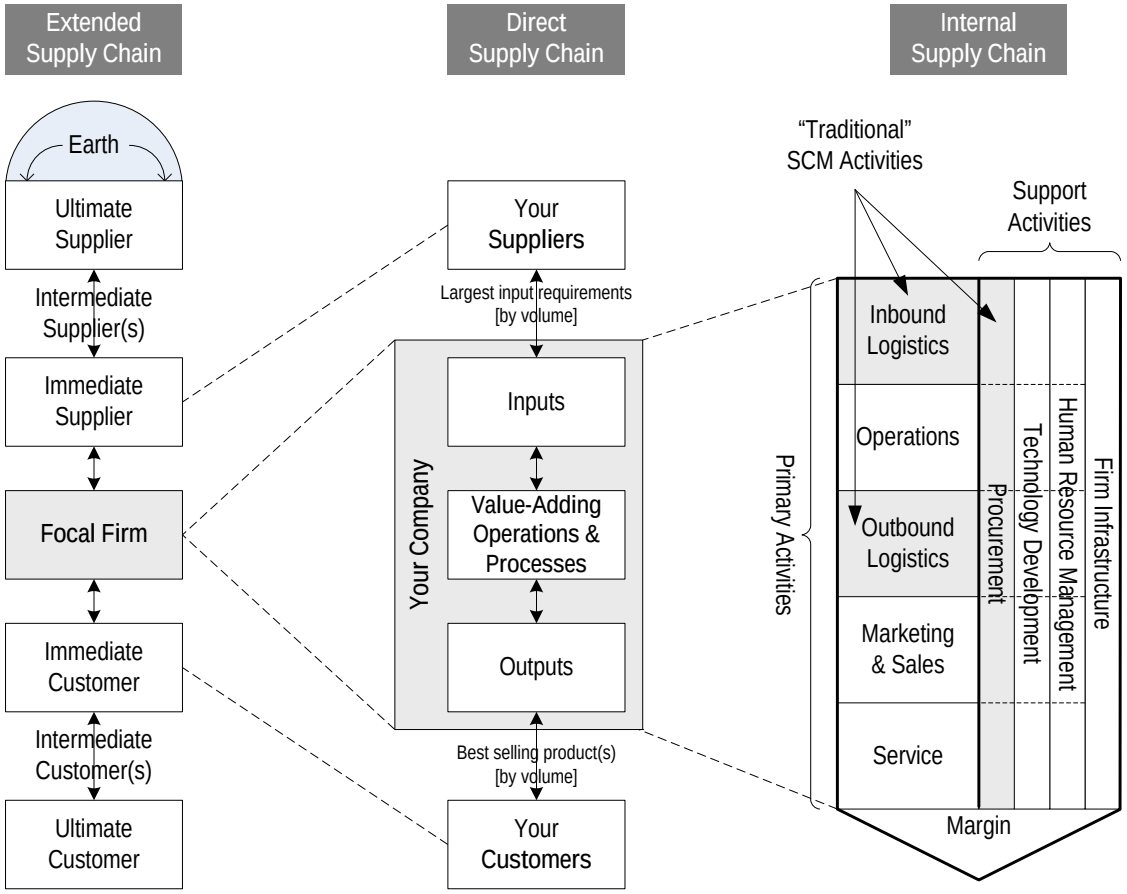
Similarly, the clear demarcations of supplier and customer of the supply chains may not be as discrete as illustrated in Figure 2.1. Reiterating an example from Mentzer et al. (2001) makes this point: "AT&T might find Motorola to be a customer in one supply chain, a partner in another, a supplier in a third, and a competitor in still a fourth supply chain" (p. 4). Hence the role of partner organizations is context dependent.

Lastly, some authors (e.g., Vollmann et al., 2000; Heikkilä, 2002; de Treville et al., 2004) contend that *supply* chain management is a misnomer, that organizations should instead focus on *demand* chains and *demand* chain management. The difference between supply- and demand- chains is captured in this definition: "A *demand chain* is a supply chain that emphasizes market mediation to a greater degree than its role of ensuring efficient physical supply of the product" (de Treville et al., 2004, p. 617; emphasis in the original). By this definition, a discussion of supply chains would not preclude demand chains. This research is concerned with the relationship between firms and how senior management views these relationships, not with whether a "push" or "pull" inventory system is at work.

The notion of "from earth ... to earth" as the end points in a supply chain is gaining attention in the literature (e.g., New and Payne, 1995; Tan, 2001; Blanchard, 2007). This idea connotes that the "ultimate supplier" is a company that extracts minerals and materials from the earth. The "ultimate customer" is the final user, or consumer, of the product before it is returned to earth in a landfill or sent for recycling. For this thesis, the earth-to-earth concept, or at least the earth as ultimate supplier, is grafted onto the extended supply chain model of Figure 2.1. Even though it extends from ultimate supplier to ultimate customer, this extended supply chain is not an "ultimate" supply chain in the vernacular of Mentzer et al. (2001) as it does not include peripheral third-party service providers.

Supply Chain Scope

The scope of supply chains for purposes of this research are three-fold: an extended supply chain at the macro level, a direct supply chain at the micro level, and an "internal" supply chain within the organization itself. Using the language of Porter (1985), this internal supply chain is also termed a "value chain." Figure 2.2 illustrates the three levels of supply chain scope. The level of scope or type of supply chain under consideration will be made clear from the context in which it is used.



Source: adapted from Mentzer et al. (2001) and Porter (1985)

Figure 2.2: Extended, Direct, and Internal Supply Chains

As this research builds on the models of Min and Mentzer (2004), who in turn built on the ideas of Mentzer et al. (2001) the definition of supply chain posited by Mentzer et al. is the definition used throughout the rest of this thesis:

> Supply chain: "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer" (Mentzer et al., 2001, p. 4).

This definition works at all three levels of scope for this research. The minimum number of three entities corresponds to the entity set of the direct supply chain. That

an entity can be an individual allows this definition to work in the internal company context. Because the definition can move upstream or downstream and include other business entities, it encompasses the ultimate supplier, ultimate customer, and every in-between intermediary of the extended supply chain. Finally, a supply chain encompasses more than the physical movement of product; this definition captures the bidirectional informational, service, and financial flows as well.

Supply Chain Scope and SCO

Although the formal discussion for the definition of SCO is still to come, as already noted on page 2, supply chain orientation is defined to be "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (Hult et al., 2008, p. 527). There is nothing in this definition that precludes 'supply chain members' from being a company's own business units or a company and its partner companies. Thus the "predisposition toward viewing the supply chain as an integrated entity" could be present in the internal, direct, and/or extended supply chain models. This idea is illustrated in Figure 2.3.

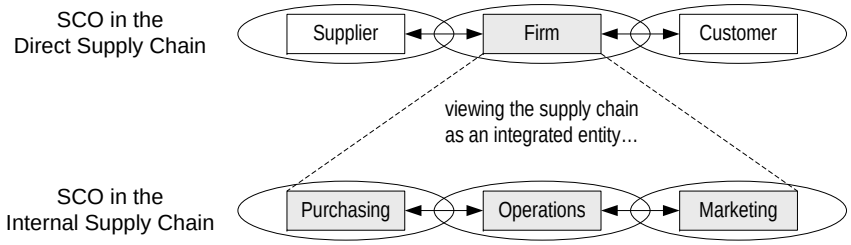


Figure 2.3: Supply Chain Scope and Supply Chain Orientation

Furthermore, as described in §1.3, SCO is a management philosophy and SCM is the implementation of that philosophy. Thus, if SCO is applicable across supply chains of differing scope, the implementation of SCO should be equally applicable. This is indeed the case. For example, with the exception of corporate boundaries and proprietary information, the SCM activities required to manage an internal supply chain are the same activities required to manage an extended supply chain. Consider an activity like collaborative planning, forecasting, and replenishment (CPFR). CPFR can be done across geographically dispersed business units in the same organization or between an organization and its suppliers—in both cases, the CPFR management activities result in a single plan to meet customer demand (Russell and Taylor, 2006).

2.1.2 Supply Chain Management

> *As a fledgling discipline, SCM is at present going through a period of great research activity in an effort to define its boundaries and build up a solid body of knowledge to be put at the service of progress in business.*
> —Alfalla-Luque and Medina-López (2009, p. 203)

The term "supply chain management" is pervasive in the business practitioner literature as well as in the academic literature. Although some authors contend that "supply chains exist whether they are managed or not" (Mentzer et al., 2001, p. 4), the focus of this research is on managed rather than ad-hoc supply chains. In order to settle on an appropriate definition of supply chain management for this research, this section will examine the evolution of the SCM idea from the two different literature streams, as well as from academic and practitioner perspectives.

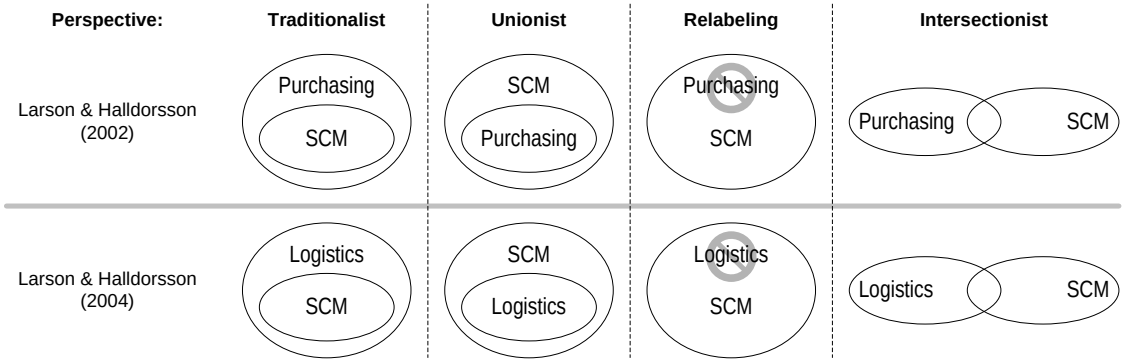
Academic Perspectives

In the internal supply chain at the right of Figure 2.2, the annotation "Traditional" SCM Activities refers to both the Inbound and Outbound Logistics primary activities and the Procurement support activity. Tan (2001) discusses how supply chain management evolved simultaneously from two different streams: transportation and logistics, and purchasing and supply. A dichotomy in the logistics and procurement literatures has existed since the term "supply chain management" first appeared in the business literature in the early 1980s.

The lack of a clear definition may be a function of its nascency. As Gibson et al. (2005) observe, "the discipline of Supply Chain Management is going through a normal maturation process of reaching consensus agreement on what is included, and what is not included, in the discipline. The result of this maturation process is an evolving definition of SCM" (p. 23). A current definition that has incorporated the evolution of SCM into it would be a better candidate than an older, less refined definition.

Larson and Halldorsson asked natural questions about the relationship between SCM and the logistics and procurement fields of study: Was SCM a subset of the other field? Was SCM a superset of the other field? Perhaps there are two distinct fields with some common ground, or maybe "supply chain management" was nothing more than a new label for the existing field (Larson and Halldorsson, 2002, 2004). Figure 2.4 summarizes this research. Since they concluded that "many resource allocation decisions are based on the firm's view of SCM" (Larson and Halldorsson, 2002, p. 43), it is important that the definition of supply chain management for this research be "stream agnostic"

with respect to SCM's procurement and logistics origins. This approach increases the generalizability of this research.



Source: Larson and Halldorsson (2002) and Larson and Halldorsson (2004)

Figure 2.4: Perspectives on Purchasing or Logistics Versus Supply Chain Management

With definitions for supply chain management being developed in two literature streams, many attempts have been made to distill this myriad of supply chain management definitions into a compact, parsimonious, and common definition (e.g., Ganeshan et al., 1999; Lummus and Vokurka, 1999; Croom et al., 2000; Mentzer et al., 2001; Tan, 2001; Svensson, 2002). Croom et al. (2000) contend that in addition to the logistics and procurement literatures, literature on marketing, organizational behaviour, best practices, strategic management, and others has also contributed to the understanding of SCM. They conclude that "one of the reasons for the lack of a universal definition of supply chain management is the multidisciplinary origin and evolution of the concept" (p. 69).

Academics have viewed supply chains and their management from many frames of reference. Is SCM as simple as "managing the flow of information through the supply chain in order to attain the level of synchronization that will make it more responsive to customer needs while lowering costs?" (Russell and Taylor, 2006, p. 453). Or is supply chain management something more than this? One early definition of SCM is that of "an integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user" (Cooper and Ellram, 1993, p. 13). Both speak to "managing flow" but they differ greatly in their level of abstraction.

Instead of an integrative philosophy, SCM can be viewed at the business process level, as in: "SCM deals with total business process excellence and represents a new way of managing the business and relationships with other members of the supply chain" (Lambert et al., 1998a, p. 1). Similarly, some authors take a more detailed approach,

viewing it as "all the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities." (Lummus and Vokurka, 1999, p. 11). Is SCM a discrete set of activities and not a management philosophy?

Effective management of supply chains is a source of competitive advantage (e.g., Cooper and Ellram, 1993; Mentzer et al., 2001; Li et al., 2006; Bowersox et al., 2007). The notion of strategy is also common in many attempts to define SCM. For example, "supply chain management consists of firms collaborating to leverage strategic positioning to improve operating efficiency" (Bowersox et al., 2007, p. 4). The focus here is on operating efficiencies, driving costs out of the system. There are other strategic reasons for SCM besides efficiency—market responsiveness for example (Fisher, 1997; Lee, 2002). There is no single, universally accepted definition of supply chain management in the literature. New (1997, p. 16) offers some insight as to why this is the case:

> The difficulty of definition reflects a daunting problem for those who wish to adopt the supply chain label as an identifier for research projects, or journals. On the one hand, too tight a definition of the supply chain concept artificially closes off productive avenues of development. On the other hand, too loose a definition allows the label to collapse into an amorphous study of everything.

Practitioner Perspectives

Physical distribution management (transportation, warehousing, and inventory management) evolved into Logistics Management—the same management processes but now efficiency focused. Logistics management in turn evolved into supply chain management when companies began looking beyond their loading docks to integrate their business processes with those of their suppliers and customers (CLM, 2004; CSCMP, 2010; SCL, 2010). The Council of Supply Chain Management Professionals (CSCMP) in the U.S. defines supply chain management and its scope as follows:

> Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. (CSCMP, 2010)

This pragmatic planning and management focus of the industry definition is in stark contrast to the notion of an integrative philosophy for SCM as described by the academics above. Another practitioner body, the Supply Chain Council, offers its members the Supply Chain Operations Reference (SCOR) model, which has five core management processes—plan, source, make, deliver, return—for five key entities in the chain: supplier's supplier, supplier, firm, customer, and customer's customer (SCC, 2009). For comparison, a third-party logistics provider is explicitly included in the CSCMP definition above and implicitly included in a management process (deliver) in the SCOR model. On the other hand, reverse logistics is explicit in the SCOR model, but implicit or assumed in the CSCMP definition. In Canada, the Purchasing Management Association of Canada (PMAC) uses its definition to make explicit what is moving between businesses, namely "flows of goods, services, finance and knowledge." It also provides reasons why companies should engage in SCM—to contribute to the strategic competitiveness of the business, enhancing competitive advantage, and enhance customer satisfaction (PMAC, 2010).

Practitioners, like academics, have not reached consensus on what to include or not as part of their supply chain management definition. For the purposes of this research, the following definition of Min and Mentzer (2004) will be used.

> Supply chain management is "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Min and Mentzer, 2004, p. 63).

The "traditional business functions" alluded to include those that would be found in Porter's "value chain" (Figure 2.2). This definition is both internally and externally focused, and as such is congruent with the definition of supply chain and the three levels of supply chain scope from §2.1.1. This definition is stream-agnostic in that it does not purport to be of either a logistics- or procurement- based origin. Finally, it does not suffer from being overly abstract nor excessively detailed in its language.

2.1.3 Supply Chain Orientation

The struggle to find a definition for supply chain management is the starting point of the Mentzer et al. (2001) paper. That paper was not the first nor last to develop an "orientation" related to supply chain management. Before the SCO concept was developed in

Mentzer et al. (2001) and later operationalized by Min and Mentzer (2004), many variations of supply chain "orientation" appeared in the literature. Few were ever defined adequately, operationalized, or used again in subsequent research. Table 2.1 on page 28 summarizes the chronological development of analogous SCO-like orientations.

As described in §2.1.2, supply chain management definitions vary from the very concrete (SCM in operational terms) to the very abstract (SCM as management philosophy) to some point in between (SCM as management processes). The academic literature had been attempting to reconcile different SCM conceptualizations until Mentzer et al. (2001) recognized that one term—supply chain management—was being used to define *two* different concepts. SCM was used to describe a management philosophy as well as the *implementation* of that philosophy. The management philosophy was split from its implementation to become supply chain orientation, while the implementation of the philosophy remained as supply chain management. Thus the earlier definition confusion was resolved with the introduction of the SCO term to provide clarity to the SCM term. The original Mentzer et al. notion of SCO was stated as follows:

> The idea of viewing the coordination of a supply chain from an overall system perspective, with each of the tactical activities of distribution flows seen within a broader strategic context (what has been called SCM as a management philosophy) is more accurately called a **Supply Chain Orientation**. The actual implementation of this orientation, across various companies in the supply chain, is more appropriately called Supply Chain Management. (Mentzer et al., 2001, p. 11, bold text in original)

As Mentzer et al. (2001) reiterate, "A Supply Chain Orientation is a management philosophy, and Supply Chain Management is the sum total of all the overt management actions undertaken to realize that philosophy" (p. 11). The clarity of this statement, however, gets obfuscated in the transition from a theoretical idea to its empirical test. Table 2.2 presents two slightly different definitions of SCO found in the Mentzer et al. (2001) paper and in the Min and Mentzer (2004) paper. The rationale for the subtle difference between the two is explained in a footnote in the latter paper: "Because a SCO is a set of implementation behaviors and, accordingly, is measured on a behavioral scale, a SCO should be defined as "the implementation" by an organization of the SCM philosophy" (Min and Mentzer, 2004, p. 84; quotations in the original).

Table 2.1: Chronological Development of SCO Concept

Concept	Author(s) / Year	Comment
Strategic Logistics Orientation	Langley and Holcomb (1991)	Adds inter-firm coordination and integration to traditional firm-based logistics to create strategic logistics.
Global Supply Chain Orientation	Warsing et al. (1997)	Used in a taxonomic schema; unrelated to management philosophy considers "commitment" as a factor.
Supply Chain Orientation	Council of Logistics Management in Lambert et al. (1998a, p. 2)	Naïve definition: "from point-of origin to point-of-consumption."
Relational Supply Chain Orientation	Maloni and Benton (2000)	Considers power differentials between auto industry players; not expanded upon.
Whole-of-Chain Orientation	Mowat and Collins (2000)	Absence of whole of chain orientation results in fragmented industry and production orientation.
Supply Management Orientation	Shin et al. (2000, p. 318)	"the management efforts or philosophy necessary for creating an operating environment where the buyer and supplier interact in a coordinated fashion."
Critique of Supply Management Orientation from above	Ho et al. (2002)	SMO construct is overly broad encompasses too many elements, concerns about construct validity. Expecting differences between supply management and supply management orientation.
Supply Chain Orientation	**Mentzer et al. (2001)**	**Supply chain orientation is a management philosophy; the implementation of SCO manifests itself as supply chain management. Operationalized by Min and Mentzer (2004). Basis for this research.**
Supply Chain Orientation	Lambert and Pohlen (2001)	Supply chain orientation is a contextual factor influencing SCM practices; since its absence has some impact. No construct defined.
Supply Chain Orientation	Narasimhan et al. (2001)	Total customer satisfaction is an element of supply chain orientation.
Supply Chain Orientation	Bullinger et al. (2002)	A set of business attributes, versus an overarching management philosophy.
Supply Chain Orientation	Macpherson and Wilson (2003)	SCO on the part of SMEs is expected by their customers; no further development.
Electronic Supply Chain Orientation	Nguyen and Harrison (2004)	E-business is a means of achieving strategic outcomes for the firm.
Supply Chain Orientation	**Hult et al. (2008)**	**SCO is an orientation of orientations (e.g., customer, competitor, supplier, logistics, operations, and value-chain orientations). Basis for SCO definition used in this research.**

Note: **Boldface** entries are used to denote the key SCO definitions used in this research.

Table 2.2: Definitions of Supply Chain Orientation

Mentzer et al. (2001) SCO:	Min and Mentzer (2004) SCO:
the **recognition** by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain (p. 11).	the **implementation** by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain (p. 63).

Boldface added for emphasis

This adds a new layer of abstraction to the search for a definition for supply chain orientation. We now require an "SCM Philosophy" the *implementation* of which is "Supply Chain Orientation" and in turn, the *implementation* of SCO is "Supply Chain Management." How is SCO, a management philosophy, different from a *supply chain* management philosophy?

Building upon earlier work by Mentzer et al. (2001) and Min and Mentzer (2004), Min et al. (2007) "propose that the SCM concept consists of different terms to delineate different phenomena: a Supply Chain Orientation (SCO) *within a firm* and Supply Chain Management (SCM) *across firms within a supply chain*, both of which are operationalizations of SCM philosophy" (p. 508; italics in the original). They go on to state that "SCM philosophy is a shared mental model or schema of joint problem solving both inside and outside the firm within the boundaries of a supply chain" (ibid). My interpretation of these ideas is illustrated in Figure 2.5.

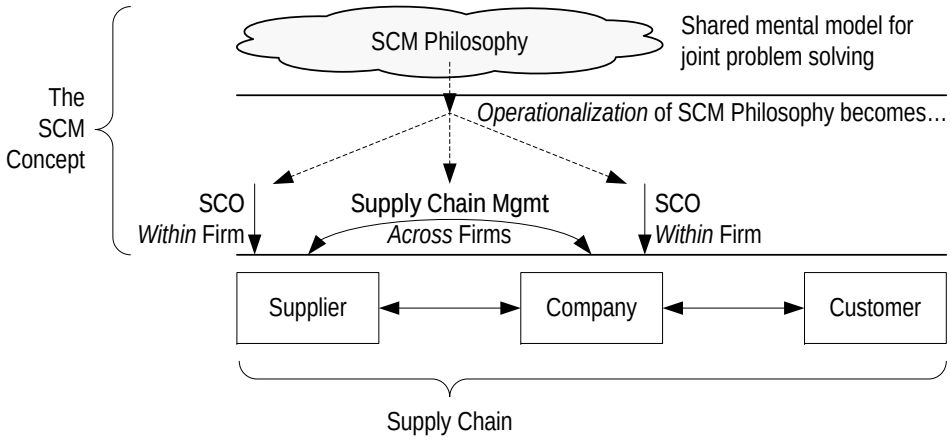


Figure 2.5: An Interpretation of the Min et al. (2007) SCM Philosophy

What exactly is meant by a "SCM Philosophy?" Although they do not define it, Mentzer et al. (2001) describe a SCM philosophy as having the following characteristics: "(1) A systems approach to viewing the supply chain as a whole, and to managing the total flow of goods from the supplier to the ultimate customer, (2) A strategic orientation toward cooperative efforts to synchronize and converge intrafirm and interfirm operational and strategic capabilities into a unified whole, and (3) A customer focus to create unique and individualized sources of customer value, leading to customer satisfaction" (p. 7).

These characteristics seem to suffer from flaws similar to the discussion of supply chains and supply chain management above. While a "systems approach" and "viewing the chain as a whole" are high-level philosophical and/or orientation-like ideas, "managing the flow of goods" is a tactical-level, concrete concept. Characteristic (2)—a strategic orientation—has a wide ranging scope: everything from operational to strategic capabilities, both inside and outside the firm.

Moving away from the Tennessee School of Thought, Hult et al. (2008) took a different approach to the issue of supply chain orientation, defining it as "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (p. 527). Stated another way, does a company view itself as an atomic entity with a supply chain (i.e., little or no SCO) or does it view itself as part of a continuum from earth to ultimate customer (i.e., a strong SCO). This is the philosophical idea.

The definition of Hult et al. is consistent with the earlier view that "A Supply Chain Orientation is a management philosophy, and Supply Chain Management is the sum total of all the overt management actions undertaken to realize that philosophy" (Mentzer et al., 2001, p. 11). "Satisfying chain needs" would of course be done through supply chain management. This is the separation of the orientation from its implementation. These ideas are presented diagrammatically in Figure 2.6.

2.1.4 Definitions Summary

As there has been much discussion about the nuances of the definitions of supply chain, supply chain management, and supply chain orientation in the preceding section, the definitions used in this research are reiterated here before moving on. Taking the top-down approach of Figure 2.6, the definitions are:

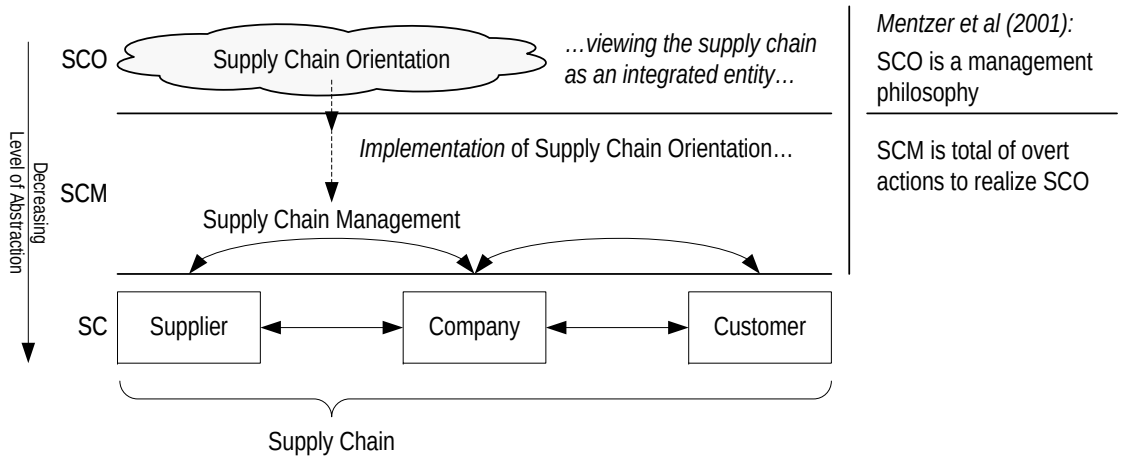


Figure 2.6: Definition of Supply Chain Orientation

Supply Chain Orientation: "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (Hult et al., 2008, p. 527). The implementation of the supply chain orientation is the basis for...

Supply Chain Management: "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Min and Mentzer, 2004, p. 63). Finally, supply chain management happens on a...

Supply Chain: "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer" (Mentzer et al., 2001, p. 4).

2.2 Strategic Orientations

This chapter opened with four components of theory from Wacker (1998). After delineating those components, Wacker continues: "Theories carefully outline the precise definitions in a specific domain to explain why and how the relationships are logically tied so that the theory gives specific predictions" (p. 363). With the key supply chain terms defined in the previous section, it is important to to discuss the concept of supply

chain orientation within the larger domain of "Strategic Orientations" in the management literature.

The supply chain orientation of Mentzer et al. (2001) is a relative newcomer compared with other orientations (e.g., Strategic Orientation—Venkatraman (1989); Market Orientation—Narver and Slater (1990); Customer Orientation—Deshpandé et al. (1993); Entrepreneurial Orientation—Lumpkin and Dess (1996)). This section begins by considering general issues associated with strategic orientations. SCO is examined in the context of other orientations to establish that it is unique from other candidate orientations and that it is indeed a strategic orientation.

2.2.1 SCO as an Orientation

The discussion of §2.1.2 noted that many different literatures have contributed to the current state of SCM understanding. The marketing literature is a fertile source of ideas to inform the development of SCM theory. More importantly, Min and Mentzer (2000) found that "The marketing concept, market orientation, relationship marketing, and SCM are not separate. Rather they are inextricably intertwined" (p. 782). Hence starting with an examination of market orientation (MO) could lead to insight into supply chain orientation due to their conceptual intertwinement.

In discussing market orientation, Henderson (1998) identifies three different variants of the orientation: MO as a behaviour, MO as "information flows," and MO as a marketing culture. Min and Mentzer (2000) also identify MO as a behaviour or an organizational culture in addition to MO as a set of activities or a set of attitudes/beliefs. Even within the same paper Narver and Slater (1990) refer to MO as "the organization culture that most effectively and efficiently creates the necessary behaviors for the creation of superior value" (p. 21) and later note that a "market orientation consists of three behavioral components: customer orientation, competitor orientation, and interfunctional coordination" (p. 22).

What is an "orientation" when freed of qualifiers like supply chain, or marketing, or strategic? As Tellefsen (1999) describes: "An orientation can be seen as a particular subculture with an identifiable set of cognitions developed around a particular solution for a group" (p. 104). In this conceptualization, orientation takes on a cultural perspective. Instead of the culture creating behaviours as Narver and Slater (1990) suggest, an orientation for Tellefsen creates a set of perceptions.

Some authors contend that an orientation is a region on a continuum. Doyle and Hooley (1992), for example, suggest companies have a product orientation if they focus on short-term profits; a marketing orientation if they focus on the other end of the spectrum,

meaning long-term market share; and a transitional orientation if they focus in between. Similarly, the model of Wright et al. (1995) ranges from "internally oriented" to "externally oriented," and it found that those firms in the middle (dual emphasis) had higher levels of return than firms on the ends of the spectrum. SCO by its very nature acts on a continuum—the extended supply chain. Depending on the nature of the relationship between partner firms in the extended supply chain, SCO will be present in varying degrees on the regions of the continuum.

Others view a strategic orientation is an "orientation of orientations"—a second-order orientation of other first-order orientations. Strategic orientation as conceived by Menguc and Auh (2005) for example, consists of customer, competitor, and technological orientations. Hult et al. (2008) view supply chain orientation as a combination of customer and competitor orientations, in addition to supplier, logistics, operations, and value-chain orientations. The stakeholder orientation of Yau et al. (2007), is a second-order construct consisting of customer, competitor, shareholder, and employee first-order orientations.

In their examination of new product performance, Gatignon and Xuereb (1997) note that "a firm's strategic orientation reflects the strategic directions implemented by a firm to create the proper behaviors for the continuous superior performance of the business" (p. 78). This notion of an orientation being implemented to achieve performance results in the business is consistent the notion of SCO developed in §2.1.3.

Another observation is that "a business orientation can be conceptualized as an underlying philosophy held by all members of the organization that influences and flavors both their strategic and tactical decisions" (Miles et al., 1995, p. 9). This observation is congruent with the SCO concept already developed; that is, SCO is the guiding philosophy which influences the SCM decisions.

Finally, Teece and Pisano (1994) argue that "the strategic dimensions of the firm are its managerial and organizational processes, its present position, and the paths available to it" (p. 541). The paths available to the firm represent a choice of strategic orientations to choose. An 'orientation' from this perspective is a set of routines—that is, the way things are done in the firm. These routines or organizational processes form the capabilities of the organization. Given the myriad of perspectives on 'orientation' (e.g., culture-based, behaviour-based, orientation-of-orientations, et al), this research will take the perspective that an orientation:

- is an intangible management philosophy that
- requires implementation in order to realize tangible outcomes
- such as the organizational routines and capabilities associated with that philosophy.

This multi-faceted perspective is congruent with the discussion and definition of supply chain orientation already established. Hence SCO is an orientation; but is it a *strategic* orientation?

2.2.2 SCO as a Strategic Orientation

Venkatraman (1989) proposed six key dimensions of competitive strategy: aggressiveness, analysis, defensiveness, futurity, proactiveness, and riskiness. Later research revealed that "competitive strategy is synonymous with the term strategic orientation" (Morgan and Strong, 1998, p. 1053). The Morgan and Strong paper established a relationship between market orientation and the dimensions of strategic orientation. A subsequent paper by the same authors indicated that "firms' emphasis upon analysis, defensiveness, and futurity in strategic orientation are related to business performance" (Morgan and Strong, 2003, p. 56). Table 2.3 summarizes these six dimensions and provides SCO-related comments.

As Prahalad and Hamel (1994) assert, "Strategy is the result of an analytical process, execution of strategy is an organizational process" (p. 11). This notion is reinforced by Manu and Sriram (1996) who claim, "Strategic orientation refers to how an organization uses strategy to adapt to and/or change aspects of its environment for a more favorable alignment. This orientation has been described variously as strategic choice, strategic thrust, strategic fit, and strategic predisposition" (p. 79). Semantically, one could take this quotation to describe SCO as follows:

> *[supply chain orientation] refers to how an organization uses [supply chain management] strategy to adapt to and/or change aspects of its environment [its supply chain] for a more favorable alignment.*

This is in line with the notion of SCO already described and in agreement with the capabilities concept of Teece and Pisano (1994)—a firm's dynamic capabilities give it the ability to change the aspects of its environment as required.

As Table 2.3 demonstrated, attributes of SCO are congruent with the dimensions of a strategic orientation. This congruence is in agreement with the assertion of Min and Mentzer (2004) that "the concepts, a SCO and SCM, are strategic in nature" (p. 83). Thus supply chain orientation is indeed a strategic orientation. The final piece of analysis in this section will address whether or not SCO is a *unique* strategic orientation.

Table 2.3: Strategic Orientation Characteristics and SCO Characteristics

Dimension	Strategic Orientation	Supply Chain Orientation
Aggressiveness	Rate of resource allocation[1] Investment to improve competitive position[1] Aggressive behaviours are indicative of high business performance[2]	Allocation of resources from intra-firm coordination to extra-firm cooperation in order to achieve some economic advantage.
Analysis	Overall problem solving nature[1] Best possible solution alternatives[1] Understanding internal/external contexts[2] Comprehensive decision processes[2]	Supply chain problems require an understanding of external realities and internal capabilities and are often very complex in nature.
Defensiveness	Cost reduction & efficiency seeking[1] Excelling in production and cost control[2]	"Efficient" supply chain operations drive the costs out of the operation; classic examples: Wal-Mart, Dell.
Futurity	Planning & tracking emphasis[1] Long term emphasis[2]	Supply chain success requires extensive planning and tracking of inventory and WIP; high switching costs require long term commitment.
Proactiveness	New opportunities[1] Responsiveness to market signals[2]	"Responsive" supply chains are quick to market and exploit opportunities before competitors.
Riskiness	Resource allocation decisions[1] Traditional rule breaking[2]	JIT strategy is highly sensitive to disruption; vendor managed inventory (VMI) is a new and innovative strategy.

Note: (1) Venkatraman (1989); (2) Morgan and Strong (2003).

2.2.3 SCO as a Unique Strategic Orientation

Section 2.1.2 discussed whether or not "supply chain management" was just a re-brand of the logistics or procurement function. In the same way, is SCO its own strategic orientation or is it a different label applied to an existing orientation? Four candidate orientations that are sufficiently close to SCO will be examined in greater detail. The candidate strategic orientations are summarized in Table 2.4. This analysis will provide support for discriminant validity—that is, supply chain orientation is indeed its own orientation and not a re-brand of an existing orientation.

Table 2.4: Candidate Strategic Orientations

Orientation	Definition	Source(s)
Market Orientation (MO)	The marketing concept is a business philosophy; MO is the implementation of the marketing concept. MO components include customer & competitor orientations and inter-functional coordination.	Kohli and Jaworski (1990); Narver and Slater (1990); Jaworski and Kohli (1993).
Network Orientation (NO)	Firms focus on core competencies; integrated systems perspective; cooperative norms; and recognition of interdependences.	Overby and Min (2001).
Supply Management Orientation (SMO)	"the management efforts or philosophy necessary for creating an operating environment where the buyer and supplier interact in a coordinated fashion."	Shin et al. (2000, p. 318).
Business Process Orientation (BPO)	"BPO emphasizes process, a process oriented way of thinking, customers and outcomes as opposed to hierarchies."	McCormack (1999, p. 6).

Market Orientations versus SCO

Market Orientation (MO) is the implementation of the "marketing concept." The marketing concept in turn is a business philosophy (Kohli and Jaworski, 1990). Both MO and SCO are strategic-level constructs, and as such, both orientations have a top management support focus. MO has a focus on the immediate customer. SCO also has a focus on the customer, but also on the customer's customer and the suppliers who also have an impact on what gets delivered to the immediate customer (Warnakulasooriya, 2007). Narver and Slater (1990, p. 22) talk about the role of interfunctional coordination—"the coordinated

utilization of company resources in creating superior value for target customers"—which is supply chain oriented in its language.

One important difference between SCO and MO is the unit of analysis (Warnakulasooriya, 2007). MO is focused on one relationship—the firm to its customer—while SCO is focused across many inter-firm, as well as intra-firm relationships. Some have suggested that the real competition is not between companies, but rather between supply chains (e.g., Christopher, 1992; Ketchen and Hult, 2007). SCO, however, does not recognize competitors—it is focused on the supply chain but not the competitive environment. MO does make explicit the role of competition in the orientation (Narver and Slater, 1990). Recent research has found that SCO is a mediator between MO and business performance (Min et al., 2007). Even though there is some overlap, for these reasons SCO is a separate construct from MO.

Network Orientation versus SCO

In their description of a Network Orientation (NO), Overby and Min (2001) assert that NO has two characteristics highly congruent with SCO: an integrated systems perspective and business relationships based on cooperative norms. From this perspective alone, there should be some interdependence between NO and SCO. However, NO has other characteristics it does not share with SCO. For example, NO "can be characterized by the recognition of interdependencies between partners" (Overby and Min, 2001, p. 402). SCO makes no claims about the dependence or independence of the supply chain member companies. Finally, NO's "strategic core" is the core competency of the company and encourages the outsourcing of non-core business functions. SCO makes no such claims. Network orientation is best represented as a superset of SCO. That is, SCO is contained within the NO definition, and NO has other characteristics SCO does not.

Supply Management Orientation versus SCO

As noted in Table 2.4, Supply Management Orientation (SMO) is attempting to address tangible management efforts in the same construct as intangible management philosophy. That difference aside, Shin et al. (2000, p. 319) define the characteristics of SMO as "1) a long-term relationship with suppliers, 2) supplier involvement in the product development process, 3) a reduced number of suppliers, and 4) a 'quality focus' meaning that quality performance is the number one priority in selecting suppliers." The Min and Mentzer (2004) model maps one-to-one with the long-term relationship characteristic, but at the SCM construct level versus the SCO construct level. At the SCM level, "supplier involvement" could be part of process integration, information sharing, or risk

and reward sharing. The Min and Mentzer (2004) model makes no claims about quality nor about reducing the number of suppliers. Thus SMO is tangentially related to, but a different concept from SCO.

Business Process Orientation versus SCO

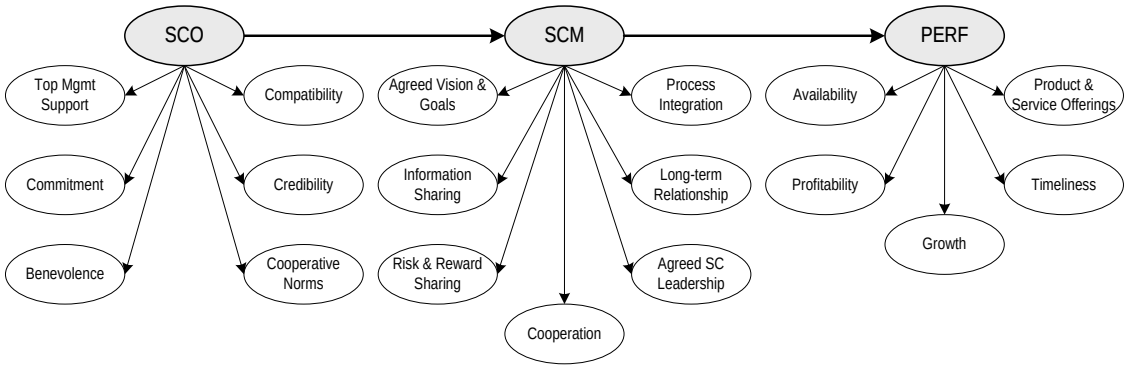
If supply chain management is to work efficiently, business processes between firms must be effectively integrated. A relatively recent orientation to the management literature is that of Business Process Orientation (BPO). The original definition of BPO is given in Table 2.4; subsequent research breaks BPO into the following components: process management and measurement, process ownership, and thorough process documentation (McCormack, 2001). When connected with SCM, it was found that "the results of our research investigating BPO in the supply chain clearly shows that process measures and process-oriented values and beliefs are critical ingredients of supply chain management" (McCormack and Johnson, 2001, p. 36). After exploring these concepts further, Lockamy and McCormack (2004) developed a supply chain maturity model. Missing from the BPO perspective is a *strategic* focus. Business processes are discussed in detail in these papers, but the overall "big picture" is missing. BPO is most congruent with the Measurement Propensity factor advocated by this research. SCO is a different concept from BPO.

The arguments presented above indicate that while supply chain orientation has common elements with market-, network-, supply management-, and business process- orientations, it is indeed sufficiently different from those orientations in some aspects to stand on its own. Hence SCO is a *unique* strategic orientation.

2.3 Theoretical Framework

The original incarnation of supply chain orientation as described by Mentzer et al. (2001) was *not* positioned within any existing theoretical framework(s). The authors make note of this, indicating "This paper also highlights the need for rigor to further develop a theoretical framework of SCM" (p. 20). The follow-up paper of Min and Mentzer (2004) refers to the "General Theoretical Framework" of Mentzer et al. (2001), as depicted in Figure 2.7. However, no attempt was made to position SCO within any larger theoretical frameworks such as the Resource-Based View (RBV) of the firm.

The work of Hult et al. (2008) began to address this gap by considering the resource-based view of the firm as the theoretical foundation for SCO. This section will begin with



Source: Figure 1 from Min and Mentzer (2004)

Figure 2.7: General Theoretical Framework of Mentzer et al. (2001)

a review of the RBV literature in general, the application of RBV to supply chain management, and a discussion of Hult et al.'s placement of SCO within the RBV framework.

2.3.1 Resource-Based View of the Firm

Nair et al. opine that today, nearly fifty years after Penrose (1959) published *The Theory of the Growth of the Firm*, "many organizational scholars… view it as a seminal text for the resource-based view of the firm, arguably one of the dominant theoretical perspectives in strategic management research today" (Nair et al., 2008, p. 1026). Penrose herself describes the *resources* in the resource-based view to…

> "include the physical things a firm buys, leases, or produces for its own use, and the people hired on terms that make them effectively part of the firm. Services, on the other hand, are the contributions these resources can make to the productive operations of the firm. A resource, then, can be viewed as a bundle of possible services" (Penrose, 1959, p. 67).

A resource is a "bundle of services," and in turn, a firm is defined as a "bundle of resources" (Wernerfelt, 1984). Penrose continued her line of reasoning to explain why two companies in the same industry with a similar resources can experience different levels of growth. When the same resource is used in different ways for different purposes, or in different combinations with other resources, differences arise between the firms that possess those similar resources. These differences manifest themselves as value creation, wealth accumulation, and growth.

To put a supply chain, or at least a transportation, context around this idea, consider two Owner-Operator (O-O) trucking firms. The tangible resources in both cases are the truck and the driver. One O-O may offer long-haul services, while the other offers only short-haul. Perhaps the long-haul trucking company offers only full truck load (FTL) services, while the short-haul company offers both FTL and LTL (less-than truck load) services. If there is a stronger market for long-haul FTL freight than for short-haul, the first O-O may have a higher rate of growth than the second O-O. Hence, RBV then is less about what resources a firm has than how the firm combines and uses its resources.

When Penrose (1959) moves from discussing "physical things" to "bundles of services" she is taking resources from the tangible to the intangible. Revisiting the O-O example, the tangible truck driver resource also has many intangible qualities that will impact on the business they do. Consider the driving record of each driver, perhaps their approaches to customer service, and so forth. Those intangible resources will contribute to differences in growth rate—the better, friendlier driver may get more repeat business than another driver who is less cautious and courteous.

Wernerfelt (1984) augmented Penrose's notion of resources by explicitly including a firm's intangible assets, like brands. He defined a *resource* as "anything which could be thought of as a strength or weakness of a given firm. More formally, a firm's resources at a given time could be defined as those (tangible and intangible) assets which are tied semipermanently to the firm" (Wernerfelt, 1984, p. 172). The key contribution of Wernerfelt lay in starting the analysis of the firm from the resource side, where previously it had been analyzed from only the product side.

Peteraf and Barney (2003) argue that RBV is an "efficiency-based explanation of performance differences" between firms (p. 311). Firms with superior resources are more efficient in the delivery of products and services to their customers. An important consideration of supply chain management is efficiency. Supply chains require an extensive asset base, such as transportation means and storage facilities. At the same time, supply chains are largely concerned with service, such as on-time delivery. These are the types of resources required in RBV (Penrose, 1959; Wernerfelt, 1984).

Wernerfelt's paper discussed competitive advantage along one dimension—first mover advantage. Barney (1991) further developed this resource-based view by considering sustained competitive advantage in the context of the strategic use of the firm's resources. He abstracts the notion of resources to a higher level still by defining a firm's resources to include "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm" (Barney, 1991, p.101). His paper introduced the VRIN (valuable, rare, inimitable, and non-substitutable) set of attributes to assess the competitive potential of a firm's resources. It also introduced the notion of capabilities. Table 2.5 provides a summary of RBV-inspired theory-of-the-firm literature.

Table 2.5: Evolution: Resource-Based View to Dynamic RBV

Author(s)	Main Idea(s) / Contribution(s)
Penrose (1959)	Definition of 'resources'; genesis of RBV; heterogeneity among firms occurs when firms combine their resources in unique ways.
Wernerfelt (1984)	Product / resource duality; resource position barrier; strategy choice: exploit existing or create new resources; firm as 'bundle of resources.'
Prahalad & Hamel (1990)	Introduce *Core Competencies* (CCs). Firms compete on portfolio of CCs vs. portfolio of SBUs. CCs (like resources) hard to imitate.
Barney (1991)	Links firm resources to sustained competitive advantage (SCA); requires VRIN resources (valuable, rare, inimitable, and non-substitutable). SCA comes from firm's resource heterogeneity and immobility.
Grant (1991)	Resources → Capabilities → Competitive Advantage → Strategy. Capability is capacity for resource to perform some task.
Amit & Schoemaker (1993)	Introduce *Strategic Assets*: "a set of difficult-to-imitate, scarce, appropriate, and specialized resources and capabilities" (p. 36)
Teece et al. (1997)	Introduce *Dynamic Capabilities*: organizational processes which perform co-ordination / integration and reconfiguration / transformation roles.
Eisenhardt & Martin (2000)	Dynamic capabilities integrate or reconfigure resources in a firm. Not firm idiosyncratic, e.g., 'best practices.'
Winter (2000)	Capability is an organizational routine (or collection of routines) to provide a set of decision options; organizational learning.
Helfat & Peteraf (2003)	Introduce *Dynamic RBV*: looks at resources over time. Considers capability lifecycle across firm boundaries.

Alternative Views

There has been ongoing scholarly debate about the work of Penrose, both on the "Pro" side (e.g., Kor and Mahoney, 2004; Lockett and Thompson, 2004) and on the "Con" side (e.g., Rugman and Verbeke, 2002, 2004). The pro-side argument is that Penrose contributes greatly to the understanding of the nature of creation and sustainment of competitive advantage. The con-side argument is that scholars are misinterpreting her work, that "Penrose's ideas remain very different from those prevailing in most modern resource-based thinking" (Rugman and Verbeke, 2002, p. 778). Pro or con, there is no denying the impact of Penrose's ideas. Google Scholar lists about 11,000 citations of her 1959 book *The Theory of the Growth of the Firm*.

Debate extends beyond the contributions of Penrose and explores the larger RBV body of literature. Some contend that RBV is not a theory, or at least is short of requirements to be a theoretical structure (Priem and Butler, 2001). Although an abundance of RBV-related theory papers have been produced, little empirical research has been done on RBV (Hoopes et al., 2003; Arend, 2006). Even the formidable Michael Porter weighs in on the issue, "...the resource-based view just cannot stand on its own" (interviewed in Argyres and McGahan (2002) p. 50). Most recently, Kraaijenbrink et al. (2010) detail eight common critiques of the RBV, dispelling five of them but warning RBV researchers that three serious critiques—that the definition of 'resource' is unworkable, that the value of a resource is too indeterminate to provide for useful theory, and that the VRIN criteria for resources is neither necessary nor sufficient for sustained competitive advantage—not be dismissed too lightly.

Others acknowledge weaknesses with the current theory but assert that it is a useful tool for strategic management, having broad appeal across multiple management disciplines (Barney, 2001; Barney et al., 2001). This approach will be taken with this research. The wide application and applicability of the RBV outweigh its perceived shortcomings, hence the resource-based view will be the theoretical basis for this research.

Alternative Theories

In addition to the resource-based view, Ketchen and Giunipero (2004) describe three strategic management theories—agency theory, the knowledge-based theory of the firm, and institutional theory—and their respective impact on SCM. Similarly, Halldorsson et al. (2007) cover the same RBV and agency theory ground in addition before exploring transaction cost analysis and network theory in a supply chain management context. A sixth alternative, resource dependence theory, was also considered as a basis for this research. Table 2.6 provides a brief overview of these six alternatives. The table also details the rationale for not pursuing them as a theoretical foundation in the context of supply chain orientation.

Halldorsson et al. (2007) admit that "that there might be no "right" theory for the management of supply chains" (p. 285; quotations in the original). Likewise Grant (1996) observes that "there are many theories of the firm which both compete in offering rival explanations of the same phenomena, and complement one another in explaining different phenomena" (p. 109). As described above, the resource-based view has wide applicability, and hence will be the underlying theoretical framework for this discussion. The next section discusses extensions to the theory to address the static nature of the RBV. That discussion is followed in turn by an examination of SCO in the context of the RBV theory.

Table 2.6: Alternative Theories of the Firm

Theory / Source	Quotation / Commentary
Agency Theory Eisenhardt (1989)	"Agency theory is most relevant in situations in which contracting problems are difficult... e.g., suppliers and buyers" (p. 71). Agency theory is used to address the principal-agent problem. Most applicable to inter-firm issues; may be less applicable to intra-firm supply chain issues.
Knowledge-Based View Grant (1996)	"Fundamental to a knowledge-based theory of the firm is the assumption that the critical input in production and primary source of value is knowledge" (p. 112). Builds on the RBV; knowledge is a strategic resource that is not (easily) transferable nor imitateable. RBV still treats knowledge as a resource, no different from other resources.
Institutional Theory Scott (1987)	"[Selznick] viewed organizational structure as an adaptive vehicle shaped in reaction to the characteristics and commitments of participants as well as to influences and constraints from the external environment" (p. 494). Institutionalization is a process whereby organizations establish rules and routines for social behaviour over time; could a supply chain be institutionalized?
Transaction Cost Analysis Williamson (1981)	"The transaction cost approach to the study of economic organization regards the transaction as the basic unit of analysis and holds that an understanding of transaction cost economizing is central to the study of organizations" (p. 548). This approach ignores other aspects of SCM like collaborative planning.
Network Theory Halldorsson et al. (2007)	"[Network Theory] is descriptive in nature and has primarily been applied in SCM to map activities, actors, and resources in a supply chain" (p. 290). Hence NT is not a good alternative for developing hypothesis support.
Resource Dependence Theory Ulrich and Barney (1984)	"Organizations are viewed as coalitions, altering their structure and patterns of behavior to acquire and maintain needed external resources" (p. 472). Firms can reduce supply uncertainly through partnerships, joint-ventures, or acquisition. Assumes minimization of a firm's dependence on others and/or a firm's maximization of the dependence of other firms on it. May be at odds with the win-win nature of supply chain.

RBV Applicability to 'Orientations' Research

Strategic 'orientation' can be referred to by other terms, for example: strategic choice, strategic predisposition, strategic design, strategic fit, or strategic thrust (Chaffee, 1985; Manu and Sriram, 1996; Morgan and Strong, 2003). Strategy is, in the words of Chandler (1962), "the determination of the basic long-term goals of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals" (p. 13). Strategic planning—the detailed development of a particular course of action—is, according to Hofer (1973), "concerned with the development of a viable

match between the opportunities and risks present in the external environment and the organization's capabilities and resources for exploiting these opportunities" (p. 47). This innate match between an organization's strategy and its resources and capabilities illustrates why the resource-based view is a commonly used framework for exploring strategic orientations. Alternative theories of the firm discussed in the previous section do not mesh as tightly with definitions of strategy as does the RBV. Hofer alludes to an "organization's capabilities" which will be discussed further in the next section. For these reasons, the resource-based view is the best choice for research into business 'orientations.'

2.3.2 Capabilities, Dynamic Capabilities, and Dynamic RBV

RBV associates tangible and intangible resources with a firm; how the firm differentially uses or combines those resources is a source of competitive advantage. Grant (1991) extends this idea in a hierarchy by introducing the notion of capabilities where a "capability is the capacity for a team of resources to perform some task or activity. While resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage" (p. 119). An organization develops these capabilities through organizational learning (Winter, 2000).

If capabilities are the main source of competitive advantage, how does an organization develop its own resources and capabilities? It does so by *dynamic* capabilities. Capabilities are more than a set of resources; they require coordination and patterns of activity—organizational routine (Grant, 1991). Capabilities become dynamic when the firm is able to read and respond to a changing business environment. By "responding," the firm can reconfigure its capabilities to meet the change. Thus, the focus of the firm is on business processes versus business assets or resources (Eisenhardt and Martin, 2000; Teece et al., 1997).

While classical RBV took a static approach to resources, the Dynamic RBV view considers the changes to a firm's capabilities over time. The main explanatory tool, the Capability Lifecycle (CLC), tracks a capability from inception to maturity. A lifecycle model tracks the entities of interest (in this case corporate capabilities) over time—from inception or founding, through development and maturation, until such time as the entity undergoes significant change. The lifecycle of a caterpillar / butterfly is an apt analogy. In the case of the CLC, mature capabilities reach a point in time where some die out, and some evolve into a new capability (Helfat and Peteraf, 2003). Since capabilities are the main source of competitive advantage, the ability to reconfigure and transform existing capabilities into new ones is important for strategy.

Figure 2.8 summarizes the resource-based view and dynamic capabilities ideas presented above. According to Penrose (1995), a firm is "a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision" (p. 24). These resources fall into two categorizations, tangible and intangible resources (Wernerfelt, 1984). A lower case "r" is used to denote these resources. A solid line around the "r" indicates the resource is tangible, whereas a dashed line indicated an intangible resource.

A firm also has capabilities. Capabilities fall into two categories: operational capabilities and dynamic capabilities. Winter (2000) used the term "organizational capability" to refer to a routine or collection of routines for producing a desired output from a given set of inputs. Helfat and Peteraf (2003) recast this idea an "operational routine." The term 'operational capability' is homogenized from these two concepts. Supply chain orientation, as described in §2.2.1 is a "set of routines" and thus is a capability.

Dynamic capabilities, as defined by Teece et al. (1997), are capabilities used to create or reconfigure operational capabilities (Helfat and Peteraf, 2003). Dynamic capabilities are transformative in that they change existing routines in response to external forces. Hult et al. (2008) depict supply chain orientation as a "strategic capability." The inclusion of the 'strategic' adjective to describe the capability implies an element of dynamism. Additionally:

> "Supply chain orientation is a capability created by combining tangible resources such as integrated Information and Knowledge Management Systems between supply chain partners to maximize chain efficiency and knowledge-sharing activities, with intangible resources such as firm cultures and value systems organized around establishing win-win relationships with firm buyers and suppliers, knowledge sharing and creating relationships across the chain, and sharing of best practices within the chain" (Hult et al., 2008, p. 528)

Hence, in this sense, supply chain orientation is a *dynamic* capability.

A traditional Inputs → Process → Outputs process diagram is used to describe the functions of the firm. Above the centre line on the right side of Figure 2.8, two tangible and one intangible resources are combined with a operational capability to create outputs. These outputs, denoted with an upper case "R," are referred to as "Penrosian Resources." As Penrose (1995) notes: "Strictly speaking, it is never *resources* themselves that are the 'inputs' in the production process, but only the *services* that the resources can render" (p. 25; italics in the original). The difference between the resources referred to at the start of this section and Penrosian resources is that the latter "consist of a bundle of potential services and can, for the most part, be defined independently of their use" (ibid).

Below the centre line on the right side of Figure 2.8 is an illustration of how a dynamic capability c can transform operational capabilities c_1 and c_2 into a new operational capability C. I also indicated a dynamic capability C as an output as well. A given dynamic capability c could improve and mature into C through learning curve effects and/or continuous improvement processes.

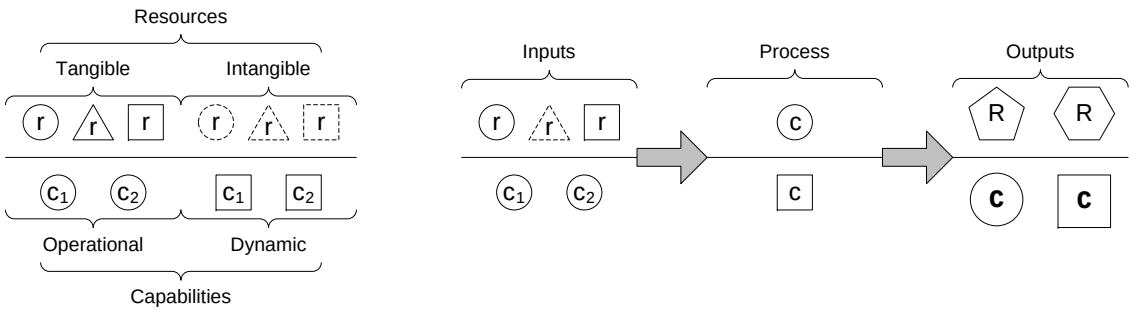


Figure 2.8: Resources and Capabilities—An Overview

Using the ideas of Figure 2.8 in combination with the O-O truck examples from §2.3.1 gives Figure 2.9. As before, two O-O companies have identical resources. How the owner-operators combine their resources results in the source of difference between the two O-O companies. This difference is labeled Penrosian Resources—the *services* the trucking firms are capable of providing.

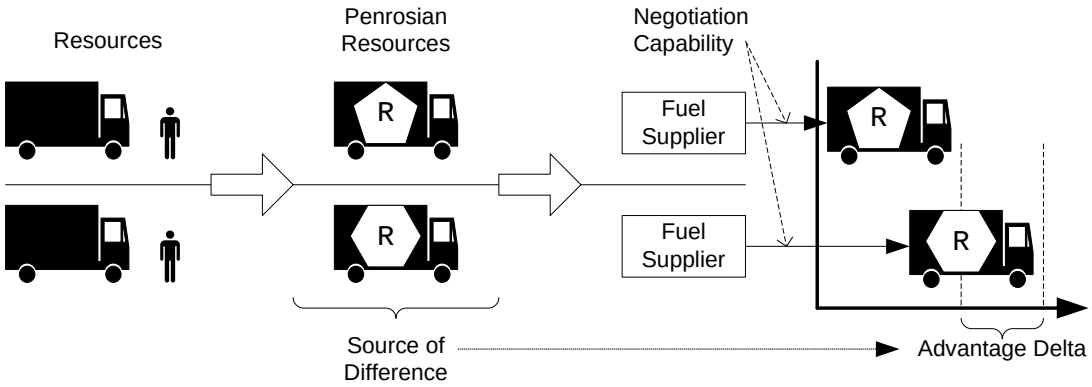


Figure 2.9: Owner-Operator Truck Example—Revisited

On the right hand side of the diagram, consider a particular capability that an O-O would be presumed to possess, namely the capability to negotiate with suppliers and customers. If the bottom O-O has a better developed "negotiation capability" than the top O-O, they may be able to gain some competitive advantage over their competition.

2.3.3 Bridging the Gap: RBV and SCO

The prevailing RBV has been applied to SCM research questions (e.g., Hult et al., 2008; Daugherty et al., 2009). Supply chain relationships can offer rare, valuable and difficult-to-imitate practices—especially with respect to information technology for supply chain information sharing (Wu et al., 2006). RBV research can be done across supply chains; it is not limited to just single company analysis (Hult et al., 2002). Ketchen and Giunipero (2004) establish that a supply chain can be considered an "organization." Hence, RBV theory applicable to strategic organizations can be applied to supply chains. The capability lifecycle of Dynamic RBV "applies to the development paths of capabilities that reach across firm boundaries, such as those involving strategic alliances or supply chains" (Helfat and Peteraf, 2003, p. 1000).

Being able to reconfigure capabilities in response to changes in the environment—for example the effects of the Icelandic volcano that erupted in 2010—requires dynamic capabilities. Understanding when warehouse barcode scanning has reached maturity and a warehouse RFID tagging capability is needed is an instance where a Dynamic RBV approach would prevail. All three segments of RBV theory (resources, capabilities, dynamic capabilities) are present in SCM—depending on the maturity of the supply chain processes (Lockamy and McCormack, 2004).

The RBV can be used to describe the SCM strategy building process used to create competitive advantage in a supply chain (Ketchen and Giunipero, 2004). Hult et al. (2008), "contend that a supply chain orientation can serve as a strategic capability for a firm" (p. 528). Although Porter dismissed the RBV as not being able to "stand on its own," he goes on to postulate: "If you could hook the resource-based view to the value chain, to strategic choices, and ultimately to profit, then you could build a more robust role for resource/capability thinking" (Michael Porter interviewed in Argyres and McGahan (2002) p. 50).

The RBV → value chain (supply chain) linkage has been made through this review of the literature. As well, SCO has been established as a unique, strategic orientation. The impending discussion of §2.6 will restate the outcomes of SCO not as profit, but as a measure of "operational performance." Figure 2.10 illustrates this linkage; the following narrative will discuss this in greater detail.

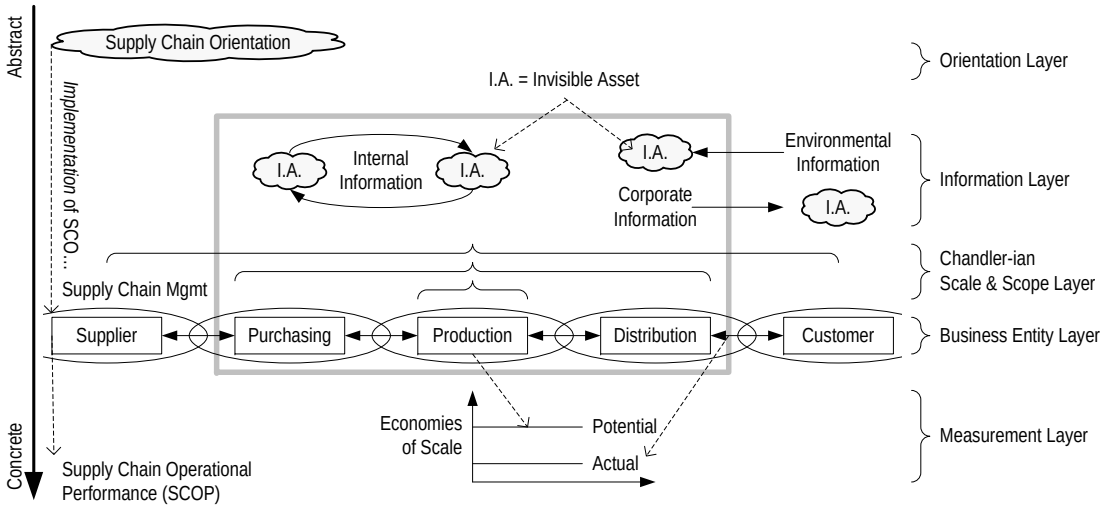


Figure 2.10: Theoretical Model: RBV and SCO

Theoretical Model

Section 2.1.2 indicated that this research is focused on managed supply chains like the one depicted in Figure 2.10. The company and its partners are shown with five "layers" arranged in decreasing abstraction from top-to-bottom. In the top-most layer is Supply Chain Orientation. The left hand side of Figure 2.10 is similar to Figure 2.6 in that if SCO exists, its implementation appears as an SCM function between the company and partner firms. The Supply Chain Management function cuts across the Information, Chandler-ian Scale & Scope, and Business Entity layers. The addition of Supply Chain Operational Performance to measure the SCM function appears in the Measurement Layer and completes the diagram.

The second layer from the top of the managed supply chain is referred to as the Information Layer. This abstract layer within the company is used to introduce the notion of "Invisible Assets." Invisible assets or invisible resources were envisioned by Itami and Roehl (1987) and include intangibles like technology, brand name, culture, and consumer information. They argue that "these invisible resources are often a firm's only real source of competitive edge that can be sustained over time" (Mahoney, 2005, p. 184). Invisible assets meet the VRIN criteria of Barney (1991). Information is key to the creation of these resources and is based on environmental information flowing into the company, corporate information flowing out of the company, and internal information flowing within the company (Mahoney, 2005).

Management, or in this case supply chain management, is a corporate resource to create invisible assets. A product brand for example, will not create itself—it needs to be created, then carefully managed to net returns for the company. As Mahoney (2005) notes, "Invisible assets serve as a focal point of strategy development and growth" (p. 185). Hence the implementation of SCO begets SCM, which allows for the creation of invisible assets—a dynamic capability responsible for corporate growth.

The middle layer in the corporation depicted in Figure 2.10 is refered to as the "Chandler-ian Scale & Scope Layer." The scale and scope arguments of Chandler (1990) directly refer to supply chain and supply chain management in the context of this research:

> The essence of successful firm strategy, Chandler argues, is the making of three interrelated investments: (1) investment in production to achieve the cost advantages of scale and scope; (2) investment in product-specific marketing, distribution, and purchasing networks; and (3) investment in managerial talent and management structure to plan, coordinate, and monitor the firm's often dispersed operations (Mahoney, 2005, p. 168).

The first two investments are depicted as braces within the corporation, the first spanning production, and the second spanning the company's internal supply chain. The third investment is depicted as a brace spanning the entire direct supply chain to capture the notion of coordinated planning and monitoring efforts. This provides support for the claim that SCM and strategy are inexorably linked.

The Business Entity Layer is an combination of the of the direct- and internal- supply chains of Figure 2.2 and is self-exlanatory.

The bottom layer of Figure 2.10 is referred to as the Measurement Layer. This layer is the most concrete of the five. Supply Chain Operational Performance (SCOP) is used here to refer to the general collection of reports, key performance indicators (KPIs), and measurements of supply chain operational effectiveness. This notion will be abstracted shortly into a latent variable for modeling purposes. The "Economies of Scale" graph refers to another idea of Chandler (1990):

> The potential economies of scale and scope are a function of the physical characteristics of the production facilities. However, the actual economies of scale and scope, as measured by throughput, are a function of organizational capabilities (Mahoney, 2005, p. 181).

Thus a plant may be physically capable of producing 100 units, but if the workforce is inexperienced, they may only be capable of producing 95. If the forklift operator is

also inexperienced and drops a pallet, perhaps only 90 get out the door. Thus there is a conceptual way of measuring the otherwise intangible capabilities of an organization.

Where Mentzer et al. (2001) did not have a strategic management theoretical framework as a basis for discussion, this section introduced the reader to the resource-based view of the firm and derivative theories thereof. Taking the advice of Porter and "connecting elements of the resource-based view to the value chain," the ideas encapsulated by Figure 2.10 brought all of the ideas of the section together into one explanatory tool.

2.3.4 SCO as a Resource

Supply chain orientation is a strategic capability (Hult et al., 2008). A SCO results in supply chain management which is a reconfiguration of the resources within the firm; hence SCO is a dynamic capability (Eisenhardt and Martin, 2000). A dynamic capability is an organizational routine (ibid). An organizational routine is an invisible asset; an invisible asset is, in turn, an intangible resource (Itami and Roehl, 1987; Mahoney, 2005). Hence a strategic orientation like SCO is an intangible corporate resource, or more generally a 'resource'.

This is consistent with Godfrey and Hill (1995) who observe: "The power of the [RBV] to explain performance persistence over time is based upon the assumption that certain resources are by their nature unobservable, and hence give rise to high barriers to imitation" (p. 523). As described above, SCO exists in the highly abstract 'Orientation Layer.' SCO is a resource but is not directly observable. As such, SCO is said to be 'latent.'

The implication of SCO being latent is that supply chain orientation cannot be measured directly, but will be reflected in the scores assigned to measurement items. Thus higher scores on the measurement items indicates a higher level of SCO.

2.4 SCO: Reflective Latent Variable

There are any number of modeling techniques available to the social scientist to describe a phenomenon like supply chain management, and any number of research methodologies to gather data for analysis with those models (Kotzab et al., 2005). For the purposes of this research, path modeling—more specifically, structural equation modeling—is used to describe the constructs of interest and the relationship between them. Hair et al. (2006) define a "construct" to be an "unobservable or *latent* concept that the researcher can define in conceptual terms but cannot be directly measured" (p. 707; emphasis in the

original). As established in the previous section, SCO is a construct of interest that is not directly observable; a so-called latent variable.

In contrast with the latent variables like SCO, there are also directly observable "manifest" variables in the model. These are the 7-point Likert-scale measurement items discussed in greater detail in Chapter 3. The "order" qualifier describes the nature of the relationship between the manifest and latent variables. A latent variable made up of manifest variables is said to be a "first-order" latent variable, while a latent variable made up of other latent variables is said to be a "second-order" latent variable. Figure 2.11, which uses the Min and Mentzer (2004) SCO conceptualization, illustrates these concepts.

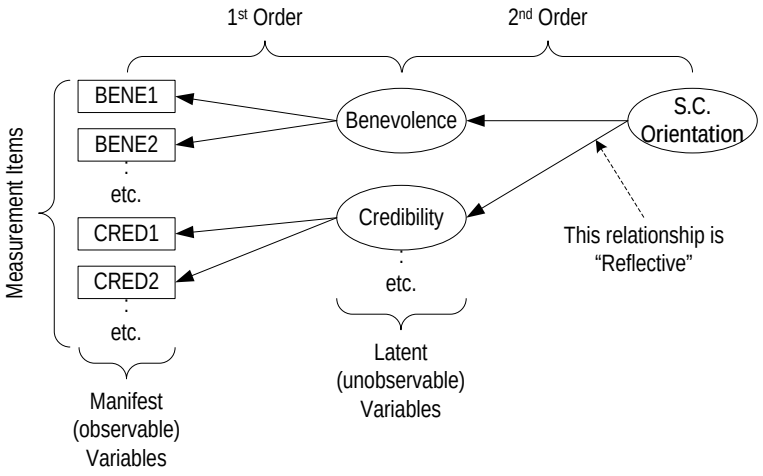
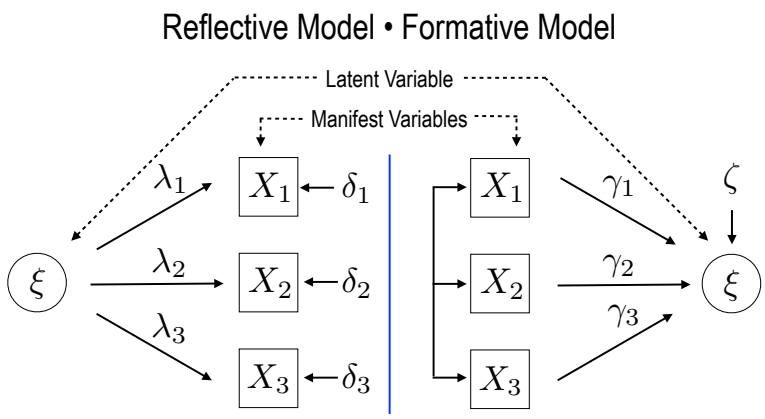


Figure 2.11: Manifest and Latent Variables

In this example, Benevolence is a latent variable because it is not directly observable. In contrast, a manager's agreement on 7-point scale from 1–Strongly Disagree to 7–Strongly Agree to the Benevolence-tapping statement "When making important decisions, our supply chain members are concerned about our welfare" is directly observable. As Churchill (1979) notes, researchers "are much better served with multi-item than single-item measures of their constructs" (p. 66), the chief reason being the increase in reliability with multi-item measures. Hence the rationale for using four measurement items versus a single measurement item to assess the level of Benevolence in an organization.

One critical consideration is the nature of the relationship between variables—is it "reflective" or "formative"? As Coltman et al. (2008) explain, "The distinction between formative and reflective measures is important because proper specification of a measurement model is necessary to assign meaningful relationships in the structural model"

(p. 1251). In a reflective model, the latent construct exists and causality goes from the construct to the items. In a formative model, the opposite occurs: causality goes from the items to the construct so that the construct is 'formed' (Coltman et al., 2008). Figure 2.12 illustrates these ideas.



Adapted from Wilcox et al. (2008) and Coltman et al. (2008)

Reflective Model	Formative Model
$X_1 = \lambda_1\xi + \delta_1$ $X_2 = \lambda_2\xi + \delta_2$ $X_3 = \lambda_3\xi + \delta_3$	$\xi = \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 + \zeta$

Figure 2.12: Reflective and Formative Models (Path Diagrams & Equations)

In a reflective model, changes in the latent variable, ξ, are 'reflected' by corresponding changes in each of the manifest variables, X_i. An increase in ξ say will result in increases in each of $X_i = \lambda_i\xi + \delta_i$ (assuming λ_i positive). Moreover, as Coltman et al. (2008) observe, "Inclusion or exclusion of one or more indicators from the domain does not materially alter the content validity of the construct" (p. 1253).

This is not the case in a formative model where the latent variable, ξ, is 'formed' as a linear combination of the manifest variables X_i. Indeed, "the indicators characterize a set of distinct causes which are not interchangeable as each indicator captures a specific aspect of the construct's domain [and] omitting an indicator potentially alters the nature of the construct" (Diamantopoulos and Siguaw, 2006, p. 1205).

In the supply chain orientation models of Mentzer et al. (2001) and Min and Mentzer (2004), no rationale is provided for why their SCO construct is reflective in nature versus formative. Could this be a methodological legacy or an unstated assumption? As Coltman et al. (2008) note, "Practically all scales in business and related methodological texts

on scale development use a reflective approach to measurement" (p. 1252). Applying the criteria of Coltman et al. (2008) reveals that supply chain orientation is indeed reflective. The construct, as hypothesized, exists independent of the measures. Causality flows from the construct to the items—a higher SCO in an organization should reveal itself with higher cooperative norms, a higher degree of trust, and so forth. Finally, items share a common theme and adding or dropping them does not alter the conceptual domain of the construct.

Having established that SCO is a reflective latent variable, a natural question to pose is: "Is SCO of first-order, second-order, or other configuration?" This question will be addressed by Hypothesis H_1 in §2.7 below. The next section will consider the Min and Mentzer (2004) conceptualization of supply chain orientation before addressing the reconceptualization of SCO which forms the basis of this research.

2.5 The Min & Mentzer (2004) SCO Conceptualization

Forza (2002) suggests that the researcher establish construct names and definitions, propositions, explanations, and boundary conditions to establish the theoretical model. The models of Mentzer et al. (2001) and Min and Mentzer (2004) entail three main constructs: SCO, SCM, and business performance (PERF); these are represented by reflective second-order latent variables in Figure 2.7 on page 39. The definitions of SCO and SCM are the same as presented in the discussion of §2.1. Business performance is a multidimensional construct concerned with product availability; features and quality of product and service offerings; timeliness of order-to-delivery cycle; profitability as measured through ROI, ROA, ROS; and growth, in terms of sales and market share relative to competition. The definitions of the factors for each of the main constructs are found in Table 2.7.

Table 2.7: Min & Mentzer (2004) Factors

Factor	Literature Source	Comments
	Supply Chain Orientation (SCO) Factors	
Trust	Achrol (1991) Morgan and Hunt (1994)	Trust consists of *credibility* and *benevolence*. Determines cooperation and relationship commitment.
Trust: Credibility (CRED)	Anderson and Narus (1990) Dwyer and Oh (1987) Scheer and Stern (1992) **Siguaw et al. (1998)**	A firms belief that its partner stands by its word, fulfills promised role obligations, and is sincere.

continued on next page

Table 2.7: *continued*

Factor	Literature Source	Comments
Trust: Benevolence (BENE)	Deutsch (1958) Larzelere and Huston (1980) Rempel et al. (1985) Anderson et al. (1987) Anderson and Narus (1990) **Kumar et al. (1995)**	Benevolence is a firm's belief that its partner is interested in the firm's welfare, is willing to accept short-term dislocations, and will not take unexpected actions that would have a negative impact on the firm.
Commitment (COMM)	Dwyer et al. (1987, p. 19) **Siguaw et al. (1998)**	Commitment is "an implicit or explicit pledge of relational continuity between exchange partners."
Cooperative Norms (NORM)	Siguaw et al. (1998, p. 102) **Cannon and Perreault Jr. (1999)**	Cooperative norms are "the perception of the joint efforts of both the supplier and distributor to achieve mutual and individual goals successfully while refraining from opportunistic actions."
Organizational Compatibility (COMP)	Cooper et al. (1997a) Cooper et al. (1997b) Lambert et al. (1998b) **Bucklin and Sengupta (1993)**	Compatible corporate culture and management techniques of each firm in a supply chain are necessary for successful SCM.
Top Management Support (TOPM)	Lambert et al. (1998b) Loforte (1993) **Jaworski and Kohli (1993)**	Top management support, which includes leadership and commitment to change, is an important antecedent to SCM, and the absence of it is a barrier to SCM.
Supply Chain Management (SCM) Factors		
Agreed Vision and Goals (VISN)	Lambert et al. (1998b) **Bowersox et al. (1999)**	There should be an agreement on the vision and focus for serving customers for SCM.
Information Sharing (INFO)	Cooper et al. (1997a) Cooper et al. (1997b) Ellram and Cooper (1990) Novack et al. (1995) **Bowersox et al. (1999)**	Mutually sharing information among the supply chain members is required, especially for planning and control processes.
Risk & Reward Sharing (RISK)	Ellram and Cooper (1990) **Bowersox et al. (1999)**	Effective SCM also requires mutually sharing risks and rewards that generate a competitive advantage.
Cooperation (COOP)	Anderson and Narus (1990) **Bowersox et al. (1999)** **Naidu et al. (1999)**	Cooperation refers to similar or complementary coordinated activities performed by the SC members to produce superior mutual or singular outcomes that are mutually expected over time.

continued on next page

Table 2.7: *continued*

Factor	Literature Source	Comments
Process Integration (INTG)	Cooper et al. (1997b) **Bowersox et al. (1999)**	The implementation of SCM needs the integration of processes across time and place in a supply chain from sourcing, to manufacturing, and to distribution.
Long-term Relationship (REL)	Cooper et al. (1997a) Ellram and Cooper (1990) **Bowersox et al. (1999)**	Effective SCM requires partners build, maintain, and enhance long-term relationships.
Agreed Supply Chain Leadership (LEAD)	Lambert et al. (1998b) **Bowersox et al. (1999)**	There should be agreement on supply chain leadership for coordinating and overseeing the whole supply chain.
	Business Performance (PERF) Factors	
Availability (AVAI)	Cooper and Ellram (1993) **Bienstock et al. (1997)**	Improving customer service through increased product availability and reduced order cycle time.
Variety of Product / Service Offerings (P&S)	Bienstock et al. (1997) Min and Keebler (2001) **Global Logistics Research Team (1995)**	Effective customer service includes such critical factors as availability, variety of product/service offerings, and timeliness.
Timeliness (TIME)	Min and Keebler (2001) **Bowersox et al. (1999)** **Bienstock et al. (1997)**	Effective customer service includes such critical factors as availability, variety of product/service offerings, and timeliness.
Profitability (PROF)	Narus and Anderson (1996) **Matsuno et al. (2000)**	Partnerships have the potential benefits of eliminating redundant pools of inventory and duplicate service operations and, therefore, reducing costs.
Growth (GROW)	**Matsuno et al. (2000)**	Growth ultimately brings profitability.

Citations in **boldface** indicate the source of the measurement items used for a factor.
Adapted from Min and Mentzer (2004)

2.6 SCO Re-conceptualized

This section details the re-conceptualization of the SCO model of Min and Mentzer (2004). Figure 2.13 provides an overview of the changes. From left to right, the changes are: a change for top management support from being a reflective first-order latent variable of SCO to being an antecedent to SCO, a modified (additional then refined) set

of indicators for supply chain orientation, the removal of the supply chain management (SCM) factor, and the re-casting of business performance as Supply Chain Operational Performance (SCOP). The rationale for each of these changes will be discussed in turn.

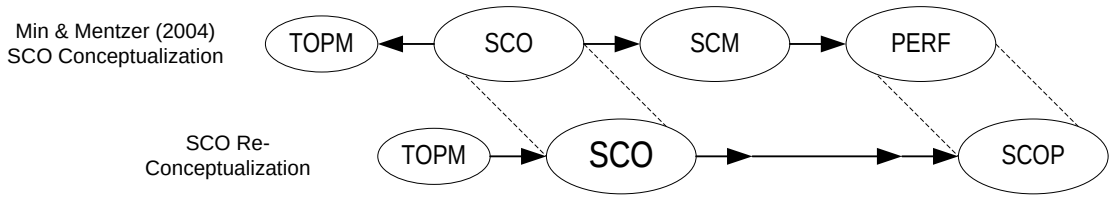


Figure 2.13: Supply Chain Orientation Re-conceptualized

2.6.1 Top Management Support

As Min and Mentzer (2004) note "Each participating firm must have strong top management support as well as compatible corporate culture inside the firm for successful implementation of SCM across firms" (p. 82). The same could be said of any management initiative—top management support will always be required for the initiative to be successful. Min and Mentzer express this condition as a first-order factor of SCO (see Figure 2.7). This research takes the position that top management support is not unique to SCO, but is a requisite condition for the success of the implementation of any corporate strategy. For this reason, the TOPM construct is changed from being an outcome of SCO to being an antecedent to SCO.

In the Min and Mentzer model, an increase in SCO would result in a corresponding increase in TOPM. In the proposed re-conceptualization, a positive increase in TOPM would result in a positive change in SCO, which is more consistent with what one would expect to happen. This modeling change is also consistent with the notion established above that SCO is a strategic "choice" of a company's senior management team. The decision to adopt a SCO must precede the actual adoption of SCO. This temporal relationship is consistent with the causal depiction of Figure 2.13. This effect is formalized in the definition of Hypothesis H_3 in the next section.

2.6.2 Modified Set of SCO Indicators

As Min and Mentzer (2004) anticipate, "It is hoped that future research will follow this study to refine the suggested indicator variables, add additional indicator variables, and

further investigate the relationships among the SCM-related concepts" (p. 84). In addressing these first two points—refine existing indicators and add additional indicators—this research will necessarily result in a modified set of SCO indicators.

With respect to the call to 'add additional indicator variables,' no additional indicator variables are proposed *a priori*. Rather, an exploratory process of interviews with industry experts is recommended to elicit responses which may indicate the presence of additional variables. This approach is different from that of Mentzer et al. (2001) who culled the supply chain management literature for the themes which they developed into the original SCO construct. The quest for the refinement of the SCO construct and any additional factors which may be present in SCO is the basis for this research.

2.6.3 Removal of the SCM Factor

Supply chain management research has borrowed liberally from more established business disciplines like marketing and management (Stock, 1997). If one compares the Min and Mentzer (2004) model of Figure 2.7 with other common business orientations in Figure 2.14, a key difference between these orientation models and the SCO model is the presence of a named management function. In the Market Orientation (MO) models of Narver and Slater (1990) and Kohli and Jaworski (1990) for example, the MO construct leads directly to Business Performance (BP). There is no "Marketing Management" or "Marketing Function" intermediary. Hence the first argument for the removal of the SCM factor from the SCO model is to make it congruent in some sense with other well established "orientation" models.

The second argument for the removal of the SCM factor has to do with scope. Supply chain management happens across firms. The unit of analysis for this research is a single firm. Hence it is not possible to measure SCM across partner companies without analyzing both companies at the same time. Finally, as Min et al. (2007) established, the hypothesis that "Firm SCO positively contributes to firm business performance indirectly through SCM" (i.e., SCO → SCM → PERF) was *rejected* in their research (p. 511).

2.6.4 Recasting PERF as SCOP

The Business Performance (PERF) construct as envisioned by Mentzer et al. (2001) and operationalized by Min and Mentzer (2004) is a multidimensional construct concerned with product availability; features and quality of product and service offerings; timeliness of order-to-delivery cycle; profitability as measured through ROI, ROA, ROS; and growth, in terms of sales and market share relative to competition. Some aspects of

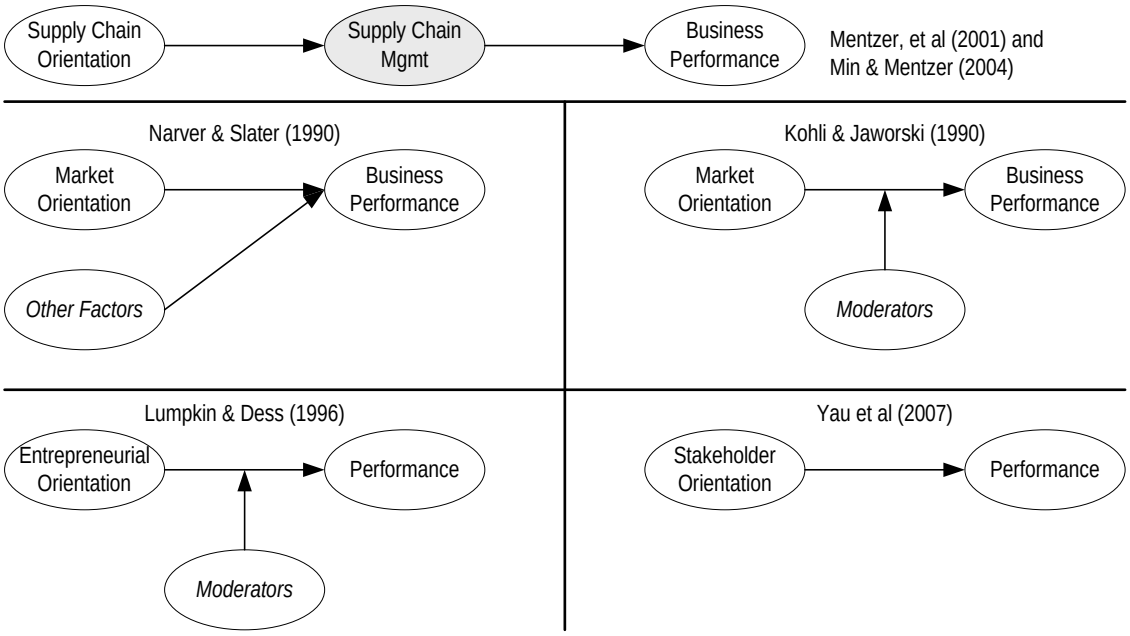


Figure 2.14: Other Orientation → Performance Linkages

the PERF measure, such as stock availability and customer order-to-delivery cycle time, are supply chain related. However, other measures like returns (ROA, ROI, ROS), and a business unit's sales growth can be influenced by many other non-SCM-related factors. Hence the rationale for moving from an overall business performance measure to a supply-chain-centric measure, the so-called "Supply Chain Operational Performance" (SCOP) scale. This scale is explained in more detail in §3.4.5.

2.7 Hypothesis Development

This section will detail the five hypotheses proposed for this research, based on the discussion of literature of the previous sections.

2.7.1 Latent Variable Structure

Supply chain orientation—as envisioned by Mentzer et al. (2001) and tested by Min and Mentzer (2004)—was posited as a reflective second-order latent variable. As mentioned previously, no arguments were made for this particular structure. However, as was shown

in §2.4, SCO is indeed a latent construct and is reflective in nature. The unresolved question regarding SCO is to determine if it is a first-order or second-order latent variable. This gives rise to the first hypothesis of this research, namely:

- H_1: Supply Chain Orientation is a reflective second-order latent variable.

No *a priori* assumptions as to the number of first-order factors that make up supply chain orientation nor the nature of those factors is made.

2.7.2 Operational Performance Linkage

Mentzer et al. (2001) proposed SCO would positively influence PERF. For the reasons described above, PERF is less preferable an outcome measure than SCOP. It is proposed that there is a SCO → SCOP relationship. The nature of this relationship is hypothesized as:

- H_2: SCO is positively related to SCOP.

2.7.3 Top Management Support as Antecedent

As described in the previous section, Top Management Support (TOPM) is an antecedent to, rather than an outcome of, supply chain orientation. Thus,

- H_3: TOPM is an antecedent to SCO.

2.7.4 SCO Across the Supply Chain

Supply chain orientation, as envisioned by Mentzer et al. (2001), is *asymmetric* across companies in the supply chain. They assert that in a direct supply chain (see Fig. 2.1) the

> company in the middle of the direct supply chain may have a SCO, but the two companies on the ends do not (because the supplier is only focused down the supply chain—an historical "channels" orientation and the customer is only focused up the supply chain—an historical "procurement" orientation) (p. 11).

In an extended supply chain (see Fig. 2.2)—where the Earth is the ultimate supplier and there is no downstream flow past the ultimate customer—one could expect a lower level of SCO at the extreme ends of the extended supply chain. In reality though, companies involved in the extraction of minerals and materials from the Earth do have suppliers (e.g., equipment suppliers, fuel suppliers, etc.); the ultimate customer may also be involved with the stewardship of the product after its useful life, so supply chain orientation—viewing the supply chain as an integrated entity—may be no different than the SCO of a company in the middle of the supply chain. Thus,

- H_4: SCO does not vary significantly by supply chain position.

2.7.5 SCO by Generic Strategy

Fisher (1997) introduced the idea of choosing a supply chain strategy based on the nature of the company's product's demand. So-called "functional" products like groceries would be best served by an "efficient" supply chain, whereas "innovative" products like semiconductors require a "responsive" supply chain. Lee (2002) extended the work of Fisher by considering the nature of a product's supply as well. Products may have low or high supply uncertainty depending on underlying supply processes. In addition to the efficient and responsive supply chain strategies posited by Fisher, Lee added "risk-hedging" and "agile" supply chains to the business vernacular.

The definition of supply chain orientation developed in §2.1.3—the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way—is neutral in its language with respect to supply and/or demand uncertainty. This definition should apply as readily to a grocery store chain's view of the supply chain as a high-tech electronics manufacturer's view. Thus,

- H_5: SCO does not vary significantly by generic supply chain strategy.

2.8 Conclusion

This chapter set out to develop the four components of theory as delineated by Wacker (1998) as they apply to supply chain orientation. First, from among the myriad of definitions of supply chain, supply chain management, and supply chain orientation, the most applicable and appropriate definitions for this research were uncovered. Supply chain

orientation was found to be a unique, strategic orientation in the domain of strategic orientations. While diagrams are not theory (Sutton and Staw, 1995), Figure 2.10 brought the elements of the resource-based view of the firm, dynamic capabilities, and invisible assets together with a supply chain and the strategic SCO orientation. Finally the five hypotheses described above were developed from this material. Figure 1.5, "SCO Model and Research Hypotheses," is shown again below to reiterate the five hypotheses in the context of the larger SCO model. The next chapter details the mixed-methods methodologies used to test the hypotheses developed in this chapter.

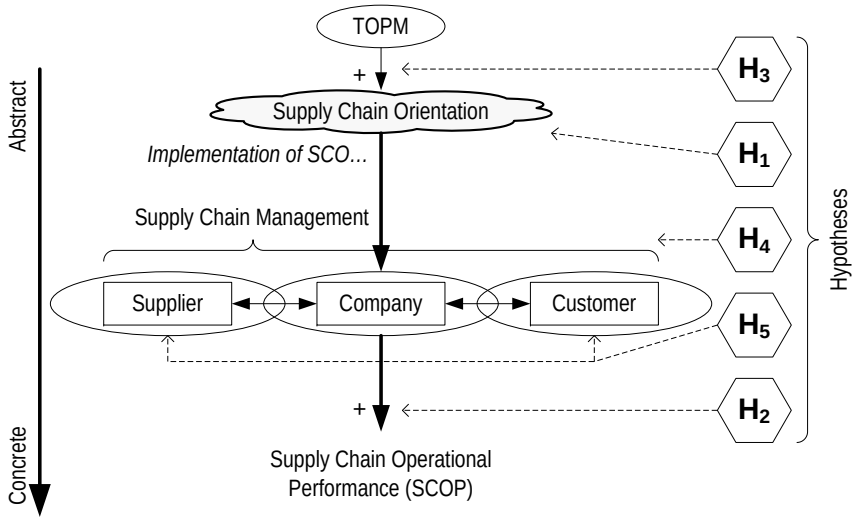


Figure 2.15: SCO Model and Research Hypotheses (Redux)

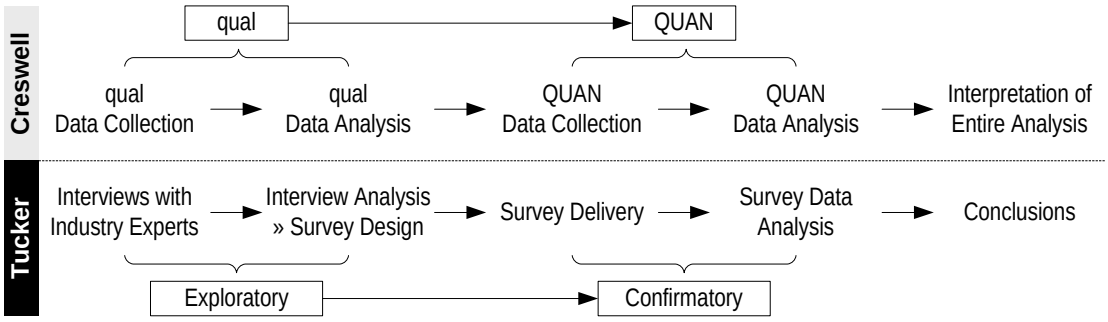
Chapter 3

Methodology

> *This paper advocates that* all *graduate students learn to utilize and to appreciate both quantitative and qualitative research. In so doing, students will develop into what we term as* pragmatic researchers.
> —Onwuegbuzie and Leech (2005, p. 375; emphasis in original).

This chapter details the methods used to address the hypotheses posed in Chapter 2. This research used the sequential exploratory approach advocated by Creswell (2003)—see Figure 3.1 for details. Among other uses, the sequential exploratory strategy explores phenomena of interest, tests emergent theories, and develops tests of new instruments—all applicable to this research (Creswell, 2003).

Although this chapter focuses mostly on the details of the qualitative and quantitative research methods used, it also explores other methodological issues. The first section provides justification for the underlying constructivist and post-positivist paradigms and the choice of a mixed methods approach. The following section outlines the *exploratory* research (interview) phase. The discussion of the *confirmatory* research (survey) phase comprises two sections: a discussion of the design considerations of the survey and an examination of the many issues related to the administration of the survey. This chapter concludes with a discussion of relevant ethical considerations. In addition to describing the methodology employed, the results of the survey and insight into the data collected provide a preface to the analyses reported in Chapter 4.



Adapted from Creswell (2003).

Figure 3.1: Sequential Exploratory Design

3.1 Justification: Paradigm & Methodology

3.1.1 Pragmatism Paradigm

The nature of the research questions should influence the philosophical paradigm of the research; the paradigm in turn should govern the choice of research methods. For example, the research question "Are there additional factors related to the SCO construct?" requires a theory-building (constructivist) philosophy. Constructivism is associated with qualitative research techniques. Likewise, downstream research to validate a refined SCO scale requires a theory-testing (positivist or post-positivist) philosophical paradigm, which calls for the use of quantitative methods (Creswell, 2003; Johnson and Onwuegbuzie, 2004; Morgan, 2007). As Morgan (2007) notes, "a pragmatic approach would redirect our attention to investigating the factors that have the most impact on what we choose to study and how we choose to do so" (p. 70).

Although researchers in the past debated whether to use qualitative methods *or* quantitative methods, the consensus in the social sciences today is towards using *both* qualitative and quantitative methods (Howe, 1988, 1992; Onwuegbuzie and Leech, 2005; Woodside, 2010). As Johnson and Onwuegbuzie (2004) note, "By utilizing quantitative and qualitative techniques within the same framework, mixed methods research can incorporate the strengths of both methodologies" (p. 23). Since the research questions fall into different philosophical domains, methods from those domains must be used. Hence a "mixed methods" approach was deemed the most appropriate way to address the research questions at hand.

Given the decision to use a mixed-methods approach, the next step is to determine

which approach to use. Johnson and Onwuegbuzie (2004) detail a 2×2 mixed method design matrix that asks the researcher to determine whether or not the qualitative and quantitative paradigms have equal status, and second, to determine whether or not the phases of the research should be carried out simultaneously or sequentially. For this research, the qualitative interviews will be used to inform and develop the quantitative survey questions; hence the answer to the second question becomes "This research is sequential in nature" with the qualitative research preceding the quantitative research. However, the answer to the first question, paradigm status, is less straightforward.

The three possibilities to describe the nature of the priority or weight (dominance) which exist are enumerated here using the notation of Creswell (2003):

- Both paradigms have equal status, that is, $\boxed{\text{QUAL}} \rightarrow \boxed{\text{QUAN}}$
- Qualitative is dominant, that is, $\boxed{\text{QUAL}} \rightarrow \boxed{\text{quan}}$
- Quantitative is dominant, that is, $\boxed{\text{qual}} \rightarrow \boxed{\text{QUAN}}$

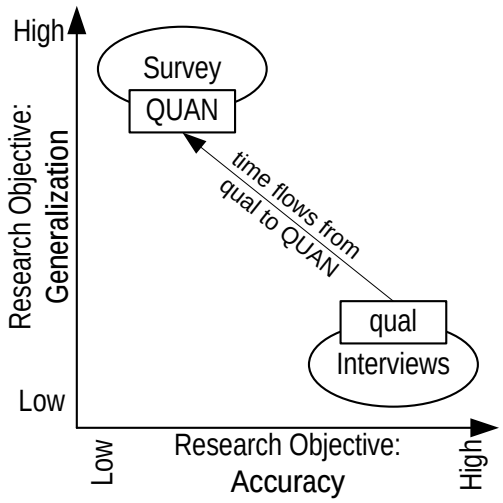
Although Johnson and Onwuegbuzie (2004) have provided a mixed-methods research typology, they offer no guidance on how to assess dominance or equality. Creswell (2003) provides some suggestions, one being to consider "the extent of treatment of one type of data or the other" (p. 212). Given that most of the analysis was directed toward the survey data, the $\boxed{\text{qual}} \rightarrow \boxed{\text{QUAN}}$ notation becomes appropriate in this case.

Paradigm Weakness

What can we lose by adopting an approach that is both qualitative and quantitative? To illustrate, one can take the linear $\boxed{\text{qual}} \rightarrow \boxed{\text{QUAN}}$ approach—which incorporates only one dimension, time—and position it in two dimensional space, bounded by two axes: the ability of the method to provide generalizable results and the accuracy of the method. This "attainment of objectives" space is illustrated in Figure 3.2, consistent with the work of Woodside (2010). The underlying dilemma is that interview techniques can provide highly accurate information that may not be generalizable beyond the interviewee's context.

Conversely, a fixed-point survey, although highly generalizable, is less accurate than an interview. This lower accuracy comes from the inability of the respondent to interact with the researcher to clarify terms used in the measurement items. Additionally, the response will only be as accurate as the number of points on the scale whereas a response to an interview question on the same topic can be augmented with additional language

(e.g., adjectives, anecdotes) making for a more accurate response. As Woodside (2010) notes, "Thorngate's (1976) 'postulate of commensurate complexity'… states that it is impossible for a theory of social behavior to be simultaneously general, accurate, and simple and as a result organizational theorists inevitably have to make tradeoffs in their theory development" (p. 66).



Adapted from Woodside (2010).

Figure 3.2: The Sequential Exploratory Design method superimposed on Attainment of Objectives space

In fact, trade-offs need not be made (Woodside, 2010). By recognizing the strengths and weaknesses of the various methods, the researcher can *strengthen* a method by leveraging the qualities of another method (Sieber, 1973). "When designing a mixed study… the research should strategically combine qualitative and quantitative methods, approaches, and concepts in a way that produces complementary strengths and nonoverlapping weaknesses" (Johnson et al., 2007, p. 127).

Finally, it is important to observe that the qual and QUAN labels refer to the research *processes* applied. The labels "exploratory" and "confirmatory" will be used instead of qual and QUAN respectively for the remainder of this thesis. This exploratory / confirmatory nomenclature is more consistent with that found in the field of Management Science. The exploratory research methods will be discussed next.

3.2 Exploratory Research: Interviews

The purpose of the interviews was two-fold. The primary goal was to identify any additional factors associated with SCO. This was done through a series of open-ended questions. The second goal was to get feedback on the existing SCO model factors and the SCO → Performance linkage. Refer to Appendix C for the complete interview script.

3.2.1 Expert Interviews

Interview participants were recruited from my various contacts developed through industry; Appendix A gives the protocol used for e-mail and telephone recruitment of participants. The participants were chosen to provide a broad spectrum of supply chain management experience and expertise. Before each interview, the participants were given an Interview Consent Form (Appendix B) to read, sign, and return. Because each participant's identity and company would remain anonymous, alphabetically ordered pseudonyms (i.e., **A**ndy, **B**etty, . . . , **I**van) and labels (Ⓐ to Ⓘ) are used to refer to the participants. Although the participant's job title in Table 3.1 is not disguised, the company he or she works for is made generic to ensure anonymity.

Figure 3.3 categorizes the interview participants by supply chain function and geographic scope. Within the supply chain function, information was gathered from manufacturers, an automotive assembler, and logistics services providers. Within manufacturing there were perishable and non-perishable products; as well, commodity and non-commodity products were represented. For example, Donald's company produces perishable products that require three distinct supply chain operations: two separate "cold chains" (frozen product and refrigerated product), and a regular supply chain for perishable but temperature-stable product.

Five of the participants came from companies with their own logistics operations. There was considerable diversity among these operations. Betty's company, for example, controls a large fleet of ocean going vessels and has an extensive rail presence in North America, whereas the other companies manage truck operations almost exclusively. Frank's company is an early adopter of and well known leader in Vendor Managed Inventory (VMI) practices with its customers.

The other four participants came from Third-Party Logistics Providers (3PLs). The rationale for using 3PL senior executives for the interviews was that one participant could comment on a variety of supply chain situations they have experienced from within their client base. Among the 3PL companies there was also diversity: Andy's company provides 3PL services to a large customer base, although Gary's company has one customer—a single large national retailer.

The geographic scope of the organizations ranges from Ontario-based and Canadian-focused enterprises, to truly global companies. Figure 3.3 shows the scope of the operations under the management of the interview participant. Frank, for example, works for a large global convenient foods producer, but has direct responsibilities for only the Ontario-Central Canada operations. In addition to their industry expertise, two of the interview participants have taught undergraduate and graduate supply chain management classes; one of these participants has written a transportation textbook.

Table 3.1: Anonymized List of Interview Participants

Pseudonym	Actual Job Title • Generic Company Description
Andy	Vice President Operations • Canadian / North American Integrated 3PL
Betty	Director – Global Supply Chain • Global Base Chemicals Manufacturer
Charles	VP Commercial/Logistics • Global Food Company
Donald	Senior Director – Strategic Customer Services • Large Canadian Food Company
Edward	President & CEO • Large North American Logistics Services Company
Frank	Director – Operations • Large Global Snack & Ready Foods Company
Gary	Chief Operating Officer • Warehousing & Logistics for Large Global Retailer
Harold	President & CEO • Logistics Focused Large Crown Corporation
Ivan	Production Control & Purchasing • Global Automotive Assembly Company

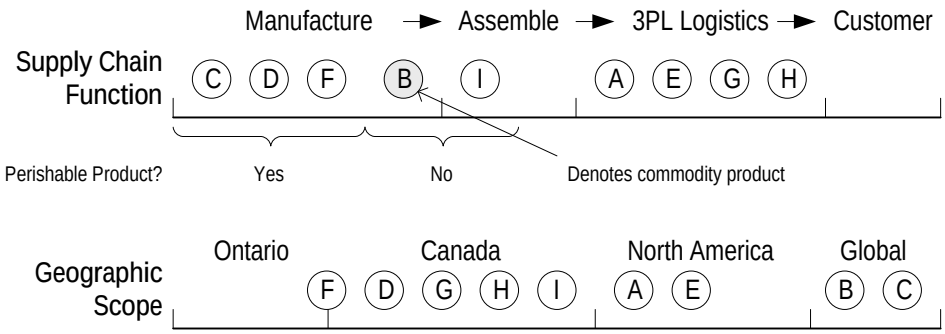


Figure 3.3: Interview Participants: Breadth Across Two Dimensions.

3.2.2 Interview Design

The interview design for this research may be described as structured and ethnographic in nature. The interview itself is structured, in that a set script is used to ask specific questions; however, there is room within the structure of the interview to explore SCO-related ideas as they arise. The interview design is ethnographic in two senses. First, as Flynn et al. (1990) describe: "Ethnographic interviewing facilitates discovery of what is meant by specific concepts" (p. 259), the concept of interest of course being supply chain orientation. Second, the structure of the interview script is best described as a hierarchy. It begins with high-level, open-ended questions like "If I used a term like *supply chain orientation*, what comes to mind?" Then the interview script continues, becoming increasingly focused on SCO with questions like "Consider this simple supply chain—a supplier, a company, and a customer; in which type of company would you expect to find a supply chain orientation?" The notion of supply chain orientation that the participant uses to answer this question is the same notion that has already been developed through the conversation from the start—hence the rationale for the ethnographic qualifier.

Interviews were conducted during the summer of 2007. After the nine interviews, redundancy started to set in—no new ideas were being solicited from the interview participants. Additional details will be discussed shortly in Section 3.2.4. At that stage, participant recruitment ceased. Flynn et al. (1990) suggest that interview transcription followed by content analysis is good practice—this approach was taken in this research. Because of technical difficulties, my telephone interview with Ivan was the only one that was recorded by hand; the other interviews (telephone or in-person) had the audio recorded. A telephone interview was recorded directly to computer using Parliant's PhoneValet software. In-person interviews were recorded using an Olympus VN-480PC digital voice recorder. All of the interviewees consented to having the interview recorded, and all of the interviews were transcribed into text documents using ResearchWare's HyperTRANSCRIBE product.

3.2.3 Analysis & Discussion

After transcription, the text-based cases were analyzed using ResearchWare's HyperRESEARCH software. HyperRESEARCH allows for the easy coding of the interviews by presenting the data in a hierarchy—a research "project" consists of many "cases" (interviews) to which many codes are applied. The text of each case are associated with codes I created to capture the semantics of the discussion. These codes are re-used for subsequent interviews. The software then produces frequency statistics and other reports for the overall research project. Even though HyperRESEARCH can attach codes directly

to multimedia files (i.e., the audio recordings of the interviews), I chose to work with text-based transcriptions so I could quickly scan or search the interview for bits of meaning. The Researchware website claims that the HyperRESEARCH product has "been in use by researchers in the social sciences and other fields since it was first introduced in 1991."

Using the terminology of Graneheim and Lundman (2004), the *unit of analysis* was the interview, the *meaning unit* or *coding unit* was phrases, statements, or sentences from the interview that contained a particular meaning. Coding units were assigned *codes* (single words or short phrases), the codes were reused throughout the interview and with other interviews.

The transcriptions contain mostly "digital" data—the speaker and the actual words used in the conversation. Data from non-verbal communication, so called "analogue" data, like word emphasis, facial expression, etc. was not captured in the transcription process. Since "meaning is partly created by how a message is communicated, that is, the voice or implied feeling that emerges from the reading of the text," some meaning will have been lost in analyzing the transcripts alone (Graneheim and Lundman, 2004, p. 111).

After analyzing the nine interviews, 36 codes were created. The most frequently stated codes are detailed in Table 3.2. From this analysis, the two themes of "Measurement Propensity" and "SCM Capability" were extracted.

Table 3.2: Interview Analysis: Code Frequencies

Code	Frequency
Measurement Propensity	7.5%
KPI – Key Performance Indicator	6.6%
SCO attributes	5.7%
Senior SCM Exec	5.7%
Tactical vs. Strategic	4.7%
Capability	3.8%
Education and Training	3.8%
SCO Example	3.8%

In addition to the frequencies, there were some interesting ideas about SCO developed through the interview process. As mentioned elsewhere, supply chains exist whether they are managed or not. Andy made a similar observation about SCO, namely "In the end I could look at every company and say well they have to have a Suppy Chain Orientation at some level. For some where it becomes critical to their business and for

others its a nice-to-have." Hence, when supply chain becomes 'critical to their business,' SCO will elevated and manifest itself as SCM.

When asked about the existing (i.e., Mentzer et al. (2001) / Min and Mentzer (2004)) incarnation of SCO, with its commitment, cooperative norms, and other factors and whether or not these ideas might be used to describe Suppy Chain Orientation, *benevolence* elicited guffaws and critical comments. Donald indicated that "Benevolence isn't one that I'd trot out very quickly" [to describe SCO]. Betty chuckled and said "Benevolence? No one is benevolent." When asked if these were things that top management cared about, Andy evaluated the terms and observed, "There were some kind of esoteric ones like 'benevolence' and things like that," the connotation being that SCM in practice was different from SCM ideas in the academy.

With respect to other points, Charles indicated that "Trust would certainly help to facilitate [SCM]. But do you have to have trust in order to focus on it, make things happen? I'm not sure that's the case." The implication here is that trust would aid in the facilitation of a supply chain management function, but its not a requisite condition. Similarly, Betty commented that "Compatibility... you could say that with any function. You know, the marketing function could be too. Its broader than just supply chain." The insinuation here is that compatibility, cooperative norms, trust and so forth might be important considerations for any business-to-business relationship, be it a supply chain management relationship or a marketing relationship or the outsourcing of a business function like Information Technology or Payroll to third-party service provider.

3.2.4 Saturation

As Guest et al. (2006, p. 65) discuss, "theoretical saturation occurs when all of the main variations of the phenomenon have been identified and incorporated into the emerging theory." Were a sufficient number of interviews conducted to reach saturation of the SCO phenomenon? The consensus theory of Romney et al. (1986) asserts that "experts tend to agree more with each other (with respect to their particular domain of expertise) than do novices" Guest et al. (2006, p. 74). The "floor" for saturation in Romney et al.'s case was as few as four interviews. Guest et al. found saturation had occurred after twelve interviews, with meta-themes emerging in as few as six.

Within the supply chain management research literature, there seems to be less clarity. Holmberg (2000) reached saturation after 33 interviews within various echelons *of the same company*. Golicic et al. (2002) reached saturation after 22 interviews with respondents from eight different firms, although Fugate et al. (2006) reached saturation after 13 interviews across nine firms. These last two papers referred to the work of McCracken (1988), who contends that "for most research projects, eight respondents will

be perfectly sufficient" (p. 17). Since the purpose of the interviews was exploratory in nature and focused on only one concept—supply chain orientation—the convergent data from the nine interviews were deemed sufficient to proceed.

3.2.5 Conclusions: New SCO Themes

The code frequencies generated by HyperRESEARCH presented in Table 3.2 were analyzed for common themes. "Measurement Propensity"—the most frequent appearing code—and similar codes like KPIs were bundled together into a measurement propensity theme. The other theme that emerged from this data was that of SCM Capability. SCM Capability encompassed frequently appearing ideas about SCM senior management in the CxO suite, actual capabilities, and education and training. These two themes from the interview data are described in greater detail below:

SCM Capability This term refers to the degree to which an organization is *capable* of undertaking supply chain management activities. This capability is at a high-level. For example, one common sub-theme was whether or not there was supply chain expertise in the CxO suite. Another sub-theme was related to the use of Electronic Data Interchange (EDI). SCM Capability would be concerned with whether or not the company was capable of implementing EDI with another company versus whether or not the company was using EDI-856 advance shipping notice (ASN) transactions. There is a natural progression from knowledge and understanding to training and expertise to systems and processes—akin to a capability maturity model.

Measurement Propensity A second common theme in the interviews was measurement, be it through the use of supply chain management key performance indicators (KPIs) or benchmarking, and so forth. Gunasekaram et al. (2001), for example, list 44 potential SCM KPIs. It is not practical to enumerate all of them in the survey; rather, the intent is to determine whether the company shows a *propensity* to use quantitative measures in the management of its operations.

Relationship to the Literature

After being identified and defined from the interview data, the two themes were vetted with the extant literature.

SCM Capability speaks to the maturity of four basic SCM processes: plan, source, make, and deliver (ignoring 'return'—the reverse logistics process) (SCC, 2009). Lockamy and McCormack leveraged the software engineering Capability Maturity Model idea and applied it to supply chain management. Using the terminology of Lockamy and McCormack, if an organization that has a high, integrated level of SCM processes they would have a higher SCM Capability than an organization at a low, ad hoc level of SCM processes. At the highest level of maturity, organizational silos are broken down (Lockamy and McCormack, 2004).

In order to achieve SCM capability, the workers within the company need to be trained in SCM practices, a requirement consistent with the mission statement of the Canadian Supply Chain Sector Council (CSCSC, 2010). Further, in order to facilitate the exchange of goods (physical supply chain) and money (fiscal supply chain), an organization requires information exchange capabilities. Thus SCM capability measurement items need to examine both the inter-firm and the intra-firm capabilities.

Measurement Propensity Although the common sub-theme of "how visible is SCM in the CxO suite" was discussed in the SCM Capability section, this idea also applies to measurement propensity. If supply chain managers or directors are part of the CxO suite, then it is likely that supply chain management KPIs are included as part of the overall management KPIs for the organization. As Storey et al. (2006) found, "The predominant method of performance measurement was the use of KPIs that cascaded down from top level business objectives and measures, through the organisation into a series of functional measures" (p. 767). Benchmarking, a long established operations management improvement process, is another critical measurement idea related to SCM (Davis, 1993; Beamon, 1999; Bhutta and Huq, 1999; Gunasekaram et al., 2001).

Working from the interview transcripts and related literature, measurement items for these themes were developed. The measurement items were vetted in an iterative process with my thesis supervisor and colleagues at Wilfrid Laurier University. The wording of the measurement items and item source provided in Table 3.3. The descriptive statistics are in Table 3.7.

Table 3.3: New SCO Measurement Items (Pre-Survey)

Label	Measurement Item Wording [source]
MEASP1	Our company includes supply chain related key performance indicators (KPIs) as part of our overall corporate KPIs. [Interviews]
MEASP2	Our company engages in benchmarking activities to compare our operations and processes against those of our competitors or service providers in our industry. [Interviews]

continued on next page

Table 3.3: *continued*

Label	Measurement Item Wording [source]
MEASP3	Our company measures our ability to deliver against Marketing's promises to our customers. [Interviews]
MEASP4	Our company uses staff performance measurements that encourage and reward supply chain performance.
CAPA1	Our company fosters supply chain management expertise through formal training and career development programs. [Interviews]
CAPA2	Our company has eliminated functional silos that result in ineffective processes and delays of information in our organization structure. [Lockamy and McCormack (2004)]
CAPA3	Supply Chain Managers / Directors are part of our company's Senior Executive team. [Interviews]
CAPA4	Our company is able to share data and information EXTERNALLY with our suppliers and customers through electronic data interchange (EDI) or other integrated computer systems.
CAPA5	Our company is able to share data and information INTERNALLY across internal functional areas through enterprise resource planning (ERP) or other integrated computer systems.
CAPA6	Our company does collaborative planning, forecasting, and replenishment with our SUPPLIERS.
CAPA7	Our company does collaborative planning, forecasting, and replenishment with our CUSTOMERS.

Note: CAPA denotes SCM Capability items; MEASP denotes Measurement Propensity items.

This section described the exploratory research undertaken using interviews, the subsequent analysis of the interview data, and the synthesis of the Measurement Propensity and SCM Capability themes from that data. These themes were developed into sets of measurement items for inclusion in the confirmatory research piece which follows, namely the survey.

3.3 Confirmatory Research: Survey Design

This section details the design of the survey instrument, beginning with five important survey design issues that apply to the entire survey. The discussion is concerned with the use of single key informants in research, the order of the questions, Likert scale point count, data categorization, and survey delivery options. The section then explores each of the six main parts of the survey and the demographics section and discusses the completed pre-launch survey design.

3.3.1 Survey Design Issues

Single Informant Issues

An important consideration is this common research dilemma: the unit of analysis for this work is the *company*, yet the source of the data is a single *key informant* selected to report on his or her company. Can a manager or executive adequately capture in a web-delivered survey the salient pieces of supply chain orientation for his or her entire organization? The weaknesses of the single informant approach include informant bias, inaccurate past event recall, idiosyncratic error, and social desirability (Kumar et al., 1993). Attempting to interpret correlations between variables dependent upon a single informant introduces the issue of *common method variance* (CMV) (Campbell and Fiske, 1959; Podsakoff and Organ, 1986). Some authors have called for the single informant approach to be abandoned, others suggest moving toward a multiple informant approach—a strategy what would create its own set of research problems (Phillips, 1981; Seidler, 1974; Bagozzi et al., 1991; Kumar et al., 1993).

As Mason and Harris (2005) observe, "The vast majority of market orientation studies involve data collection from single respondents, despite the recognition since the early 1980s that single informant research is likely to be unrealistic and unreliable. With few exceptions, the main response of researchers is to acknowledge the manifest weaknesses of the approach without taking any remedial or corrective action" (p. 375). Although a previous paragraph in this thesis has acknowledged those issues, taking 'remedial or corrective action' is not feasible within the design of the survey.

Academic opinion of CMV is polarized between a criteria for automatic desk-rejection of scholarly work and 'urban legend' (Chang et al., 2010). Ex ante techniques—like the collection of data from multiple sources or alternate response formats and alternate forms with different wording of items—were not included due to the additional time required to do so. Different sources (e.g., Podsakoff et al., 2003; Chang et al., 2010) provide a decision tree to determine post hoc statistical remedies, like a Harman one-factor analysis or a single-common-method-factors approach as a means to detect and control CMV. These methods will be discussed in detail later.

In addition to CMV, one also needs to consider the possible impact of CMB—Common Methods *Bias*. Common methods bias is not the same as common methods variance. As Meade et al. (2007) explain, "Whereas CMV implies that *variance* in observed scores is partially attributable to a methods effect, CMB refers to the degree to which *correlations* are altered (inflated) due to a methods effect" (p. 1; emphasis added). However, their research has concluded that "In many cases, CMB may be trivially small and certainly does not necessarily jeopardize the validity of study conclusions in every case" (Meade et al., 2007, p. 4).

Question Order

The next issue in the survey design concerned the order of the questions. Should all the measurement items for a given construct be grouped together in the survey or should they be randomly ordered? For example, the twenty supply-and-demand uncertainty framework questions require the respondent to consider a simplified supply chain diagram and then respond to as many as seven measurement items on the screen before moving to the next screen. Although a randomized approach to the questions could be taken, it is more efficient to introduce the framework followed by the measurement items than to randomly repeat the measurement items and associated diagram many times throughout the survey instrument (Couper, 2001).

One downside to the grouping together of related items is the potential for increased inter-item correlation (Couper, 2001). Although so-called 'order effects' have been found to exist, their impacts are unknown (Schwarz et al., 1991; Krosnick, 1999). As McFarland (1981) found, "The more specific the content of a question and the more concrete the required response, the less susceptible the question is to order effects" (p. 213). For this survey, senior managers are being queried about their own company's supply chain situation. With 106 questions on the survey, the argument for efficiency and expediency put forward by Couper outweighs any possible order-effects issues.

Likert Scale Point Count

A third design consideration is the number of points to use on a Likert scale. The original Min and Mentzer (2004) SCO survey used a 7-point Likert scale with responses anchored from 1 (strongly disagree) to 7 (strongly agree). Continued use of the 7-point Likert scale is warranted because neither scale reliability nor validity is enhanced by using more scale points (Netemeyer et al., 2003). Although the examples in Dillman (2000) embody the "strongly agree … strongly disagree" order, use of the "strongly disagree … strongly agree" order is consistent with other sources (e.g., Netemeyer et al. (2003)); it is also consistent with Principle 2.9 of Dillman (2000) stating both sides of an attitude scale, and with Principle 2.6 of using equal numbers of positive and negative categories. This approach includes a neutral point, scored at 4. In the final survey instrument design, these principles are reinforced visually by using font accents like italics and colour—green for agree and red for disagree.

Likert Scale Data Treatment

How should the Likert data be treated? Stevens (1946) categorized scale data as nominal, ordinal, interval, and ratio then prescribed statistics that were permissible to data in those categories. An as-yet-unresolved controversy continues is whether or not Likert scale data, although ordinal in nature, can be considered interval (Michell, 1986; Dawis, 1987; Velleman and Wilkinson, 1993; Jamieson, 2004). As Clason and Dormody (1994) assert "It is not a question of right and wrong ways to analyze data from Likert-type items. The question is more directed to answering the research questions meaningfully" (p. 34).

Indeed, the ordinal-interval data issue was rarely if ever mentioned in commonly used texts dealing with surveys or scale construction (e.g., Dillman, 2000; Netemeyer et al., 2003; Groves et al., 2004). In supply chain management research, surveys with ordinal scales were found to be the most commonly used research method; most researchers used analytical techniques like structural equation modeling on this non-interval data (Kotzab, 2005). This research relies on the scale development approach of DeVellis (2003) who observes: "Although, strictly speaking, items using Likert or semantic differential response formats may be ordinal, a wealth of accumulated experience supports applying interval-based analytic methods to the scales they yield" (p. 159).

Survey Delivery Mechanism

For this type of questionnaire, several delivery mechanisms are available, such as telephone survey, mail survey, and web-based survey. Some authors contend that web-based surveys have response rates similar to those of traditional mail-based surveys (Kaplowitz et al., 2004; Baruch and Holtom, 2008). Advantages of web-based surveys, other than low cost, include the removal of phone-related interviewer bias, removal of the time and cost to transcribe traditional mail-related paper responses, and overall convenience (Van Selm and Jankowski, 2006).

The initial decision for the the web-based delivery of the survey centered on whether to host the survey on a University of Waterloo (UW) server or on an external, non-UW server. UW has site licences for SensusWeb and phpESP. The advantage of using these tools is that a survey URL like:
`http://someurl.uwaterloo.ca/SupplyChainSurvey`
appears more "legitimate" than an externally hosted URL like:
`http://www.surveymonkey.com/s.aspx?sm=WZcagKsj7TnvTWRsRc2URA`.

SensusWeb had a steep learning curve and non-intuitive interface. Surveys created by phpESP appeared dated rather than modern. Building a survey from scratch using PHP and hosting it on the UW Management Sciences department server was another possibility, but it would take the researcher considerable time to ensure the survey code was bug-free. Mail management tools would also need to be written, or sourced from the open-source-software community—again, a large commitment of time.

A number of "software as a service" (SaaS) questionnaire administration options were reviewed (e.g., Vovici.com, ClassApps.com, SurveyMethods.com, Zoomerang.com, QuestionPro,com, SurveyGizmo.com, et al) and I ultimately decided that SurveyMonkey.com provided the best solution for purposes of this research. SurveyMonkey's offering provided the mail management toolset, offered an easy to use interface, and generated a professional quality survey. The remaining subsections of the survey discussion will detail each survey component in the order in which they appear in the survey.

Web Survey Best Practices

Dillman and Bowker (2001) outline fourteen principles for the design of web-based surveys. While the basis for these principles is the reduction of sampling, coverage, measurement, and non-response error in the survey, they also increase the level of survey usability. Not all principles were applied however. For example, Dillman and Bowker's suggestion to "Provide a PIN number for limiting access only to people in the sample" was not applicable since the survey was not publicly available; it could only be accessed through an URL included in the invitation e-mail. A principle like "Use graphical symbols or words that convey a sense of where the respondent is in the completion process, but avoid ones that require significant increases in computer memory" is a default of the SurveyMonkey.com toolset and did not need to be explicitly included during the survey authorship process. A checklist of the Dillman and Bowker principles and commentary for this research appears in Table 3.4. Annotated screen captures from the SurveyMonkey survey are presented in Figures 3.4, 3.5, and 3.6.

Table 3.4: Design of Web Surveys Principles

Dillman and Bowker (2001) Design of Web Surveys Principle ☞ ***Commentary with respect to this research.***
1. Introduce the web questionnaire with a welcome screen that is motivational, emphasizes the ease of responding, and instructs respondents on the action needed for proceeding to the next page. ☞ *The opening page delineates the Office of Research Ethics information. It establishes the voluntary nature of the survey and the approximate 20 minute time frame.*

continued on next page

Table 3.4: *continued*

Dillman and Bowker (2001) Design of Web Surveys Principle ☞ ***Commentary with respect to this research.***
2. Provide a PIN number for limiting access only to people in the sample. ☞ *Not required; not a publicly accessible survey.*
3. Choose for the first question an item that is likely to be interesting to most respondents, easily answered, and fully visible on the first screen of the questionnaire. ☞ *See Figure 3.4.*
4. Present each question in a conventional format similar to that normally used on paper self-administered questionnaires. ☞ *Yes. Supply and demand uncertainty measurement items read from "low" to "high"; all others read Strongly Disagree to Strongly Agree across all survey screens*
5. Restrain the use of color so that figure/ground consistency and read-ability are maintained, navigational flow is unimpeded, and measurement properties of questions are maintained. ☞ *SurveyMonkey's cascading style sheets (CSS) ensure that the spacing between response radio buttons remains consistent; background colour is neutral*
6. Avoid differences in the visual appearance of questions that result from different screen configurations, operating systems, browsers, partial screen displays and wrap-around text. ☞ *Again, CSS technology removes browser specific / idiosyncratic behaviour*
7. Provide specific instructions on how to take each necessary computer action for responding to the questionnaire and other necessary instructions at the point where they are needed. ☞ *Links to "Exit this survey…" and navigation buttons to go to the Next and Previous screens are provided by the SurveyMonkey tool*
8. Use drop-down boxes sparingly, consider the mode implications, and identify each with a "click here" instruction. ☞ *Drop-down boxes only used for the categories in the demographics section at the end of the survey.*
9. Do not require respondents to provide an answer to each question before being allowed to answer **any** subsequent ones. ☞ *There were no requirements for respondents to answer any questions; they had complete control over page navigation as well.*
10. Provide skip directions in a way that encourages marking of answers and being able to click to the next applicable question. ☞ *There was no skipping logic required for this survey.*
11. Construct web questionnaires so they scroll from question to question unless order effects are a major concern, and/or telephone and web survey results are being combined. ☞ *As discussed above, order effects were considered, but deemed less important than survey navigation.*

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Table 3.4: *continued*

Dillman and Bowker (2001) Design of Web Surveys Principle ☞ ***Commentary with respect to this research.***
12. When the number of answer choices exceeds the number that can be displayed in a single column on one screen, consider double-banking with an appropriate grouping device to link them together. ☞ *This did not occur with the choice of seven categories for questions and sparse titles.*
13. Use graphical symbols or words that convey a sense of where the respondent is in the completion process, but avoid ones that require significant increases in computer memory. ☞ *Refer to Figure 3.5; status bar is a default in SurveyMonkey.*
14. Exercise restraint in the use of question structures that have known measurement problems on paper questionnaires, e.g., check-all-that-apply and open-ended questions. ☞ *Not required for this survey.*

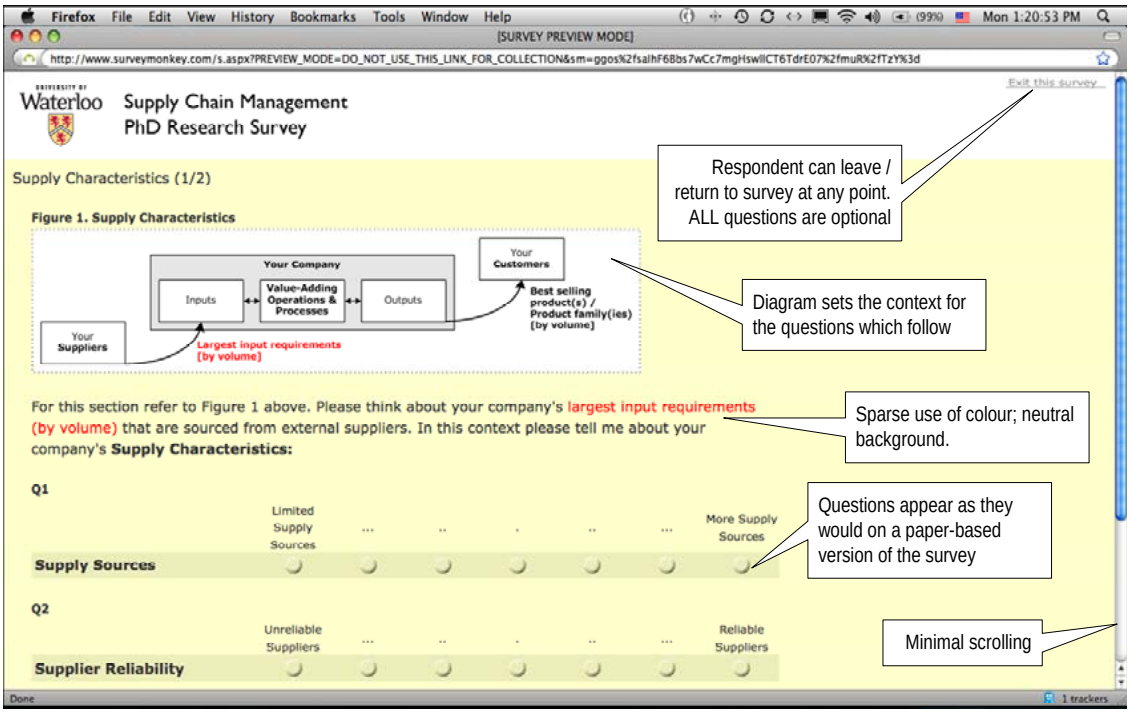

Figure 3.4: Start of Survey after "Welcome" screen

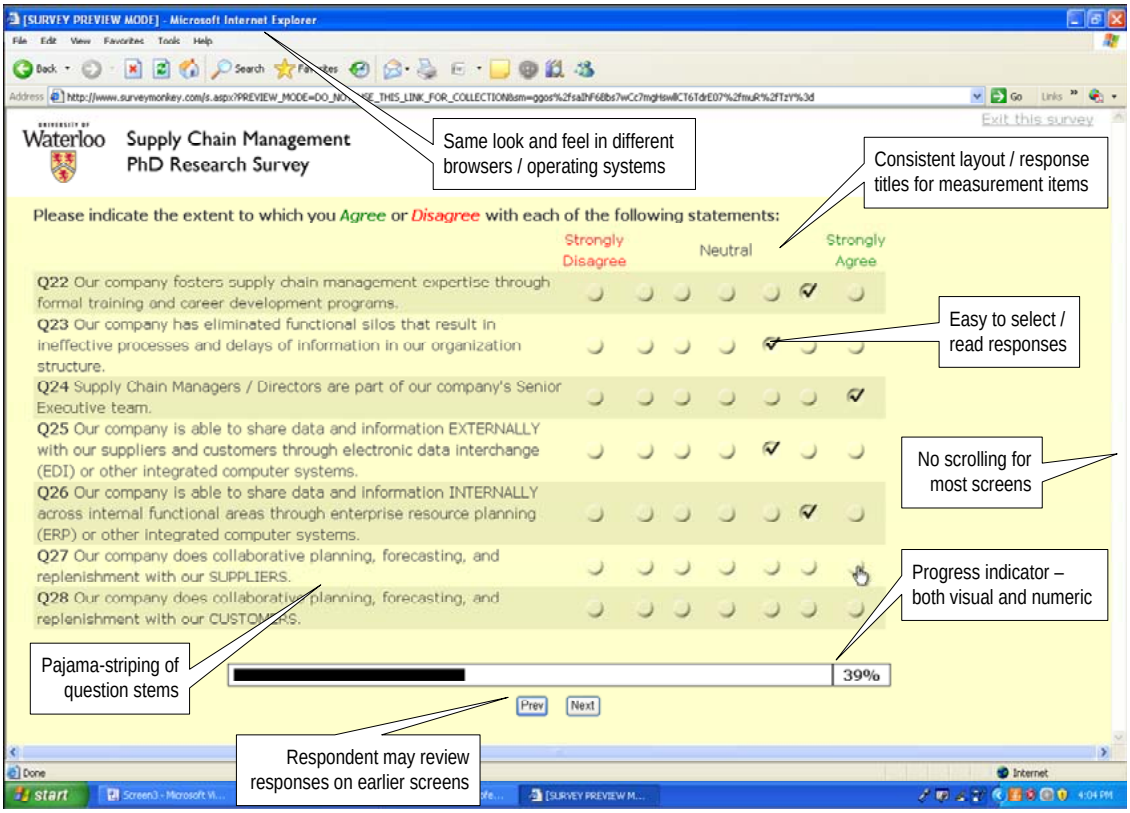

Figure 3.5: Typical SurveyMonkey Screen

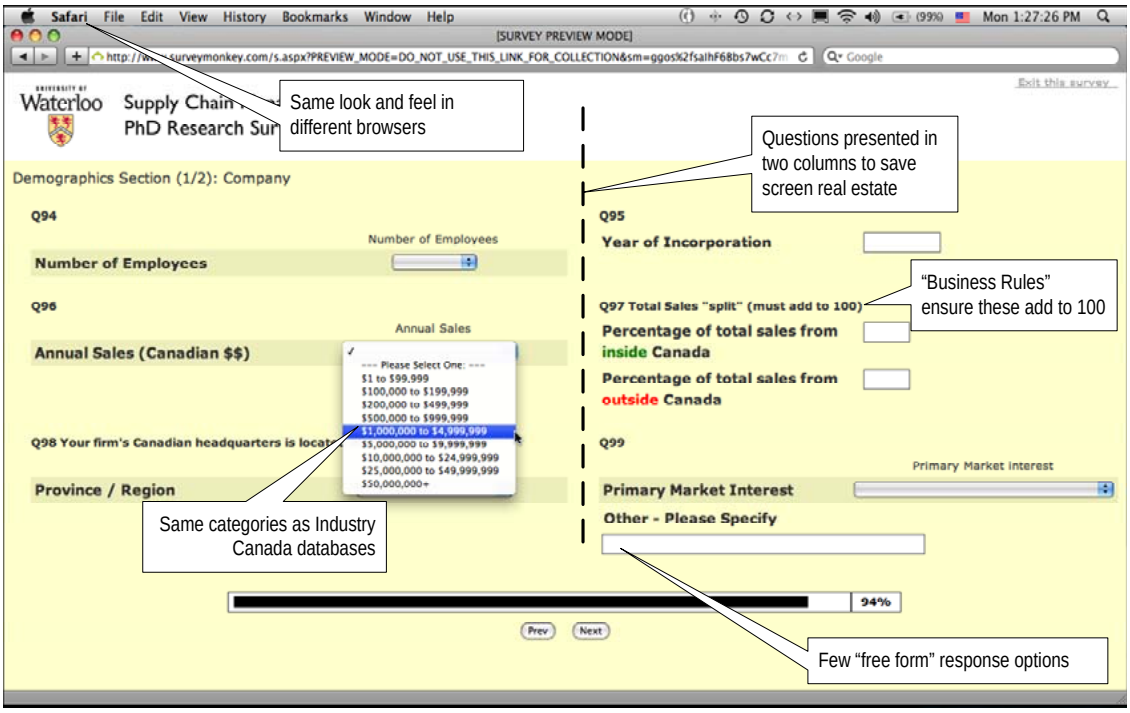

Figure 3.6: Demographics Information Screen

3.4 Survey Questions

3.4.1 Part I: Lee Model

In order to address Hypothesis H_5—whether or not SCO varies by generic supply chain strategy—the Lee (2002) supply and demand uncertainty framework needed to be operationalized. Lee posited 20 characteristics of uncertainty—10 for supply and 10 for demand. The operationalization of the Lee model was straightforward: typically a one-to-one mapping of the characteristics onto anchors on 7-point Likert-like scales. For example, a supply characteristic like "Supply Sources" was anchored with 'limited supply sources' on one end and 'more supply sources' on the other.

I say "Likert-like" scales were used because these scales do not measure agreement with a particular statement per se, but rather measure affinity toward an uncertainty characteristic. This approach does meet several of the principles of writing survey questions as espoused by Dillman (2000). For example, the measurement items use short phrases with simple (non-jargon) words. There is a balance between the number of 'positive' and 'negative' categories, there is a neutral point, and the categories are mutually exclusive.

The measurement items were set up to read 'low' to 'high,' but the underlying uncertainty scale was typically 7 points to 1 point. Using the example of SU01—Supply Sources, limited supply sources has higher supply uncertainty associated with it, and hence the score is 7. Conversely, an item like DU04—Inventory Cost would retain the low $\rightarrow$ high *reading* order, but its underlying uncertainty scale values become $1 \ldots 7$ (high cost being indicative of high uncertainty). The item design also includes asking the participants to frame their responses about supply and demand in terms of "largest input requirements by volume" and "best-selling product(s)." This option was chosen to focus on inputs and outputs that would require the greatest *supply chain management effort*—rather than ask the participants to consider, for example, the most expensive part or highest margin product. Table 3.5 details the measurement items, their anchor points, and ordering as well as providing the descriptive statistics for the Lee model portion of the survey. Refer to the survey in Appendix G for the full lay-out and wording of the questions. This set of 20 easy-to-answer questions were positioned strategically at the beginning of the survey, so that the survey participant would very likely commit to continuing the survey after investing time on the first 20 questions.

Table 3.5: Lee Model Measurement Items and Results

Label	"Low"	Measurement Item	"High"	Order	Mean	S.D.
Context: respondents asked to consider "largest input requirements (by volume)"						
SU01	Limited Supply Sources	**Supply Sources**	More Supply Sources	7 to 1	4.11	1.793
SU02	Unreliable Suppliers	**Supplier Reliability**	Reliable Suppliers	7 to 1	2.73	1.382
SU03	Variable Lead Time	**Lead Time**	Dependable Lead Time	7 to 1	3.38	1.606
Context: respondents asked to consider their company's "operations and processes"						
SU04	Inflexible	**Flexibility**	Flexible	7 to 1	2.74	1.573
SU05	Difficult to Changeover	**Changeover**	Easier to Changeover	7 to 1	3.16	1.598
SU06	Vulnerable to Breakdowns	**Breakdowns**	Less Breakdowns	7 to 1	3.00	1.493
SU07	Potential Capacity Constrained	**Capacity**	Less Capacity Constraint	7 to 1	3.73	1.509
SU08	More Process Changes	**Process Changes**	Less Process Changes	7 to 1	3.44	1.356
SU09	Potential Quality Problems	**Quality Problems**	Less Quality Problems	7 to 1	3.09	1.449
SU10	Variable and Lower Yields	**Yield**	Stable and Higher Yields	7 to 1	3.09	1.306
Context: respondents asked to consider "best selling product(s) / product family(ies) [by volume]"						
DU01	Low Demand Uncertainty	**Demand Uncertainty**	High Demand Uncertainty	1 to 7	4.39	1.546
DU02	Lower Volumes per SKU	**Volumes / SKU**	Higher Volumes per SKU	7 to 1	4.38	1.546
DU03	Low Product Variety	**Product Variety**	High Product Variety	1 to 7	4.64	1.801
DU04	Low Inventory Cost	**Inventory Cost**	High Inventory Cost	1 to 7	4.15	1.703
DU05	Low Profit Margins	**Profit Margin**	High Profit Margins	1 to 7	4.12	1.614
DU06	Low Stockout Cost	**Stockout Cost**	High Stockout Cost	1 to 7	4.04	1.622
DU07	Low Obsolescence	**Obsolescence**	High Obsolescence	1 to 7	2.95	1.627
DU08	Difficult to Forecast	**Demand Forecast**	More Predictable Demand	7 to 1	4.86	1.585
DU09	Short Selling Season	**Product Life**	Long Product Life	7 to 1	2.32	1.410
DU10	Variable Demand	**Demand Variability**	Stable Demand	7 to 1	4.32	1.615

Note: Labels SUxx connote Supply Uncertainty, while DUxx connotes Demand Uncertainty

3.4.2 Part II: Supply Chain Position

Does a company like Dell, which is well down the supply chain, have a different level of supply chain orientation than a company like Teck Mining, which extracts copper from the earth to make the wires which go into Dell's products? To ascertain whether or not SCO varied across the supply chain, a measurement item to identify a company's relative "position" within the supply chain had to be included in the survey.

One approach to this data-gathering problem was developed by New and Payne (1995) as shown in Figure 3.7. Their method provides seven possible supply chain positions. However, it also includes six inter-positional indicators and allows the respondent to "check all that apply." Because of the combinatorial complexities this approach creates, it was dropped in favour of a simpler "choose-one-of-seven-categories" approach.

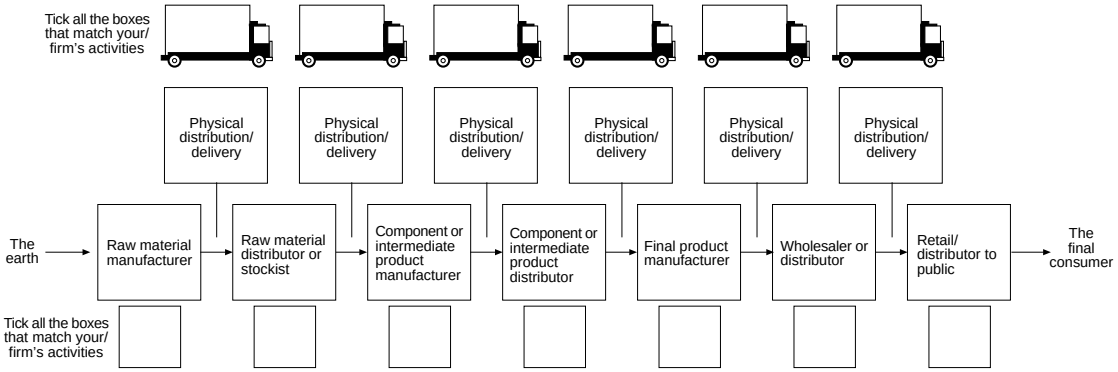

Figure 3.7: Supply Chain Position indicator as developed by New and Payne (1995)

The seven-category approach reorients the vertical "extended" supply chain of Figure 2.2 to the horizontal arrangement of Figure 3.8. The supply chain positions are numbered from 1 (ultimate supplier) to 7 (ultimate customer). To avoid having every respondent choose the "4. Focal Firm" option, detailed instructions, as well as an example, were provided. Refer to the survey in Appendix G for details.

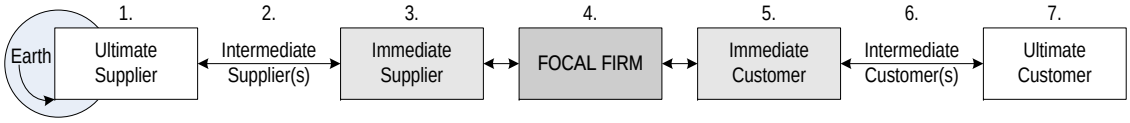

Figure 3.8: Supply Chain Position indicator for this research

As the results of Table 3.6 indicate, while a majority of respondents (45.4%) identified with the "Focal Firm" position indicator, there was a variety of responses both upstream and downstream on the supply chain from this midpoint.

Table 3.6: Supply Chain Position Results

	Ultimate Supplier	Intermediate Supplier	Immediate Supplier	FOCAL FIRM	Immediate Customer	Intermediate Customer	Ultimate Customer
Count	10	22	40	103	18	23	11
Proportion	4.4%	9.7%	17.6%	45.4%	7.9%	10.1%	4.8%

3.4.3 Part III: New SCO Themes

As discussed already, the SCM Capability and Measurement Propensity themes identified from the interviews and expanded upon from the literature were developed into sets of measurement items and included in this survey at this stage. Table 3.7 includes the descriptive statistics post-survey; the measurement item text is the same as Table 3.3.

Table 3.7: New SCO Measurement Items and Results

Label	Measurement Item Wording	Mean	S.D.
MEASP1	Our company includes supply chain related key performance indicators (KPIs) as part of our overall corporate KPIs.	3.43	1.846
MEASP2	Our company engages in benchmarking activities to compare our operations and processes against those of our competitors or service providers in our industry.	3.46	1.817
MEASP3	Our company measures our ability to deliver against Marketing's promises to our customers.	4.97	1.686
MEASP4	Our company uses staff performance measurements that encourage and reward supply chain performance.	3.99	1.792
CAPA1	Our company fosters supply chain management expertise through formal training and career development programs.	3.32	1.674
CAPA2	Our company has eliminated functional silos that result in ineffective processes and delays of information in our organization structure.	4.56	1.448
CAPA3	Supply Chain Managers / Directors are part of our company's Senior Executive team.	4.46	1.989
CAPA4	Our company is able to share data and information EXTERNALLY with our suppliers and customers through electronic data interchange (EDI) or other integrated computer systems.	3.89	2.252

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Table 3.7: *continued*

Label	Measurement Item Wording	Mean	S.D.
CAPA5	Our company is able to share data and information INTERNALLY across internal functional areas through enterprise resource planning (ERP) or other integrated computer systems.	4.66	1.952
CAPA6	Our company does collaborative planning, forecasting, and replenishment with our SUPPLIERS.	3.96	1.916
CAPA7	Our company does collaborative planning, forecasting, and replenishment with our CUSTOMERS.	4.08	1.751

Note: CAPA denotes SCM Capability items; MEASP denotes Measurement Propensity items.

3.4.4 Part IV: Original SCO Construct

The 20 measurement items from Min and Mentzer (2004) used in the survey are detailed in Table 3.8. Table 3.9 shows the four measurement items that had minor wording changes made to them, along with the rationale for those changes.

Table 3.8: Original Min & Mentzer SCO Measurement Items and Results

Label	Measurement Item Wording	Mean	S.D.
BENE1	When making important decisions, our supply chain members are concerned about our welfare.	4.33	1.608
BENE2	When we share our problems with our supply chain members, we know they will respond with understanding.	4.67	1.464
BENE3	In the future we can count on our supply chain members to consider how their decisions and actions will affect us.	4.48	1.541
BENE4	When it comes to things that are important to us, we can depend on our supply chain members' support.	4.79	1.437
COMP1	Our business unit's goals and objectives are consistent with those of our supply chain members.	4.78	1.339
COMP2	Our CEO and the CEOs of our supply chain members have similar operating philosophies.	4.65	1.382
CRED1	Promises made to our supply chain members by our business unit are reliable.	5.23	1.309
CRED2	Our business unit is knowledgeable regarding out products and/or services when we are doing business with our supply chain members.	5.40	1.254
CRED3	Our business unit does not make false claims to our supply chain members.	5.91	1.297
CRED4	Our business unit is open in dealing with our supply chain members.	5.67	1.217

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Table 3.8: *continued*

Label	Measurement Item Wording	Mean	S.D.
COMM1	We defend our supply chain members when outsiders criticize them.	5.28	1.302
COMM3	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	5.47	1.295
NORM1	Our business unit is willing to make cooperative changes with our supply chain members.	5.24	1.286
NORM2	We believe our supply chain members must work together to be successful.	5.70	1.200
NORM3	We view our supply chain as a value added piece of our business.	5.67	1.256
TOPM1	Top managers repeatedly tell employees that this business unit's survival depends on its adapting to supply chain management.	4.32	1.639
TOPM2	Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business unit's success.	4.79	1.613
TOPM3	Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business unit's success.	4.43	1.624
TOPM4	Top managers repeatedly tell employees that sharing risk and rewards with our supply chain partners is critical to this business unit's success.	4.33	1.583
TOPM5	Top management offers various education opportunities about supply chain management to line employees.	3.55	1.765

Table 3.9: Measurement Item Wording Changes from Min & Mentzer Design

Measurement Item Wording Change and Rationale
CRED4 was "Our business unit is not open in dealing with our supply chain members," now reads: "Our business unit is open in dealing with our supply chain members." ☞ Rationale: Positive wording.
COMM1 was "We defend our supply chain members when outsiders criticize them, if we trust them," now reads: "We defend our supply chain members when outsiders criticize them." ☞ Rationale: Uncertain who was 'them' in previous version, supply chain members or outsiders.
TOPM4 was "Top managers repeatedly tell employees that sharing risk and rewards is critical to this business unit's success," now reads: "Top managers repeatedly tell employees that sharing risk and rewards with our supply chain partners is critical to this business unit's success." ☞ Rationale: Clarifies with whom risk and reward are shared.

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Table 3.9: *continued*

Measurement Item Wording Change and Rationale
TOPM5 was "Top management offers various education opportunities about supply chain management," now reads: "Top management offers various education opportunities about supply chain management to line employees." ☞ Rationale: Indicates who would be receiving the training.

3.4.5 Part V: Supply Chain Operational Performance

The business performance (PERF) construct of Min and Mentzer (2004) has been replaced with Supply Chain Operational Performance (SCOP) based on work by Beamon (1999). As discussed previously, some aspects of the Min and Mentzer (2004) PERF measure, such as stock availability and customer order-to-delivery cycle time, are supply chain related. However, other measures like returns (ROx: return on assets, return on investment, and return on sales), and a business unit's sales growth can be influenced by non-SCM-related factors and non-company factors, providing the rationale for moving from an overall business performance measure to a supply-chain-centric measure.

How can supply chain operational performance be measured in survey form? Gunasekaram et al. (2001) developed a framework for measuring the performance of a supply chain which had over 40 individual performance metrics sorted by level, that is strategic, tactical, and operational, and was further categorized by financial and non-financial measures. This framework, while extensive, is not conducive to being measured with a survey instrument. Consider the strategic-level performance metric "total supply chain cycle time" (TSCCT). What are meaningful units of measure? Days? Weeks? Do these apply to the entirety of a company's product line or some portion thereof? Since the respondent base is Canadian manufacturers, how can a meaningful comparison be drawn between the TSCCT of a sheet metal company and the TSCCT of a nuclear monitoring products business? This issue is highlighted in the Beamon's 1999 paper "Measuring supply chain performance":

> One of the most difficult areas of performance measure selection is the development of performance measurement systems. This involves the methods by which an organization creates its measurement system... However, a generally applicable systematic approach to performance measurement has not been developed. Different types of systems require specific measurement system characteristics, and therein lies the difficulty in creating such a general approach (p. 277).

Beamon synthesized the various measures into three classes: resources, output, and flexibility. Table 3.10 summarizes her work. Because no SCOP scale existed, measurement items for the Resource, Output, and Flexibility factors were developed and vetted with academic colleagues.

Table 3.10: Goals of Performance Measure Types

Performance measure type	Goal	Purpose
Resources	High level of efficiency	Efficient resource management is critical to profitability.
Output	High level of customer service	Without acceptable output, customers will turn to other supply chains.
Flexibility	Ability to respond to a changing environment	In an uncertain environment, supply chains must be able to respond to change.

from Beamon (1999, Table III, p. 281)

The Resource factor was measured using six measurement items: two items (cost decrease and improved efficiency) across three business functions (manufacturing, inventory, and distribution). Output was measured across five variables: production levels, cycle times, availability, on-time deliveries, and lead time. Flexibility was assessed across four categories: volume, delivery, product mix, and new product flexibilities. The criteria of Coltman et al. (2008) were used to establish that the SCOP latent variable is reflective. The measurement items developed for SCOP appear in Table 3.11. Section 4.5 includes a more detailed analysis of the reliability and validity of the SCOP scale.

Table 3.11: Supply Chain Operational Performance (SCOP) Measurement Items

Label	Measurement Item Wording	Mean	S.D.
FLEX1	Over the past two years, the VOLUME FLEXIBILITY (i.e. the ability to change the output level of products produced) at your company has INCREASED.	4.91	1.324
FLEX2	Over the past two years, the DELIVERY FLEXIBILITY (i.e., the ability to change planned delivery dates) at your company has INCREASED.	4.97	1.185
FLEX3	Over the past two years, the MIX FLEXIBILITY (i.e., the ability to change the variety of products produced) at your company has INCREASED.	4.90	1.362
FLEX4	Over the past two years, the NEW PRODUCT FLEXIBILITY (i.e., the ability to introduce and produce new products – including modification of existing products) at your company has INCREASED.	5.10	1.338

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Table 3.11: *continued*

Label	Measurement Item Wording	Mean	S.D.
OUTP1	Over the past two years, PRODUCTION LEVELS (i.e., number of items produced) at your company have INCREASED.	4.89	1.874
OUTP2	Over the past two years, CYCLE TIMES (i.e., time required to produce a particular item or set of items) at your company have DECREASED.	4.79	1.514
OUTP3	Over the past two years, AVAILABILITY (i.e., reduced backorders / stockouts, improved available-to-promise) at your company has INCREASED.	4.72	1.390
OUTP4	Over the past two years, the number of ON-TIME DELIVERIES (i.e., product shipped to customers) at your company has INCREASED.	5.05	1.407
OUTP5	Over the past two years, the LEAD TIME (i.e., elapsed time between customer order receipt and order delivery) at your company has DECREASED.	4.67	1.518
RSRC1	Ignoring inflation and increased energy costs, our manufacturing costs TODAY have DECREASED compared to these same manufacturing costs at this time two calendar years ago; i.e., our product costs less to produce today than two years ago.	3.61	2.026
RSRC2	Our business unit has become more efficient with respect to manufacturing.	5.11	1.359
RSRC3	Ignoring inflation, our inventory costs (i.e., total value held in inventory both work-in-process and finished goods) TODAY have DECREASED compared to these same inventory costs at this time two calendar years ago.	3.68	1.764
RSRC4	Our business unit has become more efficient with respect to inventory.	4.91	1.355
RSRC5	Ignoring inflation and increased energy costs, our distribution costs TODAY have DECREASED compared to these same distribution costs at this time two calendar years ago.	3.59	1.634
RSRC6	Our business unit has become more efficient with respect to distribution.	4.61	1.263

3.4.6 Part VI: Stakeholder Orientation

Including a Stakeholder Orientation (StkO) scale provides an opportunity to test for discriminant validity, i.e., that SCO and StkO are indeed separate constructs. For this purpose, the stakeholder orientation model of Yau et al. (2007) was adopted. It is an "orientation of orientations" model—a second-order reflective latent variable comprised of four first-order latent variables: Customer, Competitor, Shareholder, and Employee

Orientations. These four sub-orientations are consistent with other authors, for example the multiple stakeholder orientation profile (MSOP) of Greenley et al. (2005). Refer to Figure 3.9 for details.

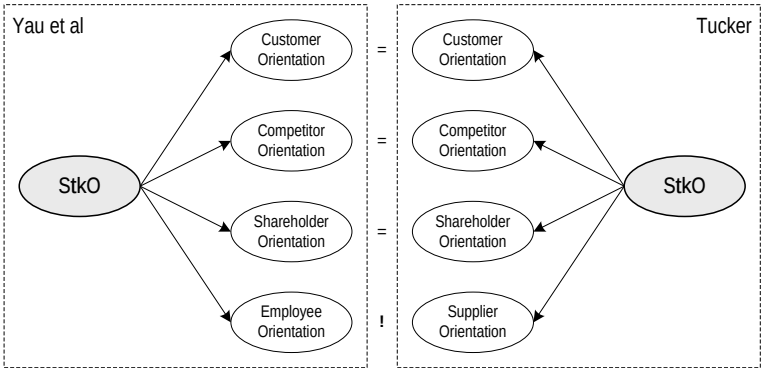


Figure 3.9: Stakeholder Orientation

Supply chain orientation has elements of the first three StkO orientations—a focus on the customer, being responsive to information from the marketplace, to ultimately create value for the shareholders. The employee orientation portion of the model, which included measurement items like "We have regular staff meetings with employees" and "As a manager, I try to find out the true feelings of my staff about their jobs," (Yau et al., 2007, p. 1314) was removed as it was sufficiently different from the notion of SCO.

In its place a newly developed Supplier Orientation variable was created. Measurement items were adapted from the Supplier Relationships section of a SCM capability assessment model developed by Lummus and Vokurka (2000). The notion of supplier orientation was adopted to include the upstream end of the supply chain in the stakeholder orientation. The downstream end was already covered by the customer orientation.

No wording changes were made to the measurement items for either Customer, Competitor, or Shareholder Orientations. The newly created Supplier Orientation factor consists of four measurement items. The measurement item wording and descriptive statistics are detailed in Table 3.12, while the discussion of §4.6 examines the reliability and validity of this scale.

Table 3.12: Stakeholder Orientation (StkO) Measurement Items and Results

Label	Measurement Item Wording	Mean	S.D.
SO-COMPx: Stakeholder Orientation → Competitor Orientation			
SO-COMP1	Sales people share information about competitors.	5.06	1.468
SO-COMP2	Top management regularly discuss competitors' strengths and weaknesses.	5.04	1.494
SO-COMP3	We achieve rapid response to competitive actions.	5.16	1.345
SO-COMP4	Customers are targeted when we have an opportunity for competitive advantage.	5.36	1.388
SO-CUSTx: Stakeholder Orientation → Customer Orientation			
SO-CUST1	Competitive strategies are based on understanding customer needs.	6.16	0.960
SO-CUST2	Customer satisfaction is systematically and frequently assessed.	5.59	1.319
SO-CUST3	Our commitment of serving customer needs is closely monitored.	5.67	1.298
SO-CUST4	Close attention is given to after-sales service.	5.63	1.312
SO-CUST5	Our objectives and strategies are driven by the creation of customer satisfaction.	5.92	1.142
SO-COMPx: Stakeholder Orientation → Shareholder Orientation			
SO-SHAR1	Our objectives are driven by creating shareholder wealth.	4.92	1.521
SO-SHAR2	Senior managers have regular meetings with shareholders.	4.76	1.626
SO-SHAR3	We regularly compare our share value to that of our competitors.	3.54	1.731
SO-SHAR4	We regularly carry out public relations aimed at shareholders.	3.47	1.629
SO-SHAR5	Designated managers have responsibility for aiming to satisfy shareholders' interests.	4.05	1.743
SO-COMPx: Stakeholder Orientation → Supplier Orientation			
SO-SUPP1	Our company has long-term agreements with suppliers.	4.29	1.905
SO-SUPP2	We regularly provide our major suppliers with our business plans and demand projections.	3.52	1.861
SO-SUPP3	Our operations people regularly confer with our suppliers' contact people on issues like quality.	4.93	1.572
SO-SUPP4	Our suppliers have a vested interest in the success of our company.	4.93	1.580

3.4.7 Part VII: Demographics

At the end of the survey, 13 demographic questions were asked. The purpose was twofold: first to compare the survey results to known demographics to determine whether or not the survey is representative of the larger population, and second, to gather data to determine whether SCO varies by industry association membership. Industry Canada-Statistics Canada (CANSIM) ranges were used for the survey demographics section to allow for meaningful comparison. Refer to Appendix G for the full set of demographics questions and their presentation in the survey.

3.4.8 Survey Overview

The final survey consisted of 106 questions—93 measurement items and 13 demographics questions—spread over 18 web-pages or "screens". A screen full of data may or may not have vertical scroll bars depending on the resolution of the respondent's computer monitor. The design intent was to reduce the requirement to scroll wherever possible. To move from one screen to the next, the user pressed a button labeled "Next" which appeared just below a progress indicator bar. All of the questions were optional; no forced responses were required. The SurveyMonkey tool allowed a user to to begin a survey, quit, and re-start the survey at a later point in time without any loss of data. A breakdown of the components of the survey is presented in Table 3.13; the full survey can be found in Appendix G.

Table 3.13: List of Survey Components

Survey Component	MIs / Qs	Screens
UW ORE Cover Page	—	1
Part I: Lee Model	20	4
Part II: Supply Chain Position	1	1
Part III: New SCO Themes*	19	3
Part IV: Original SCO Construct	20	2
Part V: Supply Chain Operational Performance	15	3
Part VI: Stakeholder Orientation	18	2
Part VII: Demographics	13	2
Totals:	106	18

*Includes one screen with eight "Worldview" MIs which were not used in this analysis. Part III final tally: 11 MIs / 2 screens.

3.5 Confirmatory Research: Survey Administration

3.5.1 Target Population: Canadian Manufacturing Companies

As discussed in Section 3.3.1, the unit of analysis in this research is "the company" and the key informant is a senior executive (e.g., President, CEO, General Manager) from that company. The research scope described in §1.6 gave the rationale for the choice of Canadian Manufacturers as the population of interest. This population, though large, is

still manageable. The Statistics Canada CANSIM[1] database listed 45,197 companies in 2007. Since it is not known how many new organizations were created through start-ups or diversification, nor how many organizations were wound down or amalgamated into other businesses between 2007 and the launch of the survey in late 2008, the 2007 census count will serve as a proxy for the size of the target population. Table 3.14 lists the NAICS codes of the manufacturing sub-industries included in the study.

Table 3.14: NAICS Codes and Descriptions

Code	Description	Code	Description
331	Primary Metal Mfg.	335	Appliance Mfg.
332	Fabricated Metal Mfg.	336	Transportation Equipment Mfg.
333	Machinery Mfg.	337	Furniture Mfg.
334	Computer Mfg.	339	Misc. Mfg.

3.5.2 Sampling Frame

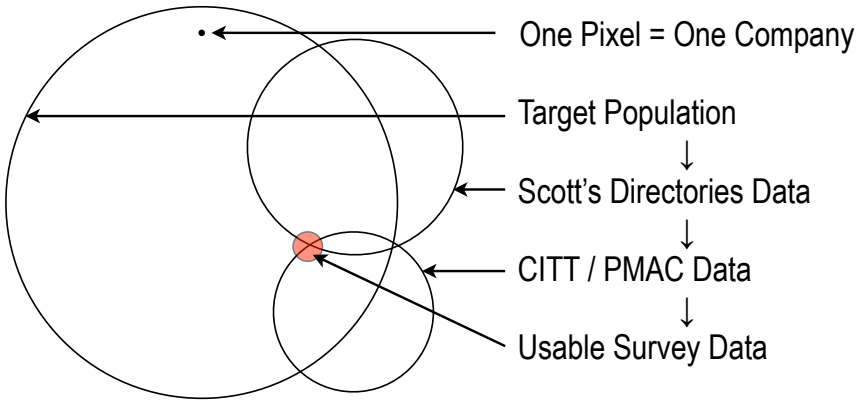
Scott's Canadian Directories online database (`scottsinfo.com`), accessed through the Wilfrid Laurier University library system, was used to build the database of target companies and the senior executives at those companies. If a company had multiple records due to locations in different provinces, a single "head office" contact was retained and the other records deleted. The final record count of companies from the Scott's database was 13,705.

Other members of my UW graduate student cohort had experienced low response rates in similar research in the past. Thus it was assumed that low response rates would be prevalent in this research as well. In an attempt to boost the number of executives contacted for the survey, two industry associations—the Canadian Institute of Traffic and Transportation (CITT) and the Purchasing Management Association of Canada (PMAC)—agreed to forward my survey invitation to their members on my behalf. While I was not given access to their mailing lists to compare to my Scott's data, more than 7,500 company executives were contacted in this way. Refer to Appendix F for a sample contact from PMAC.

A drawback to this approach is that there is no way of knowing how many companies overlap (i.e., belong to both PMAC and the Scott's list). Nor is it possible to ascertain

[1]CANSIM Table 301-0006 — *Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS), annually (Dollars)*

how many companies from the industry association are not in the target population (e.g., a trucking firm member of CITT). The Venn diagram in Figure 3.10 illustrates this point; the location of the 'usable survey data' circle is not known, but for purposes of this discussion, it is assumed to be part of the target population.



The area of each circle (in pixels) approximates the number of companies in each data set.
The 'one pixel' is exaggerated 4× to improve image resolution.

Figure 3.10: Relative Sizes of Target Population, Sampling Frames, and Sample

3.5.3 Survey Administration

The initial wave of survey invitations (see Appendix E) was sent on Tuesday, November 18, 2008. The time of the release of the survey was chosen for two reasons: a survey invitation received on a Monday or a Friday would have a higher likelihood of being ignored, and delaying the survey to December would conflict with fiscal year-end for many companies as well as seasonal holiday plans for survey respondents. The survey invitation indicated the survey would take respondents about 20 minutes to complete. A later analysis of timestamp data from SurveyMonkey.com revealed that the average completion time was 24.6 minutes and the median time was 20.3 minutes.

The first wave of invitations from SurveyMonkey generated 1,502 e-mail failures (11.0%). An additional 287 invitees (2.1%) were removed for the following reasons: They had opted-out of the survey on the SurveyMonkey side (204), had declined to take the survey (64), had asked to be removed from the mailing list (18), or had died (1). Those who declined the survey gave reasons such as "wrong demographic," meaning not a manufacturer, not part of a supply chain, an IP licensor with no inventory; too small a

business; and against company policy (e.g., previous issues with malware, or unable to participate in surveys).

Eight days after the launch of the survey, PMAC and CITT members were invited by their associations to take the survey. The survey descriptions contained in the e-mail to the PMAC and CITT members were not as detailed as the boilerplate invitations addressed individually to managers culled from the Scott's Directories.

Two weeks after the initial launch of the survey, a reminder e-mail was sent to those invitees who had a non-failing e-mail address and had not opted out of the survey. It was not however feasible to send a reminder to industry association members. Figure 3.11 provides a breakdown of the survey responses over time. At the end of the process, 412 surveys had been initiated, and 227 were usable.

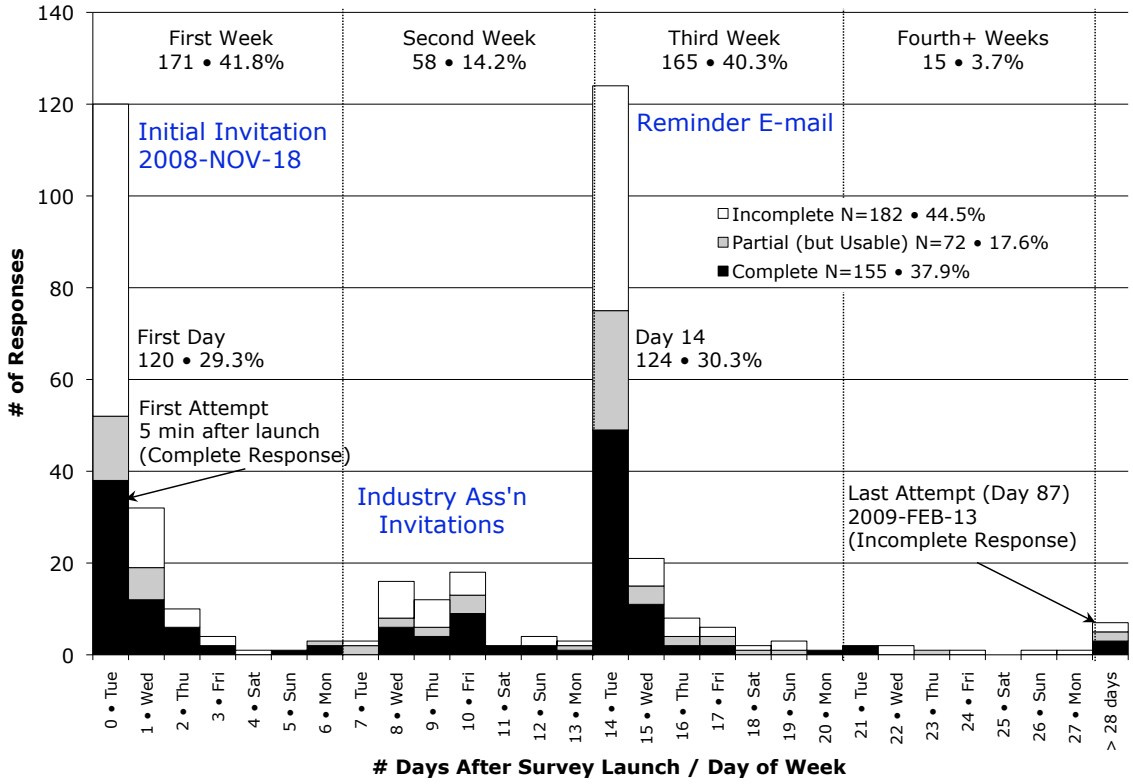


Figure 3.11: Survey Response Over Time

3.5.4 Response Rate

To use the terminology of Larson and Poist (2004), this research took a "shotgun" approach to the survey versus a targeted "sharpshooter" approach. This was by design. Previous studies like Min and Mentzer (2004) relied on self-selecting groups like the CSCMP membership roster for the respondent pool. In order to assess the *generalizability* of the supply chain orientation concept, an industry-wide survey approach was utilized. The Response Rate (*RR*) for this survey is not knowable. In the "best case," all of the PMAC and CITT invitees were already part of the Scott's Directories list. In the "worst case," there was no overlap. Hence the true response rate is in this range:

$$\frac{227}{13,705 + 7,547} \leq RR \leq \frac{227}{13,705} \text{ or } 1.07\% \leq RR \leq 1.66\%$$

In contrast to the 18 web screens of this survey, New and Payne (1995) distributed a short six-page questionnaire—with a letter of endorsement from the UK Institute of Logistics director-general—and only managed a 2.5% response rate. Does the fact of having *more* data automatically imply having *better* data? Krosnick (1999) found that "surveys with very low response rates can be more accurate than surveys with much higher response rates," and that "having a low response rate does not necessarily mean that a survey suffers from a large amount of nonresponse error" (p. 540). Those claims are based on the work of Visser et al. (1996) who found the data accuracy—measured as the difference between predicted and actual outcomes—was higher in a low-response-rate mail survey than in a higher-response-rate telephone survey.

3.5.5 Respondent Profile

The completed surveys indicated that a typical survey respondent could be described as an educated, experienced, loyal, senior-level manager. The companies they represent could be described as southwestern Ontario-based, mature, small- to medium-sized enterprises—that is, having fewer than 50 employees and annual sales of less than $10-million, mostly within Canada. Table 3.15 provides an overview of the demographics information, while Appendix I provides additional detail for each of the categories.

3.5.6 Survey Responses: Congruence

Although Cook et al. (2000) discuss response rates in terms of election polls, they note that "the *representativeness* of our samples is much more important than the response

Table 3.15: Demographics Overview

Characteristic	Most Frequent Response	2nd Most Frequent	3rd Most Frequent
Respondent Level Demographics			
Job Title*	President/CEO (41.1%)	Manager (19.8%)	VP / EVP (12.3%)
Education	College Diploma (33%)	U.Grad Degree (23.8%)	Grad Degree (19.8%)
Years in Industry	20 to 30 years (31.3%)	10 to 20 years (25.6%)	5 to 10 years (14.1%)
Years with Company	10 to 20 years (27.8%)	5 to 10 years (20.3%)	20 to 30 years (18.1%)
Company Level Demographics			
# of Employees	1 to 10 (37.9%)	11 to 50 (33.5%)	101 to 250 (9.7%)
Age of company	10 to 20 years (26.4%)	20 to 30 years (22.5%)	5 to 10 years (12.3%)
Annual Sales	1 to 5 M$ (29.1%)	200 to 500 K$ (11.9%)	5 to 10 M$ (11.0%)
Location of HQ	Ontario-GTA (27.3%)	Ontario-SWO (21.6%)	B.C. (11.9%)

*5.7% of respondents identified themselves as "Owner."

rate we obtain" (p. 821; emphasis in the original). Is the sample data from the survey representative of the data from the population being studied? Table 3.16 compares three data sets—the CANSIM record set representing the 'population,' the Scott's Directories data set representing the 'sampling frame,' and the actual Survey data received from respondents—across two demographic dimensions: NAICS Code and geographic Region. Goodness-of-fit (χ^2) statistics showed significant differences between all three data sets—not entirely unexpected given the previous discussion about coverage error. Table I.1 in Appendix I show side-by-side comparisons between the Scott's data and Survey data on number of employees, annual sales, and company age demographics. Again, the Survey results differed from the Scott's data.

A comparison of Survey data with the CANSIM data on NAICS code in Table 3.16, shows a higher incidence of machinery manufacturing in the Survey results than in the CANSIM data. However, furniture manufacturing is under-represented in the Survey results compared with the the population of such firms in Canada. The explanation may be found in an analysis of the geographic data: the Survey data has a preponderance of Ontario-based companies, but it is under-represented in Quebec-based companies. The original CANSIM table shows that Ontario has more machinery manufacturers than Quebec, whereas Quebec has more furniture manufactures than Ontario. It is not known why Ontario is 20.2% over-represented in the survey by population; a possible explanation is that people in Ontario are more familiar with, and therefore responsive to, the University of Waterloo than those in Quebec.

At least three replies were received from Quebec respondents indicating that the invitee would respond only to a French version of the survey questions—the survey was

available in English only. The rationale for a unilingual survey instrument was two-fold: high translation costs versus few additional responses from Francophone respondents and the difficulty of establishing the semantic equivalence of items in a multi-language survey.

Table 3.16: Industry & Geographic Demographics Across Datasets

	CANSIM	Scott's	Survey
By NAICS Code			
331 Primary Metal Mfg.	2.0%	3.1%	1.6%
332 Fab. Metal Mfg.	25.6%	28.7%	23.8%
333 Machinery Mfg.	17.1%	21.6%	27.0%
334 Computer Mfg.	6.7%	8.6%	10.8%
335 Appliance Mfg.	3.7%	4.6%	10.8%
336 Transportation Eq. Mfg.	7.7%	6.1%	4.3%
337 Furniture Mfg.	15.7%	9.7%	8.1%
339 Misc. Mfg.	21.5%	17.6%	13.5%
Goodness-of-Fit[(a)]	$\chi^2_{0.05,7} = 14.067$	$\chi^2_{Scott's} = 846.22$	$\chi^2_{Survey} = 55.99$
By Region			
Atlantic	3.9%	5.2%	4.0%
Quebec	25.2%	26.2%	10.8%
Ontario	42.2%	46.0%	62.3%
The West	28.8%	22.7%	22.9%
Goodness-of-Fit[(a)]	$\chi^2_{0.05,3} = 7.815$	$\chi^2_{Scott's} = 292.87$	$\chi^2_{Survey} = 42.73$

Note:

(a) The χ^2 value in the CANSIM column is the *critical* value at 5%. The χ^2 value in the Scott's column represents the goodness-of-fit between the Scott's data (observed) and CANSIM data (expected), likewise for the χ^2 value in the Survey column. In both cases the Scott's data and Survey data **do not** have the same distribution as the CANSIM data.

If this research were concerned with differing levels of SCO by manufacturing sector or geographic location, then the statistically significant differences between the CANSIM, Scott's, and Survey data demographics may be an issue. However, since this research is only concerned with the survey data in aggregation, this is not an issue.

3.5.7 Nonresponse Error: Unit Nonresponse

For the reasons discussed, it is not possible to calculate the response rate for this survey. The theoretical best case occurs when all of the industry association contacts have already

been included in the Scott's list of contacts; the worst case is when there is no overlap. The true response rate lies between. Table 3.17 details the counts of invitations sent and responses received for the survey. Of the 13,705 Scott's database records, only 182 (1.3%) did not have a named contact person in the record. Invitations to these companies were sent using a "Generic" mailing list addressed to "Dear Sir / Madam." In addition, 3,693 records (26.9%) had a nonspecific e-mail address like `info@company.com`, which are less likely to have reached the intended respondent, but were still addressed to specific individuals within the company from the Scott's database record.

Table 3.17: Survey Response Overview

Data Source	Invites		Attempts		Usable	
Scott's						
Generic	182	1.3%	2	0.6%	1	0.5%
Atlantic	702	5.1%	12	3.5%	9	4.9%
Ontario	6,225	45.4%	225	66.2%	115	62.2%
Quebec	3,562	26.0%	32	9.4%	19	10.3%
The West	3,034	22.1%	69	20.3%	41	22.2%
Total	13,705		340		185	
Industry						
CITT	1,250	16.6%	10	13.9%	10	23.8%
PMAC	6,297	83.4%	20	27.8%	19	45.2%
unidentified			42	58.3%	13	31.0%
Total	7,547		72		42	
Grand Total			412		227	

The SurveyMonkey.com tool reported 412 responses. Because three "responses" were completely blank, 409 records were actually downloaded. Of those 409, 155 had 100% of questions completed; in 72 of the records, from 1 to 8 measurement items (of 93 total) were missing (i.e., 98.9% to 91.4% response); and in the remaining 182 records, more than 9 responses were missing so were rejected. The cut-off point of 9 items is consistent with guidelines suggested by Hair et al. (2006); hence, this analysis will be working with $n = 227$ records.

Figure 3.12 on page 102 shows a high-level colour-coded overview of all the pre-imputation survey results. Each row on the figure represents one survey response. The small rectangles within a row represent the responses to particular measurement items using a "rainbow" colouring scheme—that is, a response of 1 receives a red fill, 2 is

orange, and so on through the colours of the rainbow to 7 which is violet. Survey questions for which no response is given have no colour fill (i.e., are white). The rows are sorted by number of responses and by a simple sum of responses. Thus respondents who abandoned the survey early have their results "float" to the top of the figure, while respondents who completed the survey and have many "strongly agree" responses will "sink" to the bottom of the figure. Demographic information is not included in this figure as it has response values outside the 1 to 7 response set.

Reading left-to-right across the graphic are the six components of the survey. Solid vertical lines denote the break between subsequent SurveyMonkey.com "screens." The step pattern seen in the top-left quadrant is especially adept at illustrating survey abandonment rates screen over screen. The dashed vertical lines denote the demarcation between survey questions related to different SCO factors within the same SurveyMonkey.com screens.

In addition to showing data quantity, this graphic was found to have diagnostic properties as well. For example, the set of responses to SU10 (immediately to the left of the Supply Characteristics / Demand Characteristics demarcation) are coloured differently than the other related supply uncertainty characteristics to its left. Further analysis revealed that the scale ordering in the survey was incorrectly entered as 1 to 7 instead of 7 to 1. This oversight was corrected in SPSS before analysis began.

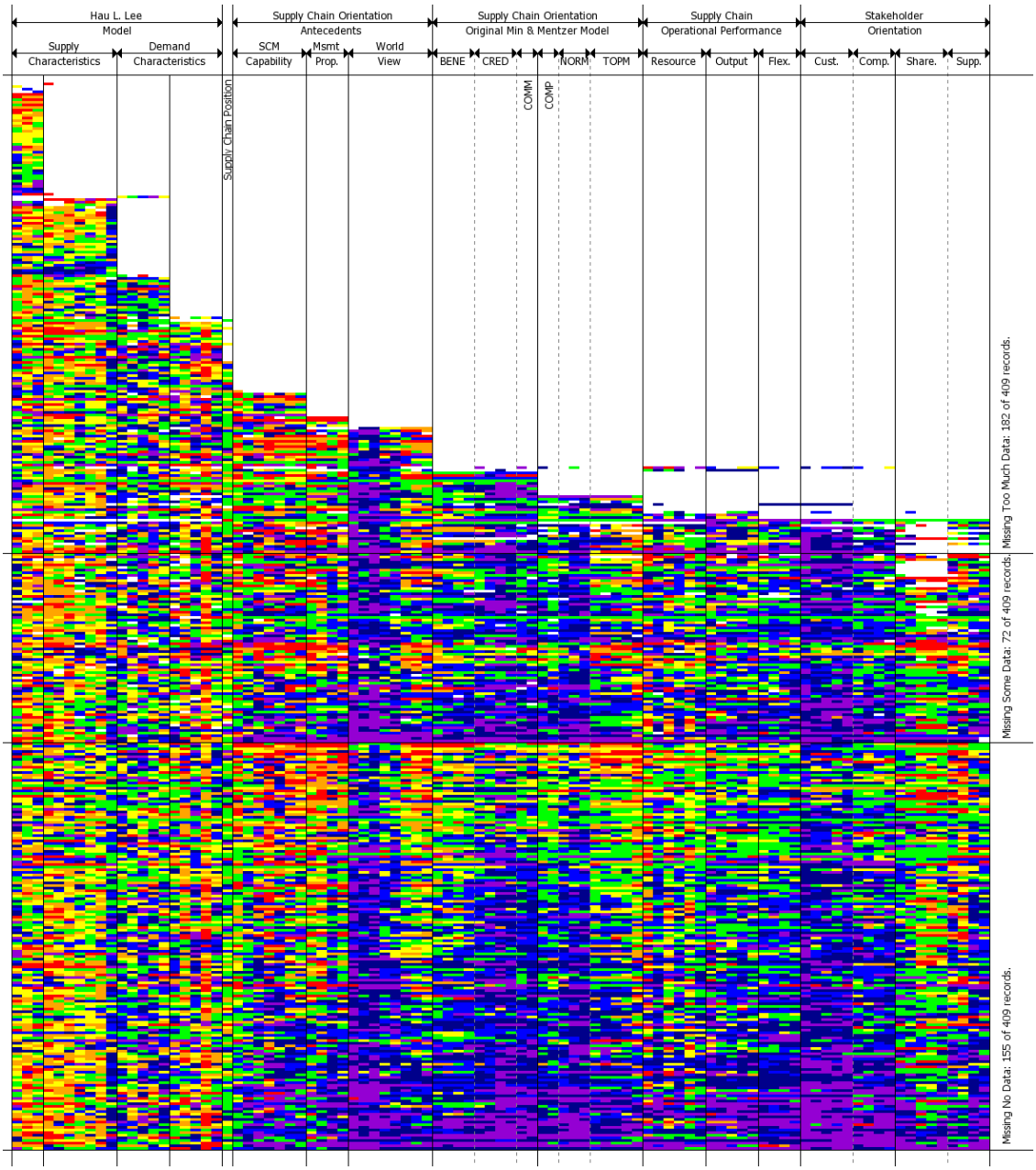


Figure 3.12: Colour-coded Survey Results

Notes:

- Colour-coding: No response=white. Rainbow coloured 7-point Likert scale responses: 1=red, 2=orange, 3=yellow, 4=green, 5=blue, 6=indigo, and 7=violet.
- Solid vertical lines denote survey page breaks. Dashed vertical lines denote the break between survey question sets on the same survey page.

3.5.8 Nonresponse Error: Wave Analysis

Response bias is the effect of non-responses on survey estimates (Creswell, 1994). One method of evaluating response bias is wave analysis, the premise being that "persons who respond in later waves are assumed to have responded because of the increased stimulus and are expected to be similar to nonrespondents" (Armstrong and Overton, 1977, p. 937). However, some authors suggest that this approach, comparing first and second waves, is weak with respect to establishing non-response bias and direction (Lambert and Harrington, 1990). A wave analysis was performed on the data; there was no statistically significant difference between the mean of measurement items in the first quartile of responses received and the mean in the last quartile (at a $p < 0.01$ level) for all measurement items in the survey.

3.5.9 Nonresponse Error: Item Nonresponse

As mentioned in §3.5.7, there are 72 survey responses that are missing between 1 and 8 measurement items. These records have sufficient information remaining to not be rejected from further analysis, however, remedies for the missing data need to be identfied and applied.

Type of Missing Data

Hair et al. (2006) suggest a four-step process for identifying missing data and applying remedies. The first step is to determine whether or not the missing data can be ignored as part of the research design. Often, this appears in surveys as branches—for example, "If your annual sales are less than $1M-million proceed to question #12, otherwise go to question #10." It was expected, however, that survey respondents would answer all questions and there was no branching in the survey design. Thus, the missing data are not ignorable, leading us to the next step in the process.

Extent of Missing Data

The 227 records for analysis are 99.2% complete; only 166 measurement items across all records were missing. Table 3.18 shows the breakdown. A close examination of figure 3.12 reveals no discernible pattern in the missing data. The six responses that omitted data in the Shareholder Orientation questions at the end of the survey show up as a white space due to the sort order on the rows for creating that graphic. This data may be missing

because of a combination of survey fatigue and the posing of questions not relevant to small companies. However, the low extent of missing data, and overall lack of pattern suggest that the 227 records chosen need not be pared down further to proceed.

Table 3.18: Missing Measurement Items

Record Level (row) Data (# of Records Missing *n* data items)

# of Records	155	38	10	7	7	4	4	1	1	Σ = 227
Missing	0	1	2	3	4	5	6	7	8	Σ = 166

Measurement Item Level (column) Data (# of Questions Missing *m* data items)

# of MIs	30	30	15	8	2	1	1	2	0	1	0	0	1	0	2	Σ = 93
Missing	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Σ = 166

Randomness of Missing Data

After evaluating the extent of missing data, the nature of missing data processes was examined to determine whether the data are MCAR, meaning Missing Completely At Random, or MAR, meaning Missing At Random. MCAR refers to data for which 'missingness' does not depend on other data values. MAR data indeed depends on other data items—that is, a missing piece of data is related to a value given for a previous response (de Leeuw et al., 2008). The Missing Values Analysis (MVA) package of SPSS 17 was used to make this determination; the results are presented in Table 3.19. Using Little's MCAR Test, only two sections of the survey, SCO Performance—Flexibility and Stakeholder Orientation—Shareholder, were found **not** to be MCAR. That is, if the significance value is less than 0.05, the data are not MCAR (SPSS, 2007). Alternatively, a statistically nonsignificant result is desired; hence a p value greater than 0.05 indicates that MCAR may be inferred (Tabachnick and Fidell, 2007). Since the data are not MCAR a usual approach would be to drop these cases with missing data. However, SEM is a large sample size technique and the data is already sparse. As Tabachnick and Fidell (2007) explain, "The decision about how to handle missing data is important. At best, the decision is among several bad alternatives…" (p. 63). The alternative chosen, expectation-maximization imputation, is discussed in the next section. This meets the higher priority goal of having sufficient cases to proceed with the SEM analysis.

Table 3.19: Nature of Missing Data

Survey Section	MCAR Test χ^2	D.F.	Sig.	Missing Data[a] 0	1	2	3	4+
Part I: Lee Model								
Supply Uncertainty (SU01–10)	81.513	76	.312	213	12	0	1	1
Demand Uncertainty (DU01–10)	119.248	111	.279	202	21	2	2	0
Part III: New SCO Antecedents								
SCM Capability (CAPA1–7)	8.018	12	.784	225	2	0	0	0
Msmt Propensity (MEASP1–4)	4.442	6	.617	225	2	0	0	0
Part IV: Original SCO Construct								
Benevolence (BENE1–4)	0.709	6	.994	225	2	0	0	0
Credibility (CRED1–4)	13.527	8	.095	224	2	1	0	0
Commitment (COMM1 & 3)	0.333	2	.847	222	5	0	0	0
Compatibility (COMP1–2)	0.178	1	.673	223	4	0	0	0
Cooperative Norms (NORM1–3)	0.985	2	.611	226	1	0	0	0
Top Mgmt Support (TOPM1–5)	6.545	8	.586	224	2	0	0	1
Part V: SC Operational Performance								
SCOP–Resource (RSRC1–6)	20.863	14	.105	223	3	1	0	0
SCOP–Output (OUTP1–5)	7.701	8	.463	224	3	0	0	0
SCOP–Flexibility (FLEX1–4)	16.526	4	.002[b]	223	2	0	1	1
Part VI: Stakeholder Orientation								
Customer (SO-CUST1–5)	3.275	4	.513	226	1	0	0	0
Competitor (SO-COMP1–4)	4.571	6	.600	222	5	0	0	0
Shareholder (SO-SHAR1–5)	42.556	17	.001[b]	211	2	4	3	7
Supplier (SO-SUPP1-4)	9.625	11	.564	221	5	1	0	0

Notes:

(a) Missing Data refers to the number of records missing n measurement items. For example, 12 records in the Supply Uncertainty question section were missing 1 field of data.

(b) Data is not MCAR; deemed to be MAR.

3.5.10 Post-survey Adjustments

Imputation Methods

The final step in the process of the remediation of missing data is to select appropriate imputation methods. For the missing categorical data of three responses to Question 21 (Supply Chain Position), the missing data were imputed manually after company websites were consulted to determine which category to use. For the missing MAR data of the

SCOP—Flexibility and Stakeholder Orientation—Shareholder sections, SPSS's MVA package was used to impute missing data using the EM (expectation-maximization) tool. For the missing MCAR data across the rest of the survey, the EM tool was also used to impute the missing values (Hair et al., 2006).

Adjustment Error

After the missing data were imputed, the original data with missing values, were compared with the complete imputed-values data set, using both a t-test and non-parametric Mann-Whitney test. The smallest p-value for the t-test was 0.875 (Q87: SO-SHAR3) and the smallest p-value for the Mann-Whitney test was 0.875 (Q48: CRED4). In no case was there a significant difference between the original and imputed data.

3.6 Ethical Considerations

3.6.1 Introduction

Any discussion of methodology would not be complete without an overview of the ethical considerations of the research (Perry, 1998). As required by the University of Waterloo, the two major research components of this dissertation were documented and approved by Waterloo's Office of Research Ethics (ORE) under the following ORE reference numbers:

- **ORE #13859**
  Title: Supply Chain Orientation Scale Development – Phase I
  Full ethics clearance: 2007-Apr-23.
- **ORE #15167**
  Title: Supply Chain Orientation Scale Development – Phase II
  Full ethics clearance: 2008-Nov-12.

3.6.2 Survey Ethics

Although the ORE process ensures that the interviewees and survey respondents are protected from physiological, psychological, emotional, social and other risks and stressors, a larger ethical issue of "oversurveying" is today being discussed in the literature (Cycyota and Harrison, 2006; Rogelberg and Stanton, 2007; Baruch and Holtom, 2008).

Researchers compare the situation to a watering hole, continually shrinking as more animals drink from it (Beardon et al., 1998; Bednall, 2002; Couper and Miller, 2008). Commandeering the computer science term *resource contention* for this discussion provides a technical description of the topic. A finite and valuable resource—in this case a senior manager's time and attention to complete a survey—competes with the demands of a large and growing number of other priorities; the survey invitation and process should respect persons' commitments and limited resources.

In 2003 the Financial Times (FT) reported on a questionnaire that had reported questionnaire fatigue as a serious issue (Tassell, 2003). A year later, FT reported that some large companies were receiving "as many as 200 questionnaires a year from ratings and research agencies, fund managers, government departments, consultants and academics" (Maitland, 2004). The Council of American Survey Research Organizations (CASRO) counsels its members in its Code of Standards and Ethics for Survey Research to "take steps to limit the number of survey invitations sent to targeted respondents by email solicitations or other methods over the Internet so as to avoid harassment and response bias caused by the repeated recruitment and participation by a given pool (or panel) of data subjects" (CASRO, 2009).

In a paper-based mail survey, the participant can browse the entire survey and choose whether or not to participate. In an e-mail survey, however, the participant must click on the link if he or she wants to see the same information, like type and number of questions (Crawford et al., 2001). As Crawford et al. (2001) note, "The e-mail invitation plays a disproportionately important role in eliciting responses to a Web survey" (p. 160). The e-mail invitation for this survey used two strategies to elicit response, doing so in an ethical fashion.

The first of these ethical techniques, informed consent, notes that the survey would take 20 minutes to complete. This time estimate was verified in advance by having UW graduate students take the survey and provide commentary on question wording, survey design, and layout.

The second consideration concerned quid pro quo: Since the responding manager's time is valuable, he or she should receive something of value in return. Larson and Chow (2003) concluded that, "To maximize response rate, use both follow-up mailings and monetary incentives" (p. 537). However, this only applies to paper-based mail survey where a prepaid cash incentive or material incentive can be included with the invitation; it does not apply to an e-mail based survey (Dillman, 2000). Additionally, this self-funded research project had no budget for incentives like gift coupons, lottery tickets, iPods for raffle, and so on. Some have suggested that such incentives have no significant impact on response rates anyhow (Manfreda et al., 2008).

The survey design "payment" for the manager's time is a three-page, customized "Report Card." The report card provided other information about the Supply Chain Orientation concept, but more importantly, detailed a respondent's aggregated responses relative to those of the other responses. Appendix H shows an actual (redacted) report card sent to a survey respondent. About three-quarters of the survey respondents, 173 total, indicated a desire to receive the report card. Eight of these had not completed more than 84 measurement items; however, even though their records were not included in the final analysis, they received a report card based on the partial data they had provided.

The report card results were calculated using Excel and exported to a .CSV file. A custom PHP script was developed to combine the .CSV data with a LaTeX template to create a professionally typeset PDF report card. The report cards were sent individually via e-mail on April 28 and 29, 2009. One respondent replied asking for his full survey response; this was extracted from the data and e-mailed to him. Four respondents replied thanking me for the report card; two called it "interesting," and one even offered an explanation as to why his company's results were lower than the Average of All Respondents score.

3.7 Conclusion

This chapter discussed the pragmatism paradigm and presented a justification for the mixed methods used in the research. The first method, a qualitative approach involving interviews with supply chain management experts, informed the development of new factors in the Supply Chain Orientation construct. The choice of interview participants helped provide a broad understanding of SCO. After nine interviews, redundancy with the responses was occurring with increasing frequency. At this stage, the interviews were transcribed and then analyzed with qualitative analysis software. Based on the frequency of codes from the analysis, two additional SCO factors—SCM Capability and Measurement Propensity—were identified.

Most of the work was concerned with the design and delivery of a survey to address the hypotheses posed in Chapter 2. The design considered a number of issues regarding question order, number of points on a fixed-point scale, and common method bias. The survey design considered ethical issues around the managerial time commitment required for the survey. Once the design was complete, the survey instrument was administered to a large number of Canadian manufacturing and supply chain management executives. Two hundred and twenty-seven usable surveys were completed, analyzed for missing data, and imputed with relevant values. The next chapter discusses the findings coming from the analysis of the data.

Chapter 4

Findings

> *Whereas management scholars have for decades devoted substantial effort to understanding traditional organizations, building knowledge about supply chains offers an important opportunity for future scholars.*
> —Hult et al. (2002, p. 584)

The primary objective of this research is the refinement of the Supply Chain Orientation (SCO) scale. The previous chapter detailed the methods used to develop the survey instrument, gather survey results, and validate the data. This chapter begins with the complete set of survey data and uses basic descriptive statistics to remove "positivity bias"—those measurement items with little variation, skewed heavily toward the *Strongly Agree* end of the Likert-scale (Groves et al., 2004).

After that analysis and discussion, the remaining valid data is randomly split into two datasets with $N_{EFA} = 113$ and $N_{CFA} = 114$ records respectively. One dataset is utilized for an Exploratory Factor Analysis (EFA) to establish a parsimonious set of SCO factors. The EFA makes no *a priori* assumptions about the existence or composition of any underlying factors within the data. The EFA utilized traditional (e.g., Principal Axis Factoring with Promax oblique rotation) and non-traditional (e.g., Parallel Analysis) techniques in its exploration of the data. The EFA is used to test Hypothesis H_1.

The second dataset is utilized for a Confirmatory Factor Analysis (CFA) to validate the findings from the EFA. The CFA tested the SCO measurement model from the EFA for reliability, convergent validity, and goodness-of-fit with nested models. Reliability is established using traditional statistical techniques (e.g., Cronbach's alpha) and modern Structural Equation Modeling (SEM) techniques. The nested models approach of Widaman (1985), used to establish both convergent and discriminant validity is entirely SEM-based.

With the SCO scale finalized, it is then used in structural models for the following purposes: to estimate SCO's discriminant validity against an alternative Stakeholder Orientation, to test its predictive capability with respect to supply chain operational performance (SCOP)—Hypothesis H_2, and to ascertain if top management support (TOPM) is indeed an antecedent to SCO—Hypothesis H_3. Analysis of variance (ANOVA) is used to test the remaining two hypotheses, Hypothesis H_4 and H_5. The conclusions and implications of these analyses will be presented in the next chapter.

4.1 Item Reduction: Face Validity

Face validity is "the degree that respondents or users judge that the items of an assessment instrument are appropriate to the targeted construct" (Hardesty and Beardon, 2004, p. 99). That is, in addition to being valid, an instrument should *appear* to be valid in the eyes of the respondent (Netemeyer et al., 2003). Since face validity is "a necessary but not sufficient condition for ensuring construct validity," an assessment of SCO's face validity must me made before proceeding to assessing its construct validity (Hardesty and Beardon, 2004, p. 99). Churchill (1979) also makes this case, noting "The analyst's attention would also be directed at refining those questions which contain an obvious "socially acceptable" response" (p. 68; quotations in the original).

A measurement item like "We believe our supply chain members must work together to be successful" garnered few dissenting responses in the survey. As Groves et al. (2004) describe, "With some types of ratings, respondents seem to shy away from the negative end of the scale producing 'positivity bias' " (p. 223). This positivity bias can be closely associated with "motherhood" statements. The Oxford English Dictionary defines a *motherhood statement* as an issue, policy, or statement that is "universally favoured or supported" (OED, 2009). Motherhood statements as measurement items do little to discriminate between respondents, hence increasing positivity bias. Items of this sort also reduce face validity since they do not "measure" anything but tacit agreement.

Identifying and removing motherhood statements to reduce positivity bias can be accomplished in different ways. For example, Schlosser and McNaughton (2009), *a priori* utilized a panel of 64 academics to identify potential motherhood statements in a pre-test of their survey instrument. This research used a *post hoc* alternative method, namely the examination of the descriptive statistics associated with each item to identify those which are "universally favoured or supported." Additionally, measurement items at the opposite end of the scale which may be "universally despised or unsupported," were also examined. However, this research found no items skewed heavily in the direction of *Strongly Disagree*.

Tables 3.7 and 3.8 in Chapter 3 detail the wording of the 31 SCO measurement items and their respective mean and standard deviation statistics. Measurement items with large means and small standard deviations were identified for further analysis in the form of skewness and kurtosis calculations. These standard descriptive statistics were used to identify four motherhood-statement measurement items to be removed from the SCO measurement items set. Table 4.1 describes these items. While there were other measurement items that were also skewed toward the *Strongly Agree* end of the scale, these were the most egregious items.

Table 4.1: SCO Measurement Items Removed (based on descriptive statistics)

		Descriptive Statistic (rank*)	
Item Label	Measurement Item Wording	Mean S.D.	Skewness Kurtosis
CRED3	Our business unit does not make false claims to our supply chain members.	5.91 (1) 1.297 (25)	-1.390 (31) 1.600 (3)
NORM2	We believe our supply chain members must work together to be successful.	5.70 (2) 1.200 (31)	-1.151 (29) 1.663 (1)
COMM3	We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	5.47 (5) 1.295 (26)	-1.184 (30) 1.604 (2)
NORM3	We view our supply chain as a value added piece of our business.	5.67 (3) 1.256 (28)	-1.143 (28) 1.385 (4)

*Note: rank is the positional rank (out of 31) for that descriptive statistic. N = 227 records.

4.2 Factor Analysis

The original statistical analysis of the SCO construct by Min and Mentzer (2004) did not include an EFA. Their SCO construct consisted of 20 measurement items grouped into six factors. After including an additional 11 items for the two themes identified in the qualitative portion of this research, the SCO scale becomes unwieldily. Factor analysis in general is used "to define the underlying structure among the variables in the analysis" (Hair et al., 2006, p. 104). Factor analysis works by grouping many measurement items together into a few factors that have significant variance in common. Hence factor analysis is also a data-reduction technique.

In EFA, "one seeks to describe and summarize data by grouping together variables that are correlated" (Tabachnick and Fidell, 2007, p. 609). The purpose of performing

an EFA on the SCO measurement items is to determine if SCO is indeed made up of eight factors or if there is a more parsimonious way of establishing SCO. Handfield and Melnyk (1998) describe four key criteria for evaluating a study such as this, one of which is parsimony. As they describe, "A good theory should be rich enough to capture the fewest yet most important variables and interactions required to explain the events or outcomes of interest. Why is parsimony so important? Because the power of any theory is inversely proportional to the number of variables and relationships that it contains" (p. 336).

Once a parsimonious set of measurement items and factors for SCO has been established by EFA, the resulting factors are tested in a confirmatory analysis. The adjectives "exploratory" and "confirmatory" were originally applied to describe the intent of the researcher. Increasingly, the terms are used to differentiate between the analytical tools used in each analysis. CFA, for example, is often synonymous with SEM (DeVellis, 2003). In the case of this research, both meanings will apply to the terms. EFA will use traditional correlation-matrix derived statistics to find the underlying structure, while CFA will use SEM-based methods to confirm the nature of the factors found. Additionally, CFA "is a much more sophisticated technique used in the advanced stages of the research process to test a theory about latent processes" and will allow for the testing of the hypotheses from Chapter 2 (Tabachnick and Fidell, 2007, p. 609).

For this research, the master dataset of 227 records was split randomly into two halves for analysis. The EFA dataset has 113 records, while the CFA dataset has 114. The sample size meet the suggested criteria of 100 or larger as recommended by Hair et al. (2006).

4.3 Exploratory Factor Analysis

Before applying EFA techniques to the data, it has to be established that the data is indeed suitable for factor analysis. As described in the previous section, factors form around correlated data. To measure the degree of intercorrelation between the data, two statistical techniques—Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA)—were applied to the correlation matrix of the data.

After completing the analysis, Bartlett's test of sphericity (χ^2 = 1960.308; df = 351; $p < 0.001$) found the presence of non-zero correlations among the data. The KMO measure of sampling adequacy (MSA = 0.857) established a "meritorious" degree of intercorrelation among the data (Kaiser, 1974). Hence there is sufficient evidence of intercorrelation among the variables, for the next stage of factor analysis to proceed.

While it is desirable to have intercorrelation between the variables as a requisite condition for factor analysis, overly strong correlation between two or more variables leads to the problem of multicollinearity. Multicollinearity makes finding unique estimates of regression coefficients impossible (Field, 2005). Examination of the correlation matrix yielded no bivariate correlations in excess of the 0.90 threshold advocated by Field (2005). Additionally, Tolerance and Variance Inflation Factor (VIF) calculations found no measurement items with VIF values in excess of 10 (i.e., Tolerance less than 0.10) as recommended by various authors (e.g., Field, 2005; Hair et al., 2006). Because we have intercorrelation but not multicollinearlity, we can proceed with the EFA.

In performing an EFA, the researcher is confronted with a large number of possible choices regarding the combination of factor extraction method, factor rotation method, and the values for various parameters associated with those methods. Since the "primary objective is to identify the latent dimensions or constructs represented in the original variables," common factor analysis (also known as Principal Axis Factoring (PAF)) is the most appropriate technique (Hair et al., 2006, p. 118). Additionally, Costello and Osborne (2005) argue that Principal Component Analysis (PCA) is not a true method of factor analysis. They assert that PAF is a superior method and should be used in the case where the assumption of multivariate normality is not met—as is the case with the number of negatively skewed items in this data. Since no prior knowledge or assumptions about the amount of specific and error variance are available, PAF is again the more appropriate of these two common extraction methods (Hair et al., 2006). Hence PAF will be the factor extraction method used throughout the rest of this analysis.

Once the factors have been extracted, they are "rotated" to simplify and clarify the underlying structure (Costello and Osborne, 2005). Rotation methods fall into two categories—orthogonal rotation and oblique rotation. Oblique rotations are used when the factors are allowed to correlate. Orthogonal rotations produce uncorrelated factors. As Costello and Osborne (2005) observe, "If the factors are truly uncorrelated, orthogonal and oblique rotation produce nearly identical results" (p. 3). If the factors are indeed correlated, orthogonal rotations result in a loss of information, hence an oblique rotation technique (Promax method) will be used as the rotation method of choice throughout the rest of this analysis.

The EFA was completed into two stages. The first stage performed an EFA on the original SCO measurement items of Min and Mentzer (2004)—less the four removed above in Table 4.1. The second stage of the EFA was performed on the measurement items remaining after the first stage with the addition of the 11 new measurement items proposed.

4.3.1 Initial EFA • Top Management Support

An initial PAF/Promax EFA was performed on the 16 remaining original SCO measurement items. Three factors had eigenvalues greater than 1.0. These three factors were confirmed with the scree plot. After rotation, the five TOPM measurement items loaded on the first factor. The three factors combined to explain 63.4% of the total variance, however, the first factor accounted for 48.3%. Aside from TOPM5, the factor loadings of the pattern matrix were also very high—ranging from 0.830 to 0.947. The first factor was also highly correlated with the other extracted factors (F1–F2 $r = 0.552$; F1–F3 $r = 0.637$).

In many ways Top Management Support is analogous to the motherhood-statement items removed above. Choosing a strategic orientation for an organization is in the domain of senior management. Section 2.6.1 of the literature review provided theoretical support for change in causality for the TOPM construct. The analysis above also supports the removal of the TOPM measurement items as they greatly dominate the factor model to the detriment of other measurement items / factors. For the remainder of this EFA, the TOPM items have been removed. TOPM will be tested as an antecedent to SCO later in this chapter (§4.10).

4.3.2 Inclusion of New Items

As discussed in §3.2.5, measurement items that add to the breadth of the SCO scale were developed after interviews with supply chain management industry experts. These measurement items fell into two themes: SCM Capability and Measurement Propensity. Eleven new measurement items were developed and deployed in the survey. The wording and descriptive statistics for those items can be found in Table 3.7.

In the previous EFA, Kaiser eigenvalues greater than 1.0 (i.e., the "K1" criterion) and scree plots were used. The K1 approach is problematic in that it tends to overestimate the number of factors, and is also arbitrary in the distinction with factors whose eigenvalues are just above or just below 1.0 (Hayton et al., 2004). The scree plot method works well for strong factors like those in §4.3.1, but suffers from the subjectivity of the observer in determining if a factor is important or if a factor is "scree" (Hayton et al., 2004; Thompson, 2004). For this important EFA iteration, the Parallel Analysis (PA) approach of Thompson (2004) was taken.

Though not widely adopted by management researchers, PA is considered a superior method for factor extraction (Hayton et al., 2004). The PA method described by Hayton et al. (2004) requires a minimum of 50 randomly generated cases and the calculation of

eigenvalue means. A simpler, yet more powerful PA approach advocated by Thompson (2004) was utilized here. Rather than creating random data on a 7-point Likert scale, the *actual* data for each variable was randomized, thereby retaining the properties (mean, standard deviation, skewness and kurtosis) of the original data. As Thompson (2004) notes, the "randomly ordered scores should have bivariate correlations approaching zero with eigenvalues all fluctuating around one" (p. 35). The actual eigenvalues are compared with the random order eigenvalues; if the actual eigenvalue exceeds the random eigenvalue, then the factor is retained.

A second PAF/Promax EFA was performed on the EFA dataset for the remaining original SCO measurement items (after the removal of the TOPM items) with the additional 11 items developed for this research. Five factors were indicated by the K1 criterion; the scree plot of Figure 4.1 also suggests the presence of five factors, though it is not conclusive. PA, however, confirmed three factors. Table 4.2 and Figure 4.2 detail the results of the PA method.

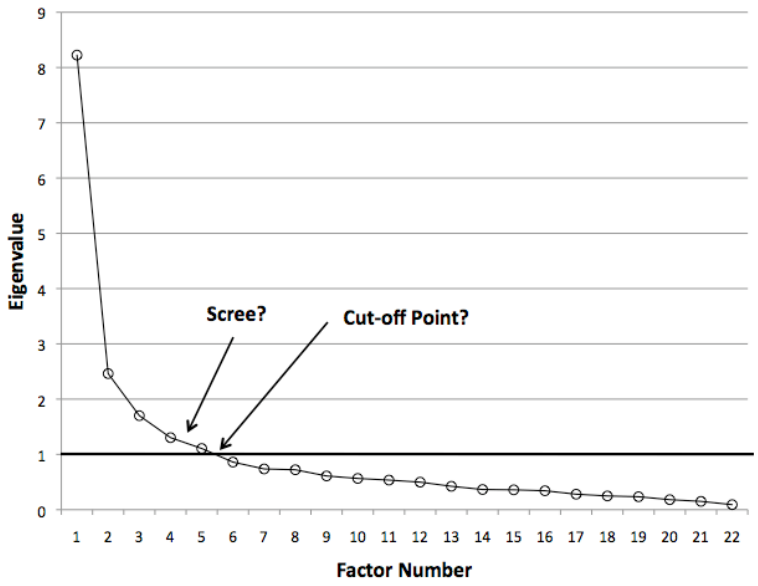


Figure 4.1: Scree Plot of Second PAF/Promax EFA Factors

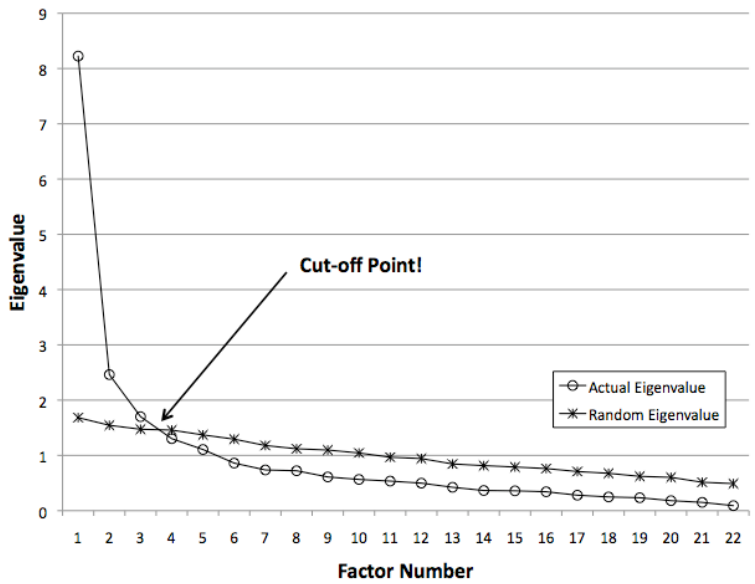


Figure 4.2: Scree Plot of Second PAF/Promax EFA Factors with PA Random Eigenvalues

Table 4.2: Parallel Analysis (PA) for SCO Factor Extraction

	Eigenvalue			Retain
Factor	Actual		Random	Factor
1	8.225	$>$	1.684	yes
2	2.462	$>$	1.545	yes
3	1.701	$>$	1.473	yes
4	1.303	$\ngtr$	1.458	no
5	1.107	$\ngtr$	1.371	no
6	0.861	$\ngtr$	1.294	no
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
22	0.091	$\ngtr$	0.49	no

Source: EFA dataset; N = 113 records.

Re-running the analysis to extract exactly three factors resulted in the Pattern Matrix of on the left side of Table 4.3. Per the guidelines of Hair et al. (2006), measurement items CAPA2, CAPA4, and COMP2 did not load at the 0.40 threshold and were removed. Factor loadings of 0.50 or less require a sample size of 120 for significance, hence Measurement items CAPA3, CAPA5, MEASP3, and COMP1, which loaded between 0.40 and 0.50 were also dropped (Hair et al., 2006). The final set of measurement items and their respective factor loadings are displayed on the right side of Table 4.3, while Table 4.4 displays the explained variance and factor correlations for this new SCO factor set.

Table 4.3: Pattern Matrices for 3-Factor SCO Model

EFA third iteration results

	Factor		
	1	2	3
CRED2	.852		
NORM1	.789		
CRED4	.720		
CRED1	.676		
COMM1	.512		
MEASP3	.451		
COMP2			
CAPA2			
CAPA4			
MEASP1		.778	
MEASP4		.762	
CAPA6		.700	
MEASP2		.698	
CAPA1		.681	
CAPA7		.558	
CAPA3		.492	
CAPA5		.419	
BENE4			.928
BENE3			.894
BENE2			.857
BENE1			.706
COMP1			.435

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.

EFA final set of SCO measurement items

	Factor		
	1	2	3
MEASP4	.801		
MEASP1	.747		
CAPA6	.733		
CAPA1	.673		
MEASP2	.668		
CAPA7	.539		
BENE4		.912	
BENE3		.906	
BENE2		.819	
BENE1		.665	
NORM1			.814
CRED2			.767
CRED4			.761
CRED1			.631
COMM1			.525

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.

Source: EFA dataset; N = 113 records. Factor loadings less than 0.40 are not shown

Note: Factor pattern matrices, which indicate the loadings of each variable to its factor, were used in this EFA analysis. Pattern matrices are preferred over factor structure matrices which include correlation information thereby making it more difficult to determine which variables load uniquely onto which factor (Hair et al., 2006).

Table 4.4: Variance Explained and Factor Correlations

	Factor 1	Factor 2	Factor 3	
% of Variance(1)	41.3%	15.2%	10.0%	Σ = 66.4%(3)
% of Variance(2)	38.7%	12.2%	7.6%	Σ = 58.6%(3)
Correlations	Factor 1	Factor 2	Factor 3	
Factor 1	1.000	0.450	0.396	
Factor 2	0.450	1.000	0.561	
Factor 3	0.396	0.561	1.000	

Notes:
(1) % of total variance explained—initial eigenvalues
(2) % of total variance explained—extraction sums of squared loadings
(3) Sum may differ due to rounding.

4.3.3 Final Set of SCO Measurement Items

Through EFA, the initial set of 31 SCO-related measurement items was reduced by more than half to 15 measurement items. These items in turn load well on three factors. The factors, measurement items, and the factor loadings are detailed in Table 4.5. Since Factor 2 consists entirely of the BENE measurement items from the original Min and Mentzer (2004) SCO model, it retains its original etymology as the "Benevolence" factor—for now. The discussion of §5.1.1 makes the case that this factor is better described as "Trust" versus benevolence.

Factor 1 combines items from the SCM Capability and Measurement Propensity themes identified earlier in this research. All of these measurement items are internally focused on activities within the company (e.g., training, planning, benchmarking, internal KPIs). This factor is termed "Internal SCM Focus."

Factor 3 combines items from the original Credibility, Commitment, and Cooperative Norms factors. All of these factors address the relationship the firm has with its supply partners. All are directed at maintaining and enhancing that relationship. This factor is termed "Partner Reliability."

Table 4.5: EFA: Final SCO Factors, Measurement Items, and Factor Loadings

SCO Factor / Label • Measurement Item	Factor Load
Factor 1: Internal SCM Focus	
CAPA1 Our company fosters supply chain management expertise through formal training and career development programs.	0.673
CAPA6 Our company does collaborative planning, forecasting, and replenishment with our SUPPLIERS.	0.733
CAPA7 Our company does collaborative planning, forecasting, and replenishment with our CUSTOMERS.	0.539
MEASP1 Our company includes supply chain related key performance indicators (KPIs) as part of our overall corporate KPIs.	0.747
MEASP2 Our company engages in benchmarking activities to compare our operations and processes against those of our competitors or service providers in our industry.	0.668
MEASP4 Our company uses staff performance measurements that encourage and reward supply chain performance.	0.801
Factor 2: Benevolence	
BENE1 When making important decisions, our supply chain members are concerned about our welfare.	0.665
BENE2 When we share our problems with our supply chain members, we know they will respond with understanding.	0.819
BENE3 In the future we can count on our supply chain members to consider how their decisions and actions will affect us.	0.906
BENE4 When it comes to things that are important to us, we can depend on our supply chain members' support.	0.912
Factor 3: Partner Reliability	
CRED1 Promises made to our supply chain members by our business unit are reliable.	0.631
CRED2 Our business unit is knowledgeable regarding out products and/or services when we are doing business with our supply chain members.	0.767
CRED4 Our business unit is open in dealing with our supply chain members.	0.761
COMM1 We defend our supply chain members when outsiders criticize them.	0.525
NORM1 Our business unit is willing to make cooperative changes with our supply chain members.	0.814

Based on the EFA data subset; N_{EFA} = 113 records.

EFA Conclusion

Factor analysis is an activity undertaken to ascertain the factors—highly interrelated sets of variables—that underlie the full set of data. Through the examination of the correlation of these variables, the factors can be discovered, hence the term *exploratory* factor analysis. The EFA process detailed above was undertaken to identify the underlying structure and to reduce the number of variables in the model. Using traditional EFA techniques and PA, a final parsimonious set of 15 measurement items which load onto three factors was developed. This supports Hypothesis H_1 that SCO is indeed a multi-factor construct. The next stage in this analysis is to use the other half of the data to confirm that this is indeed the case.

4.4 Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) was undertaken using techniques suggested by Garver and Mentzer (1999). The EFA of the previous section used 113 randomly selected records from the original dataset. All of the findings for this CFA section were developed using the remaining 114 non-EFA records. Figure 4.3 is a simplified path diagram of the SCO measurement model under consideration.

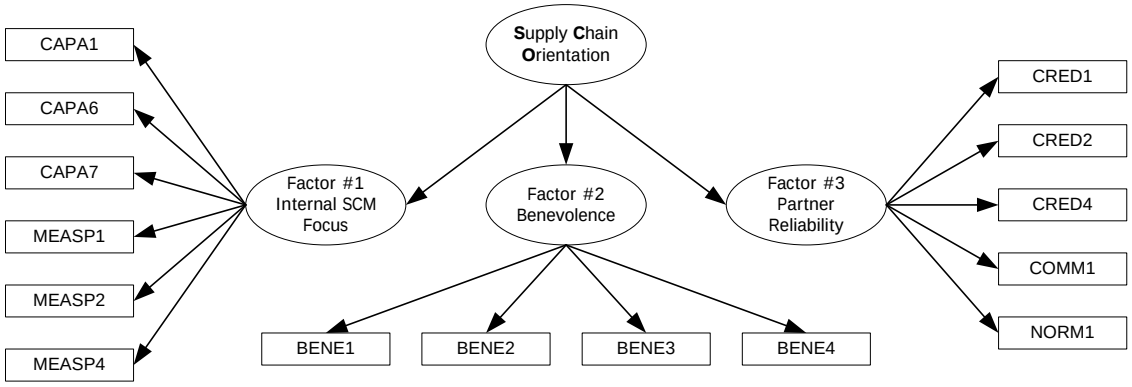


Figure 4.3: SCO Measurement Model

The CFA will begin with an examination of the unidimensionality the components of the model. Once unidimensionality is established, the reliability of each factor will be tested using Cronbach's alpha as its criteria. Reliability will be further tested through construct reliability (CR) and squared multiple correlation (SMC) analysis. Convergent validity of the model will be assessed through the calculation of variance extracted (VE).

The last stage of the CFA will take a "nested models" approach where successively restrictive hierarchal models will be assessed using various goodness-of-fit criteria to establish the fit of the measurement model of Figure 4.3.

Unidimensionality

As Garver and Mentzer (1999) explain, "Because unidimensionality is an assumption of scale reliability, unidimensionality of each latent construct must be established before assessing construct reliability" (p. 43). Two diagnostic indicators—standardized residuals and modification indices—are used to establish unidimensionality. Again, Garver and Mentzer (1999) provide guidance by noting that "An acceptable measurement of unidimensional constructs should reveal relatively small standardized residuals and modification indices" (p. 42).

Relatively small, in the case of standardized residuals (s.r.), are those standardized residual whose absolute value is less than 2.58 (Garver and Mentzer, 1999). Only two instances (of 105 combinations) did not meet this criteria: CAPA6 ↔ CAPA7 (s.r. = 2.711) and CAPA6 ↔ MEASP4 (s.r. = 2.657). As no other problems are associated with these measurement items, they remain in the model (Hair et al., 2006).

The guideline for relatively small in the case of modification indices (MI) varies. Hair et al. (2006) suggest a threshold of 4.0 or greater, Garver and Mentzer (1999) place the threshold higher at 7.88, while Fassinger (1987) uses a value of 9.0. Using the greatest threshold value of 9.0, the following regression weight MI values that exceed this value were found to be CAPA7 ← CAPA6 (MI = 13.061) and CAPA6 ← CAPA7 (MI = 15.061). These two items were also identified in the standardized residuals discussion.

CAPA6—Our company does collaborative planning, forecasting, and replenishment with our SUPPLIERS, and CAPA7—Our company does collaborative planning, forecasting, and replenishment with our CUSTOMERS, are only subtly different with respect to the third party (suppliers or customers) involved in the collaborative activities. Given the integral nature of these activities to supply chain management couple with the fact that multiple authors (e.g., Garver and Mentzer, 1999; Hair et al., 2006) recommend against making model changes based on modification indices, no changes will be made to the model.

Reliability

The reliability of the SCO measurement model was assessed using both Cronbach's alpha and Construct Reliability. Cronbach's alpha, also known as coefficient alpha, and item-total correlations are presented in Table 4.6. Coefficient alpha is a commonly applied

estimate even though it may understate reliability (Hair et al., 2006). All of the EFA-derived factors had alpha values greater than 0.75, above the threshold of 0.70 advocated by Nunnally (1978) or 0.60 advised by Bagozzi and Yi (1988).

Table 4.6: SCO Factors: Reliability Analysis

Factor / Item	Alpha	Item-Total Correlation	α if item deleted	**Factor** / Item	Alpha	Item-Total Correlation	α if item deleted
SCO	0.871			**Factor 3**	0.776		
Factor 2	0.899			CRED1		0.481	0.762
BENE1		0.724	0.890	CRED2		0.622	0.710
BENE2		0.746	0.880	CRED4		0.612	0.714
BENE3		0.829	0.849	COMM1		0.530	0.741
BENE4		0.806	0.859	NORM1		0.517	0.745
Factor 1	0.818						
CAPA1		0.556	0.795	MEASP1		0.628	0.779
CAPA6		0.575	0.792	MEASP2		0.607	0.784
CAPA7		0.537	0.798	MEASP4		0.593	0.787

Note: Source: CFA dataset; N = 114 records.
Factor 1: Internal SCM Focus; Factor 2: Benevolence; Factor 3: Partner Reliability.

The second estimate of reliability is Construct Reliability, *CR*. High construct reliability indicates that internal consistency exists, that is, the measures consistently represent the same latent construct. The standardized loading factors and construct reliability are presented in Table 4.7. The recommended threshold level for *CR* is 0.70; however values in the 0.60–0.70 range are acceptable "provided that other indicators of a model's construct validity are good" (Hair et al., 2006, p. 778). The *CR* value of 0.587 for Factor 1 (Internal SCM Focus) is only slightly less than the 0.60 threshold value; likely due in part to the size of the CFA sample data (N = 114) being used with SEM—a large sample size technique. Given that Cronbach's alpha (0.818) exceeded the 0.70 threshold, this model is accepted as being reliable.

The rightmost column of Table 4.7 displays the Squared Multiple Correlations (SMC) for each measured variable. This value is sometimes referred to as "item reliability" as "it represents how well an item measures a construct" (Hair et al., 2006, p. 796). However Hair et al. (2006) and other sources (e.g., Arbuckle and Wothke, 2004; Kline, 2005; Schumacker and Lomax, 2004) do not provide guidance for interpreting SMC values. They are provided "as is" for completeness of data reporting. Other reliability measures already discussed are sufficient for purposes of keeping or dropping measurement items or providing some indication of a larger issue with the data.

Convergent Validity

Variance Extracted, VE, was also calculated for each latent variable. Netemeyer et al. (2003) suggest a VE threshold of 0.45. Based on the data in Table 4.7, the VE values for Factor 1 (Internal SCM Focus) and Factor 3 (Partner Reliability) fall just short of this threshold; this is likely due to the small sample size. With respect to standardized loading estimates, Hair et al. (2006) give a rule-of-thumb that these estimates be 0.50 or higher; this is the case across all paths in the measurement model.

The second to last column of Table 4.7 details the Critical Ratios from the SCO measurement model. The AMOS software calculates the critical ratios as the regression weight estimate divided by its standard error. At a minimum, all factor loadings should be statistically significant (Hair et al., 2006). Though not shown, all AMOS-reported regression weights are significantly different from zero at the 0.001 level (two-tailed). Where applicable, p-values in excess of 0.001 are described in table footnotes.

Goodness of Fit

Convergent validity was demonstrated in the previous section. A nested-model approach advocated by various authors (e.g., Widaman, 1985; Koufteros et al., 2009) was also used to determine convergent validity as well as discriminant validity. This approach utilizes three SEM models and the goodness-of-fit statistics associated with each model. The three models are:

Model 0 A "null" model consisting of the 15 SCO measurement items and no latent variables. The covariances are assumed to be zero. This is consistent with the criteria of Widaman and Thompson (2003) that "Any version of the null model must (a) estimate as few parameters as are reasonable for the data, and (b) reproduce a nonzero variance and mean (if included in the analysis) for each manifest variable" (p. 20).

Model 1 A second model consisting of the same 15 items, with one latent variable—Supply Chain Orientation. Model 1 has fewer degrees of freedom than Model 0, hence it is more restrictive. The comparison of Model 0 with Model 1 provides additional evidence of *convergent validity* (Widaman, 1985).

Model 2 A third model consisting of the same 15 items, the three first-order latent variables from the EFA, and a one second-order Supply Chain Orientation latent variable. Model 2 is more restrictive than Model 1. The comparison of Model 1 with Model 2 provides evidence of *discriminant validity* (Widaman, 1985).

Table 4.7: SCO: Convergent Validity

Factor / Item	SCO	Standardized Loadings Factor 1	Factor 2	Factor 3	$V(\delta_i)$	Critical Ratio	SMC
Factor 1	0.614				0.683	(FIXED)	0.377
Factor 2	0.740				0.654	3.275	0.548
Factor 3	0.705				0.371	3.210	0.498
CAPA1		0.641			1.575	(FIXED)	0.410
CAPA6		0.634			2.354	5.500	0.402
CAPA7		0.576			1.912	5.095	0.332
MEASP1		0.719			1.493	6.042	0.517
MEASP2		0.687			1.707	5.845	0.471
MEASP4		0.679			1.878	5.795	0.460
BENE1			0.748		1.141	(FIXED)	0.559
BENE2			0.764		0.904	8.259	0.584
BENE3			0.915		0.379	10.011	0.836
BENE4			0.899		0.397	9.862	0.808
COMM1				0.641	0.829	5.158	0.411
CRED1				0.609	1.254	(FIXED)	0.371
CRED2				0.686	0.807	5.388	0.471
CRED4				0.684	0.761	5.376	0.467
NORM1				0.612	1.050	4.994	0.375
CR	0.713	0.587	0.769	0.690			
VE	0.474	0.432	0.697	0.419			

Notes:
Factor 1: Internal SCM Focus; Factor 2: Benevolence; Factor 3: Partner Reliability.
$V(\delta_i)$ is the error variance term for each item,
SMC is the squared multiple correlations value,
p-value for Factor 2 $\leftarrow$ SCO and Factor 3 $\leftarrow$ SCO paths is 0.001,
Source: CFA dataset; N = 114 records.

If Model 0 and Model 1 have a bad fit with the data while Model 2 has the best fit, this supports the assertion that Supply Chain Orientation is indeed a second-order latent variable composed of three first-order factors.

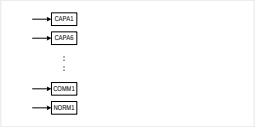
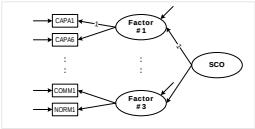
Goodness-of-fit statistics fall into two classes: absolute and incremental fit indices. Absolute fit indices directly measure how well the observed data fit with the model specification, while incremental fit indices assess how well the model specification fits compared to a null or baseline model. There are dozens of candidate fit indices in the literature; Table 4.9 details the six common indices used in this analysis.

There is no single estimate or simple rule for determining good fit across all situations, hence the use of multiple goodness-of-fit estimates (Hair et al., 2006). Further to this point Shah and Goldstein (2006) note: "fit indices should not be regarded as measures of usefulness of a model. They each contain some information about model fit but none about model plausibility" (p. 161). One pattern to observe is that the goodness-of-fit estimates improve as the model advances in each iteration from Model 0 to Model 2. Comparing the estimates of Model 2 in Table 4.8 to the threshold values in Table 4.9 indicate it has a good fit with the data.

At the bottom of Table 4.8, the differences in χ^2 values and degrees-of-freedom (DF) are calculated. The Chi-square probabilities (e.g., $P(\chi^2 = 469.772, DF = 15) = 0.000$) for the differences are zero in both model deltas; these differences are significant. This significant difference between Models 0 and 1 demonstrates convergent validity, and the significant difference between Models 1 and 2 demonstrates discriminant validity (Widaman, 1985).

The SCO measurement model has demonstrated convergent validity and reliability. This confirms Hypothesis H_1 that SCO is indeed a reflective second order latent construct. The measurement model discussion for Supply Chain Operational Performance (SCOP) will follow the same template set here but will be less detailed than this initial section.

Table 4.8: SCO Measurement Model: Goodness of Fit

Model Thumbnail	Goodness of Fit Statistic		Goodness of Fit Statistic	
Model 0				
	χ^2_0	846.825	GFI	0.367
	DF_0	105	AGFI	0.276
	CMIN/DF	8.065	CFI	0.000
	RMSEA	0.250	TLI	0.000
Model 1				
	χ^2_1	377.053	GFI	0.640
	DF_1	90	AGFI	0.519
	CMIN/DF	4.189	CFI	0.613
	RMSEA	0.168	TLI	0.549
Model 2				
	χ^2_2	179.093	GFI	0.829
	DF_2	87	AGFI	0.764
	CMIN/DF	2.059	CFI	0.876
	RMSEA	0.097	TLI	0.850
Model 0 - 1				
$P(\Delta\chi^2, \Delta DF) = 0.000$	$\chi^2_0 - \chi^2_1$	469.772		
	$DF_0 - DF_1$	15		
Model 1 - 2				
$P(\Delta\chi^2, \Delta DF) = 0.000$	$\chi^2_1 - \chi^2_2$	197.960		
	$DF_1 - DF_2$	3		

Source is CFA dataset; $N = 114$ records.

Table 4.9: Summary of Fit Indices

A/I	Label	Name	Description & Threshold Values
A	χ^2/DF or CMIN/DF	Generalized Likelihood Ratio	Compensates for sample size impact on χ^2 statistic. Values less than 2.5 or 3.0 (Woody, 2006) or less than 2 to 3 (Arbuckle and Wothke, 2004) indicate good fit.
A	RMSEA	Root Mean Square Error of Approximation	Known distribution; represents how the model fits a population. Values less than 0.05 (Schumacker and Lomax, 2004) or less than 0.10 (Hair et al., 2006) indicate good fit.
A	GFI	Goodness of Fit Index	Less sensitive to sample size than χ^2. Values greater than 0.90 (Hair et al., 2006) or close to 0.95 (Schumacker and Lomax, 2004) indicate good fit.
A	AGFI	Adjusted Goodness of Fit Index	Adjusts the GFI for model complexity. AGFI values are typically lower than GFI values. Values close to 0.95 (Schumacker and Lomax, 2004) indicate good fit.
I	CFI	Comparative Fit Index	CFI is a normed index (i.e., $0 \leq CFI \leq 1$). Values should be at least 0.90 (Woody, 2006) or at least 0.92, 0.95, or 0.97 depending on N (number of observations) and m (number of variables) (Hair et al., 2006) to indicate good fit.
I	TLI	Tucker Lewis Index	Similar to CFI, though not normed. Values close to 0.95 (Schumacker and Lomax, 2004) indicate good fit.

Note: A/I refers to whether or not the fit index is (A)bsolute or (I)ncremental.

4.5 SCOP Measurement Model

In order to test the predictive validity of SCO, a dependent variable is required. Supply Chain Operational Performance (SCOP) is that variable. The SCO → SCOP structural model will be discussed later in §4.9; this discussion focuses on the SCOP measurement model. SCOP is a second-order latent variable comprised of three first-order latent variables: Resource, Output, and Flexibility. Figure 4.4 illustrates this relationship. Table 3.11 detailed the measurement item wording and descriptive statistics of these three factors. Like the previous measurement items, these items utilized a 7-point Likert scale anchored from Strongly Disagree (1) to Strongly Agree (7). No high mean / low standard deviation cases were found in the data.

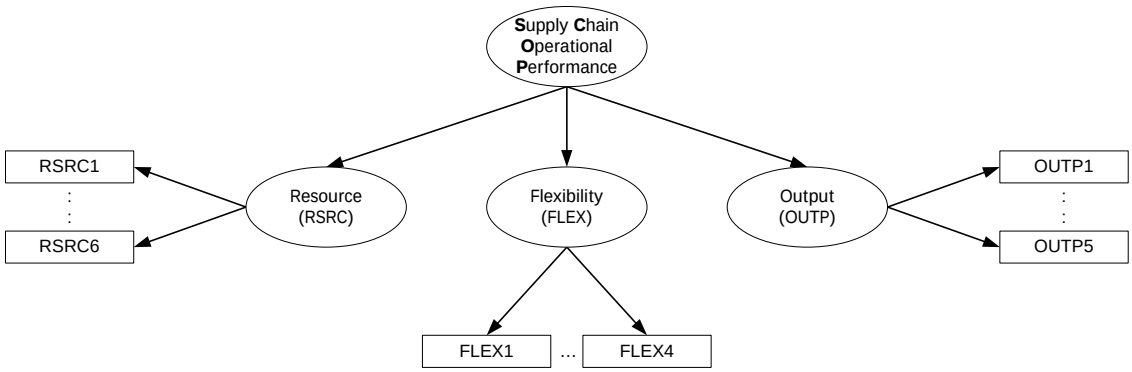


Figure 4.4: Supply Chain Operational Performance (SCOP) Measurement Model

This measurement model was found to have an inadmissible converged solution. An inadmissible converged solution occurs when a parameter estimate returns with an illogical value (Kline, 2005). This was due to a negative variance on the estimate of the OUTP error term (i.e., eOUTP = −0.0.23) caused by a greater-than-one regression weight of 1.014 on the OUTP ← SCOP path. This "Heywood case" is usually associated with small sample sizes ($N < 100$) and few (two) indicators per variable, bad start values, extreme outliers, or extremely high or low population correlations (Kline, 2005; Loehlin, 2004; Schumacker and Lomax, 2004). The exact cause of this problem was not able to be determined but the small sample size is the most likely culprit. To correct this problem the variance on the OUTP error term was forced to a very small value (0.005) as suggested by Dillon et al. (1987). The estimates for this corrected model are in Table 4.11.

The SCOP measurement items were tested for reliability using Cronbach's alpha (Table 4.10). Item RSRC4, with its low item-total correlation (0.306), is a candidate for

deletion. RSRC4 is confusingly worded—what does it mean to "become more efficient with respect to inventory?" Decreased inventory *costs* (RSRC3) can be readily identified in an organization, likewise *efficiencies* for manufacturing and distribution (RSRC2 and RSRC6 respectively) are easily understood. The original measurement item design paired three business functions (manufacturing, inventory, distribution) with two measures: decreased costs and improved efficiency. "Inventory efficiency" is not part of the supply chain argot, hence the possible confusion.

Another SCOP measurement item to be deleted as part of this purification process is OUTP1. The fact that production levels have increased may have little relation to supply chain operational performance. Production levels may fluctuate independently of any supply chain management influences—for example, they may be in near lockstep with the economy in general as is the case for building materials. However, reduced cycle times, increased availability, increased on-time deliveries, and decreased lead-times (items OUTP2 through OUTP5) are more likely a result of having a SCO than general economic influences. The four Flexibility measurement items remain as is.

Table 4.10: Supply Chain Operational Performance (SCOP): Reliability Analysis

Factor / Item	Alpha	Item-Total Correlation	α if item deleted	**Factor** / Item	Alpha	Item-Total Correlation	α if item deleted
SCOP	0.827			**Resource**	0.716		
Output	0.739			RSRC1		0.520	0.657
OUTP1		0.385	0.752	RSRC2		0.474	0.672
OUTP2		0.613	0.651	RSRC3		0.426	0.686
OUTP3		0.541	0.681	RSRC4		0.306	0.714
OUTP4		0.574	0.669	RSRC5		0.563	0.639
OUTP5		0.446	0.714	RSRC6		0.436	0.683
Flexibility	0.766						
FLEX1		0.604	0.690	FLEX3		0.511	0.686
FLEX2		0.560	0.716	FLEX4		0.496	0.748

N = 227 records.

Table 4.11 shows the factor loadings, construct reliability, and variance explained for the SCOP construct. One explanation for this low variance explained (or high variance *un*explained) is the "mixed-temporal" settings for the questions. For example, RSRC5 reads: *Ignoring inflation and increased energy costs, our distribution costs TODAY have DECREASED compared to these same distribution costs at this time two calendar years ago.* The next measurement item, RSRC6, reads: *Our business unit has become more efficient with respect to distribution*—no timeframe is given or assumed. Thus costs are

considered over a set time period; there is no time period implied or suggested over which the efficiency change is examined. Another temporal aspect to be considered (but which cannot be qualified) is that the survey was administered in November 2008, at the height of the global financial crisis. Would there be less variance in a "steady-state" economic situation vs. the turbulent times of Fall 2008?

Table 4.11: SCOP: Convergent Validity

Factor /	Standardized Loadings					Critical
Item	SCOP	RSRC	OUTP	FLEX	$V(\delta_i)$	Ratio
RSRC	0.437				1.548	(FIXED)
OUTP	0.997				0.005*	4.509
FLEX	0.747				0.472	4.269
RSRC1		0.684			2.173	(FIXED)
RSRC2		0.576			1.229	6
RSRC3		0.478			2.390	5.95
RSRC5		0.679			1.432	7.352
RSRC6		0.517			1.164	5.291
OUTP2			0.657		1.296	(FIXED)
OUTP3			0.627		1.167	7.739
OUTP4			0.735		0.906	8.062
OUTP5			0.613		1.430	7.425
FLEX1				0.783	0.675	(FIXED)
FLEX2				0.750	0.611	11.003
FLEX3				0.625	1.125	7.658
FLEX4				0.525	1.291	6.374
CR	0.701	0.506	0.591	0.660		
VE	0.581	0.351	0.435	0.460		

Notes:
$V(\delta_i)$ is the error variance term for each item,
* OUTP error variance forced to 0.005 to avoid Heywood case,
N = 227 records.

Table 4.12: SCOP Measurement Model: Goodness-of-Fit

Model	χ^2	DF	CMIN/DF	RMSEA	GFI	AGFI	CFI	TLI
Model 0	1044.047	78	13.385	0.234	0.469	0.381	0.000	0.000
Model 1	446.195	65	6.865	0.161	0.761	0.666	0.605	0.526
Model 2	302.191	63	4.797	0.130	0.830	0.754	0.752	0.693

Compare	$\Delta\chi^2$	ΔDF	$P(\Delta\chi^2, \Delta DF)$	Comment
Model 0-1	597.852	13	0.000	Evidence of *convergent* validity
Model 1-2	144.004	2*	0.000	Evidence of *discriminant* validity

*The missing degree of freedom is accounted for by forcing V(eOUTP) = 0.005.

4.6 StkO Measurement Model

The Stakeholder Orientation (StkO) measurement model is depicted in Figure 4.5. As mentioned in §3.4.6, the purpose of this set of measurement items is to provide a tool for discriminant validity of the overall Supply Chain Orientation structural model. The StkO latent variable and its four constructs demonstrate high reliabilities as measured by Cronbach's alpha and good item-total correlations as shown in Table 4.13. No measurement items are deleted in this measurement model.

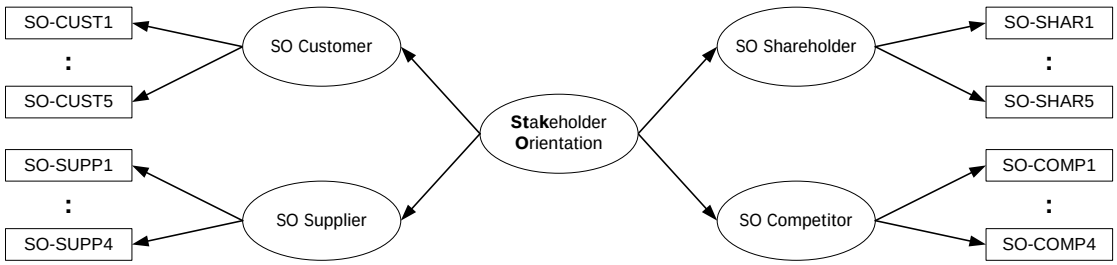


Figure 4.5: Stakeholder Orientation (StkO) Measurement Model

The StkO measurement model was estimated using AMOS and the results are shown in Table 4.15. The SO-SHAR ← StkO path has a low regression weight (0.334). In the original survey data, the Shareholder Orientation (SO-SHAR) question set had the greatest amount of missing data, likely due to the fact that the respondents were small, closely held businesses where the interests of the shareholders are far less important and visible

than for larger, widely held enterprises. The critical ratio for the SO-SHAR ← StkO path was still statistically significant. Since the measurement model had evidence of convergent and discriminant validity and reasonable fit with the data (per Table 4.14), no changes were made to the SO-SHAR ← StkO path.

Table 4.13: Stakeholder Orientation (StkO): Reliability Analysis

Factor / Item	Alpha	Item-Total Correlation	α if item deleted	**Factor** / Item	Alpha	Item-Total Correlation	α if item deleted
StkO	0.866						
Customer	0.866			**Shareholder**	0.804		
SO-CUST1		0.554	0.868	SO-SHAR1		0.472	0.800
SO-CUST2		0.762	0.818	SO-SHAR2		0.542	0.791
SO-CUST3		0.760	0.818	SO-SHAR3		0.592	0.766
SO-CUST4		0.688	0.838	SO-SHAR4		0.643	0.750
SO-CUST5		0.688	0.838	SO-SHAR5		0.697	0.731
Competitor	0.832			**Supplier**	0.767		
SO-COMP1		0.552	0.837	SO-SUPP1		0.560	0.718
SO-COMP2		0.676	0.782	SO-SUPP2		0.664	0.654
SO-COMP3		0.742	0.754	SO-SUPP3		0.551	0.721
SO-COMP4		0.687	0.777	SO-SUPP4		0.505	0.742

Table 4.14: StkO Measurement Model: Goodness-of-Fit

Model	χ^2	DF	CMIN/DF	RMSEA	GFI	AGFI	CFI	TLI
Model 0	2010.164	153	13.138	0.232	0.357	0.281	0.000	0.000
Model 1	981.353	135	7.269	0.167	0.618	0.516	0.544	0.484
Model 2	383.836	131	2.930	0.092	0.832	0.781	0.864	0.841

Compare	$\Delta\chi^2$	ΔDF	P($\Delta\chi^2, \Delta DF$)	Comment
Model 0-1	1028.811	18	0.000	Evidence of *convergent* validity
Model 1-2	597.517	4	0.000	Evidence of *discriminant* validity

Table 4.15: StkO: Convergent Validity

Factor / Item	Standardized Loadings StkO	SO-CUST	SO-COMP	SO-SHAR	SO-SUPP	$V(\delta_i)$	Critical Ratio
SO-CUST	0.752					0.142	(FIXED)
SO-COMP	0.941					0.074*	5.109
SO-SHAR	0.334					0.448	3.198
SO-SUPP	0.457					1.359	4.506
SO-CUST1		0.597				0.591	(FIXED)
SO-CUST2		0.849				0.485	9.248
SO-CUST3		0.845				0.478	9.260
SO-CUST4		0.736				0.785	8.698
SO-CUST5		0.729				0.608	8.598
SO-COMP1			0.548			1.501	(FIXED)
SO-COMP2			0.706			1.115	7.829
SO-COMP3			0.876			0.420	8.490
SO-COMP4			0.841			0.562	8.339
SO-SHAR1				0.468		1.798	(FIXED)
SO-SHAR2				0.539		1.868	5.754
SO-SHAR3				0.725		1.415	5.625
SO-SHAR4				0.804		0.935	5.752
SO-SHAR5				0.794		1.118	6.563
SO-SUPP1					0.690	1.895	(FIXED)
SO-SUPP2					0.786	1.319	9.733
SO-SUPP3					0.643	1.442	6.876
SO-SUPP4					0.583	1.641	6.482
CR	0.753	0.827	0.710	0.609	0.537		
VE	0.443	0.573	0.568	0.462	0.462		

Notes:
$V(\delta_i)$ is the error variance term for each item,
* p-value for variance = 0.332; variance is not significantly different from zero,
N = 227 records.

4.7 Discriminant Validity

As Garson (2009) notes, "Discriminant validity analysis refers to testing statistically whether two constructs differ"—the constructs of interest in this case are the Supply Chain Orientation and Stakeholder Orientation constructs. Three methods, a correlation method, a factor method, and a CFA method were used to establish that SCO is indeed distinct from StkO.

4.7.1 Correlational Method

The model of Figure 4.6 was estimated in AMOS, the correlation results are presented in Table 4.16. As one would expect, there was correlation between the factors of the two variables. However, the correlations were stronger between the first-order variable and its second-order "parent" than between the variable and the other parent. None of the correlations exceeded the $r = 0.85$ threshold as suggested by Garson (2009). Thus the SCO factors are not sufficiently correlated with the StkO factors to be considered the same construct.

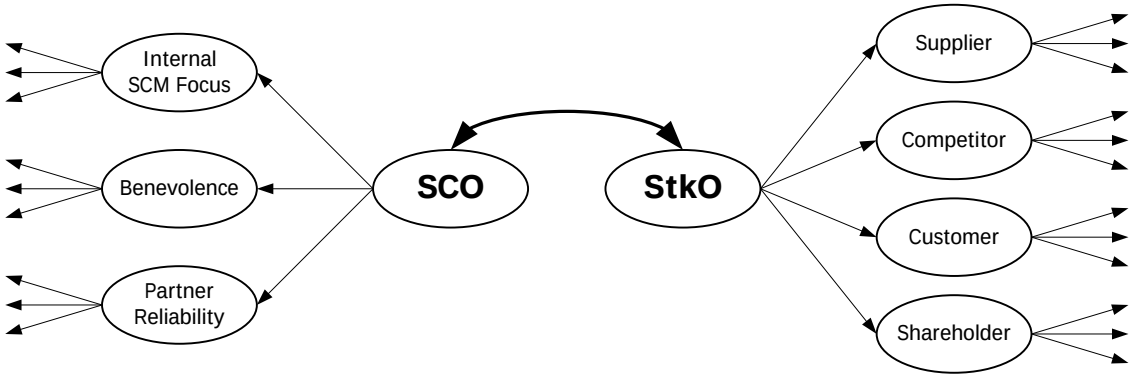


Figure 4.6: SCO ⟷ StkO Correlation Model

4.7.2 Factor Analysis Method

A second method for establishing discriminant validity is to perform a Principal Components Analysis (PCA) on the set of measurement items encompassing both variables of interest (see Straub, 1989). Table 4.17 displays the results of this analysis. There

Table 4.16: SCO, StkO Factors: Correlation Matrix

	SCO	StkO	Factor 3	Factor 1	Factor 2	Supp.	Share.	Comp.	Cust.
SCO	1.000								
StkO	0.918	1.000							
Factor 3	0.706	0.648	1.000						
Factor 1	0.767	0.704	0.541	1.000					
Factor 2	0.600	0.551	0.424	0.460	1.000				
Supp.	0.623	0.679	0.440	0.478	0.374	1.000			
Share.	0.423	0.461	0.299	0.324	0.254	0.313	1.000		
Comp.	0.667	0.726	0.470	0.511	0.400	0.493	0.335	1.000	
Cust.	0.657	0.715	0.464	0.504	0.394	0.486	0.330	0.520	1.000

Note: Factor 1: Internal SCM Focus; Factor 2: Benevolence; Factor 3: Partner Reliability

were occasional, weak factor loadings with both SCO and StkO measurement items included in three of the factors identified through the PCA. However, the PCA reveals seven factors, and the measurement items loading on those factors correspond to the models identified for SCO and StkO in earlier discussion.

4.7.3 CFA Method

The third method leverages confirmatory factor analysis (CFA) techniques. The two structural models used in this analysis are shown in Figure 4.7, an unconstrained model on the left and a constrained model on the right. Both models were estimated in AMOS; the results appear in Table 4.18. Using the criteria advocated by Garson (2009), "If the two models do not differ significantly on a chi-square difference test, the researcher fails to conclude that the constructs differ," it is evident that StkO and SCO are different. Based on the results of these three methods, Supply Chain Orientation is an unique, distinct construct.

Table 4.17: Discriminant Validity: Factor Analysis Approach

Pattern Matrix[a]

	Component						
	1	2	3	4	5	6	7
SO-CUST2	.862						
SO-CUST3	.846						
SO-CUST5	.765						
SO-CUST4	.698						
SO-CUST1	.478						
COMM1							
BENE3		.927					
BENE4		.860					
BENE2		.807					
BENE1		.719					
MEASP1			.835				
MEASP4			.825				
MEASP2			.798				
CAPA1			.607				
CAPA6			.486		.458		
SO-SHAR4				.886			
SO-SHAR3				.844			
SO-SHAR5				.812			
SO-SHAR2				.535			.528
SO-SHAR1				.445			.437
SO-SUPP3					.871		
SO-SUPP2					.774		
SO-SUPP4					.677		
SO-SUPP1					.513		
CAPA7					.508		
SO-COMP1						.834	
SO-COMP2						.709	
SO-COMP3	.414					.592	
SO-COMP4	.423					.506	
CRED2							.713
CRED1							.580
NORM1	.442						.532
CRED4	.454						.529

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 14 iterations.

Note: Factor loadings < 0.40 are not shown.

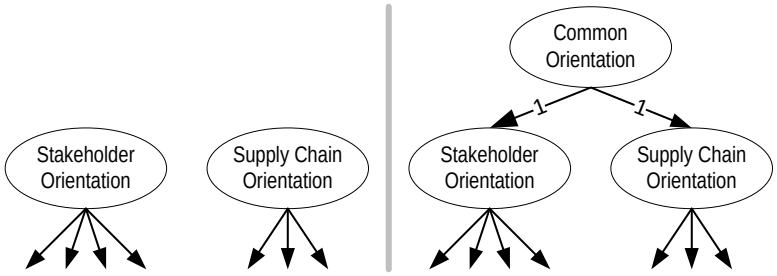


Figure 4.7: SCO / StkO Discriminant Validity: Unconstrained and Constrained Models

Table 4.18: SCO / StkO Discriminant Validity: AMOS Results

Model	χ^2	DF	CMIN/DF	RMSEA	GFI	AGFI	CFI	TLI
Unconstrained	1309.166	488	2.683	0.086	0.742	0.703	0.789	0.772
Constrained	1225.088	487	2.516	0.082	0.746	0.707	0.810	0.794

Compare	$\Delta\chi^2$	ΔDF	$P(\Delta\chi^2, \Delta DF)$	Comment
Un vs. Constrained	84.078	1	0.000	Evidence of *discriminant* validity

4.8 Generalizability of the Supply Chain Orientation

The purpose of this section is to test the generalizability of supply chain orientation. That is, does SCO vary significantly with any industry association membership, a company's position within the supply chain, or generic supply chain strategy. The primary variable of interest is SCO Score, a simple weighted average, is calculated for each survey response as follows:

$$\text{SCO Score} = \sum_{Item \in \{BENE1, BENE2, \ldots, MEASP4\}} \text{ItemScore}_{Item} \times \text{FactorScoreWeight}_{Item} \quad (4.1)$$

where:
ItemScore_{Item} is the score (1...7) on measurement item *Item*,
$\text{FactorScoreWeight}_{Item}$ is the intersection of *Item* and SCO in Table 4.19, and
Item is the set of 15 SCO measurement items {BENE1, BENE2, ..., MEASP4}.

Table 4.19: SCO Measurement Model: Factor Score Weights

Unobserved Variables	Observed Variables					
	CAPA1	CAPA6	CAPA7	MEASP1	MEASP2	MEASP4
Internal SCM Focus	0.116	0.093	0.089	0.148	0.126	0.118
Benevolence	0.005	0.004	0.004	0.006	0.005	0.005
Partner Reliability	0.007	0.006	0.005	0.009	0.008	0.007
SCO	0.022	0.017	0.016	0.027	0.023	0.022
	CRED1	CRED2	CRED4	COMM1	NORM1	
Internal SCM Focus	0.009	0.014	0.014	0.012	0.010	
Benevolence	0.008	0.012	0.012	0.010	0.008	
Partner Reliability	0.116	0.178	0.182	0.155	0.128	
SCO	0.035	0.054	0.055	0.047	0.039	
	BENE1	BENE2	BENE3	BENE4		
Internal SCM Focus	0.006	0.008	0.022	0.020		
Benevolence	0.095	0.112	0.330	0.292		
Partner Reliability	0.008	0.010	0.029	0.026		
SCO	0.025	0.030	0.087	0.077		

The Factor Score Weights of Table 4.19 are calculated by AMOS when estimating the SCO measurement model of Figure 4.3. As Arbuckle and Wothke (2004) describes, "The table of factor score weights has a separate row for each unobserved variable and a

separate column for each observed variable" (p. 170). The four rows by fifteen columns of the original AMOS output has been rearranged for readability in Table 4.19. A survey respondent who responded "Strongly Agree" to measurement item CAPA1 would add 7×0.022 to their total SCO Score.

An analysis was performed on the SCO Score data (Table 4.20 and Figure 4.8) and it was found to be normally distributed.

Table 4.20: SCO Scores: Descriptive Statistics

N	Minimum	Maximum	Mean	Std. Dev.	Skewness	Kurtosis
227	3.823	15.946	10.430	2.192	-0.219	-0.089

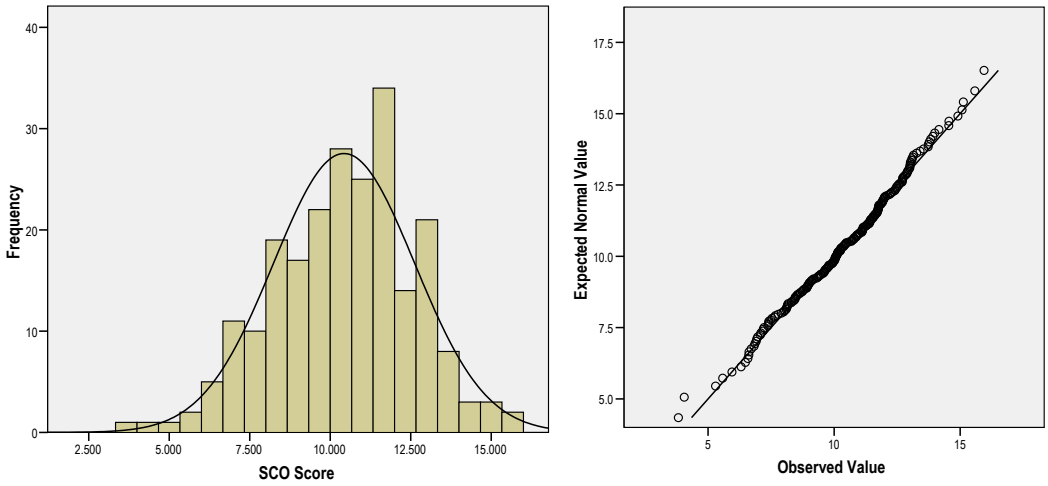


Figure 4.8: SCO Scores: Histogram with $N(10.430, 2.192)$ and Normal Q-Q Plot

4.8.1 SCO by Industry Association Membership

Min and Mentzer (2004) used "Target respondents [who] were identified from the Member Roster of the Council of Logistics Management" (p. 68) as the respondent pool for their survey instrument. Since the key informant or their company was a member of a supply chain-related industry association, it is conceivable that this membership and the

exposure it brings to supply chain ideas through association communications and conferences could bias the results of the survey. This research's target respondent pool was "Canadian manufacturers" and made no presumptions about industry membership.

To determine if SCO is different among respondents that reported a supply chain management industry association membership and those that did not, SCO Score was calculated per Equation (4.1) and eight indicator variables were determined. Indicator IA had a value of 1 if the record came from the SurveyMonkey Industry Association e-mail list and 0 otherwise. Based on results of question Q104 on the survey, 5 indicators were created: APICS, CITT, CSCSC, PMAC, and SCLCan. Each indicator received a value of 1 if the respondent indicated membership in that organization and 0 otherwise. The "Other" indicator had a value of 1 if the respondent indicated membership in a related organization not listed on the survey but supply chain management focused. For example, responses like: NIGP—The National Institute of Governmental Purchasing, ISM—Institute for Supply Management, P.Log.—designation of The Logistics Institute, would score a 1 for Other, while responses like PEO—Professional Engineers of Ontario would score a 0. An aggregate indicator titled "Any" had a value of 1 if any of the other indicators had a value of 1 and 0 otherwise—essentially a logical OR function. Independent samples *t*-tests were completed; the results are tabulated in Table 4.21.

Table 4.21: SCO: Industry Association Membership vs. Non-Membership

	Number		SCO Score Mean		Mean			
Indicator	0	1	0	1	delta	*t*-stat	DF	Sig.
IA	185	42	10.423	10.461	▲	-0.103	225	0.918
APICS	221	6	10.386	12.031	▲	-1.823	225	0.070
CITT	215	12	10.389	11.161	▲	-1.188	225	0.236
CSCSC	225	2	10.399	13.847	▲	-2.234	225	0.026
PMAC	196	31	10.436	10.387	▼	0.116	225	0.908
SCLCan	222	5	10.393	12.066	▲	-1.695	225	0.092
Other	220	7	10.425	10.425	▲	-0.106	6.152	0.919
Any	167	60	10.564	10.564	▲	-1.237	225	0.217

Notes:
1 indicates membership; 0 indicates non-membership. Independent Samples *t*-Test. Number totals to 227 cases. In every group (except "Other"), Levene's Test for Equality of Variances indicated that the *Equal Variances Assumed* assumption was correct. Significance is two-tailed. The Mean delta indicators show whether or not a membership group's mean SCO Score score was higher (▲) or lower (▼) than that of non-members.

Only in the case where respondents identified with CSCSC—the Canadian Supply Chain Sector Council—was there a significant difference between their mean SCO Score score and the mean SCO Score of non-members at $p < 0.05$. However, only 2 of 225 (less than 1% of respondents) identified with this membership so this result is called into question. As well, the CSCSC is an "umbrella" organization that draws it membership from the "pillar associations of the sector" (APICS—The Association for Operations Management, CITT—Canadian Institute of Traffic and Transportation, Canadian International Freight Forwarders Association, PMAC—Purchasing Management Association of Canada, and Supply Chain & Logistics Association Canada) (CSCSC Website, 2010). As indicated by the "Any" result, SCO was no different between respondents who were industry association members and those who were not.

In six out of seven instances the average SCO Score score was higher for respondents who identified with an industry association versus those who did not. However, there was no statistically significant difference in SCO between those two groups of respondents. The implication of this result is that results from convenience samples—for example the CSCMP membership roster—are generalizable to a larger supply chain management practitioner population who are not members of a sampled association.

4.8.2 SCO by Supply Chain Position

This section answers the question "Does supply chain orientation vary across the supply chain from 'ultimate supplier' to 'ultimate customer'?" in order to assess Hypothesis H_4. SCO Score values were calculated using Equation (4.1). Supply Chain Position values from survey question Q21—where the categories ranged from (1) Ultimate Supplier (earth / extraction) to (7) Ultimate Customer—were collected. The mean SCO Score scores and 95% confidence intervals for the mean for the seven supply chain positions are plotted in Figure 4.9.

The Q-Q Plot (Figure 4.8) of the SCO Score data indicated that the data were normally distributed. A Test of Homogeneity of Variances yielded a Levene Statistic of 0.670 (df1=6; df2=220) with a significance value of 0.674. This indicates the variances of the seven supply chain positions are not significantly different, or stated another way, are approximately equal (Field, 2005). With the assumptions of normality and equal variance met, the remainder of the ANOVA analysis can continue.

The null hypothesis is: there are no significant differences between the SCO Score mean scores across the supply chain position categories. An analysis of variance (ANOVA) calculation determined an F-statistic value of 0.384 with 6 df and a significance value of 0.889. Thus, we do not reject this null hypothesis, hence the differences of SCO Score

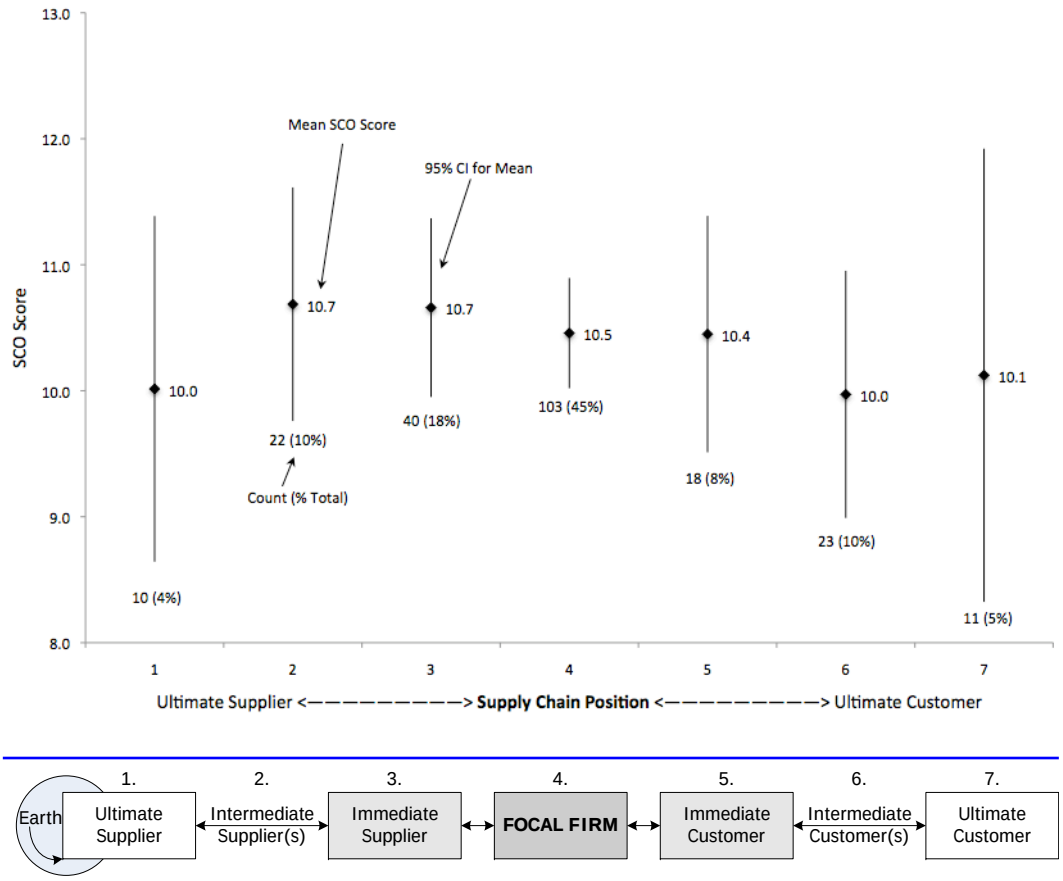


Figure 4.9: Supply Chain Orientation Across the Supply Chain

means depicted in Figure 4.9, while interesting, are not statistically significant. Those organizations that identified themselves as Intermediate or Immediate Suppliers had the highest mean SCO and those organizations on the extreme ends—Ultimate Suppliers, Intermediate and Ultimate Customers—had a lower mean SCO. From a statistical perspective though, all positions in the supply chain had statistically indistinguishable levels of SCO.

The bars on Figure 4.9 represent a 95% confidence interval for the location of the mean SCO Score at the different locations through the supply chain. The higher volume of respondents that identified with position #4 (Focal Firm)—103/227 or 45.4%—is the most probable reason for the smaller confidence interval width. Similarly, the fewer number of responses on the end-points would account for the larger confidence interval widths.

Figure 4.10 plots the mean SCO Scores and the minimum and maximum for each of the seven supply chain position points. The largest range occurred at position four—again, likely due to the preponderance of data at that point. Similarly, the smallest range occurred at the Ultimate Supplier end of the spectrum.

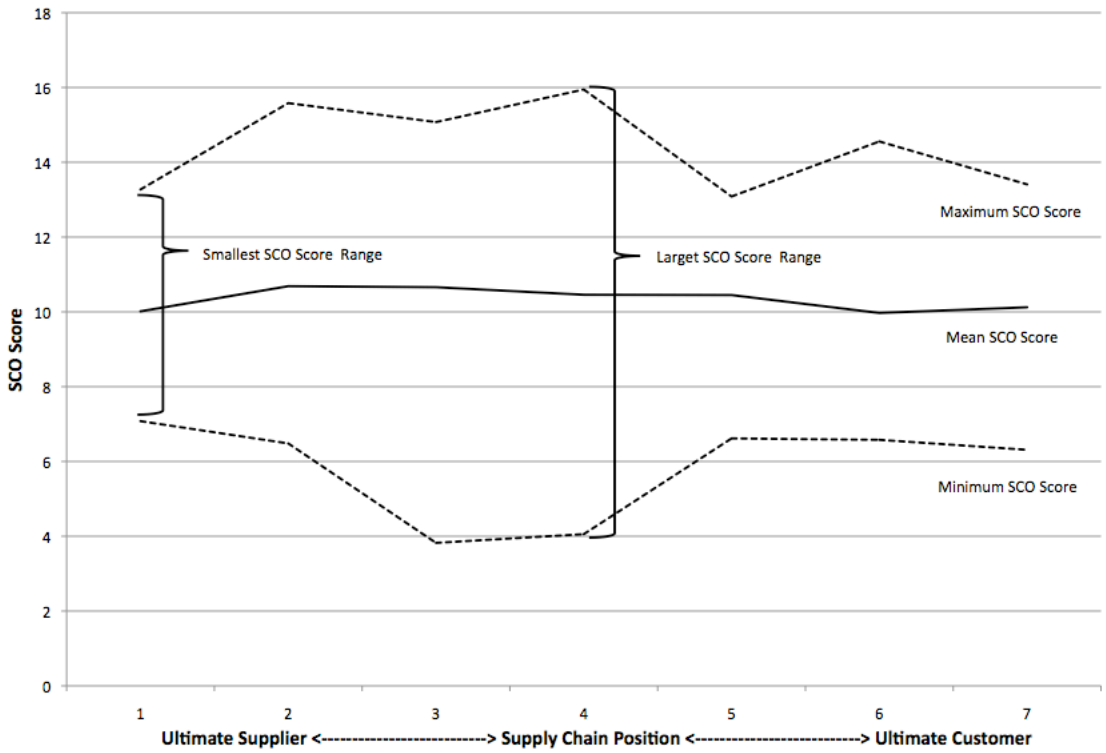


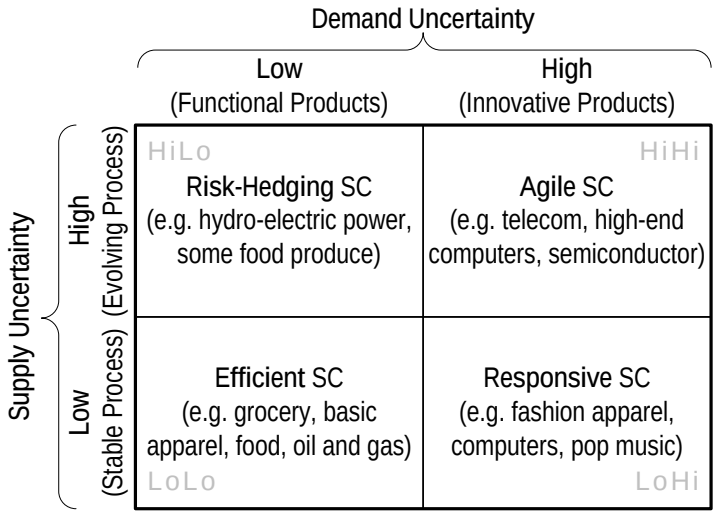
Figure 4.10: SCO Score by Supply Chain Position: Means and Ranges

The implication of this finding is that the SCO construct can be be applied equally well in different business contexts. For example, a study of SCO as it relates to extraction industries does not require a redefinition of SCO as it applies to downstream industries like retail distribution. Likewise a study examining SCO in the context of a company and its upstream and downstream SCM partners would not require any changes to SCO for these relationships. There is no association between supply chain position and level of SCO as measured with the SCO Score. This finding provides support for Hypothesis H_4.

4.8.3 SCO by Generic Supply Chain Strategy

The last generalizability question addressed by this research is "Does Supply Chain Orientation differ depending upon generic supply chain management strategy?" That is, does a company with an efficient supply chain strategy have a different level of SCO than a company with a responsive supply chain (say)? The answer to this question will assist in assessing Hypothesis H_5.

In order to answer this question, the responding companies needed to be sorted into the quadrants of the Lee (2002) "Uncertainty Framework." In order to do that, the levels of supply and demand uncertainty needed to determined. The first twenty measurement items of the survey accomplished this goal—10 measurement items for each of Supply- and Demand- Uncertainty. The generic strategies of efficient, risk-hedging, responsive, and agile supply chains have been discussed in detail previously in §2.7.5. Lee's 2×2 model is presented in Figure 4.11.



Source: adapted from Lee (2002).

Figure 4.11: Lee's Uncertainty Framework with Matched Strategies and Examples

Anecdotal Support for Lee's Model

Professor Lee indicated that his model had not been operationalized prior to this research (Hau L. Lee, personal communication, 2009-MAY-15). A natural question would be, does this taxonomy work in the field? To examine this question, simple averages

of the 1…7 scale data were calculated for the supply and demand uncertainty for the responding companies. The data was plotted to determine if there was sufficient variety to examine SCO for different supply chain strategies—which there is. Some data points that could be associated with a specific company were chosen at random and labeled in Figure 4.12.

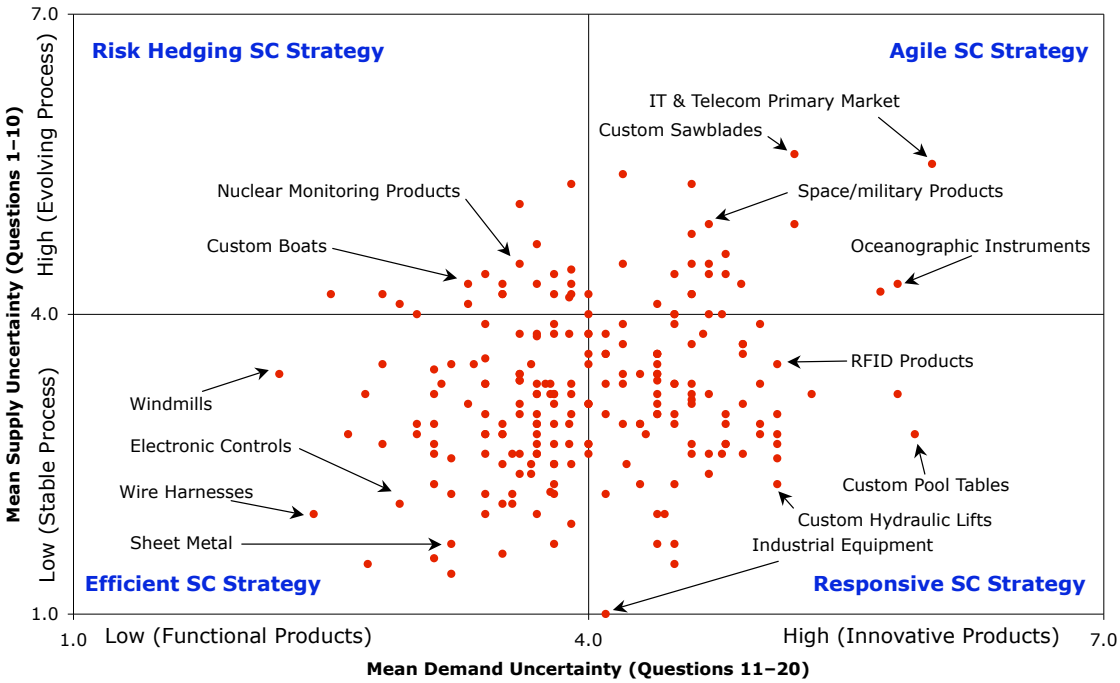


Figure 4.12: Lee Model Scatter Plot (with example company data points)

Anecdotally, a product like sheet metal (say) is a functional product and the supply processes associated with it are very stable; hence one would expect to see it in the "Efficient" quadrant (and we do). Likewise, one would expect to find innovative products with evolving supply processes (like space/military products) in the high-high quadrant for an agile supply chain strategy. From this non-scientific analysis, there is sufficient variety to proceed with answering the research question posed at the start of this section.

Generic Strategies Classification

The Lee model splits uncertainty into "low" and "high" ranges across both supply- and demand- uncertainty. For this research, a K-Means Cluster analysis was performed to classify the data into $K = 2$ clusters for each type of uncertainty. Combining the clusters

together resulted in four groupings, the breakdown of the number of responses for each quadrant appear in Table 4.22. The mean SCO Score for each generic supply chain strategy was calculated and appear on the radar chart in Figure 4.13.

Table 4.22: Number (Proportion) of Respondents by Uncertainty Cluster

		Demand Uncertainty Low	Demand Uncertainty High	Total
Supply Uncertainty	High	Risk-Hedging 36 (16%)	Agile 48 (21%)	84 (37%)
	Low	Efficient 74 (33%)	Responsive 69 (30%)	143 (63%)
Total		110 (48%)	117 (52%)	227 (100%)

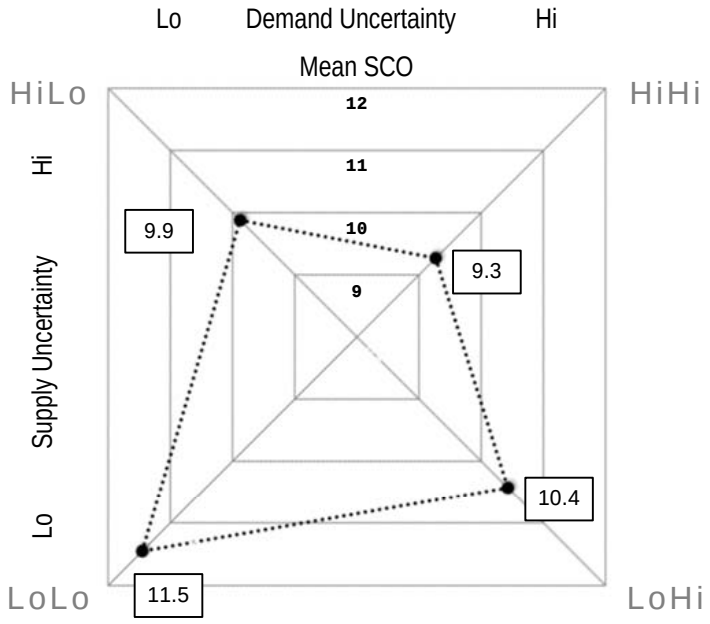


Figure 4.13: Mean SCO Score by Generic Supply Chain Strategy

Companies in the "LoLo" (Efficient supply chain strategy) quadrant exhibited had a higher SCO Score than companies in the other quadrants, while companies in the "HiHi" (Agile supply chain) quadrant had the lowest level of SCO as measured by the SCO Score. As mentioned above, the data for SCO Score is normally distributed. A Test of

Homogeneity of Variances yielded a Levene Statistic of 1.044 (df1=3; df2=223) with a significance value of 0.374 so an ANOVA test was justified for this analysis.

The ANOVA calculation was completed (F-statistic value of 12.219, 3 df, $p < 0.000$) and it was determined that the differences between levels of SCO across the four generic supply chain strategies *is* statistically significant. This implies that there is no statistical evidence to support Hypothesis H_5, that is, SCO *does* vary significantly by generic supply chain strategy.

This unexpected finding required further analysis. Post hoc, independent sample t-tests were performed on the six possible combinations of the four generic strategy mean SCO Scores. The results are shown in Table 4.23. At a typical rejection level of $p < 0.05$, the mean SCO Score for companies with an Efficient supply chain strategy is significantly different from the SCO Score of companies employing any other alternative strategy. Companies employing Responsive supply chain strategies will see a statistically significant different level of SCO (as measured by SCO Score) in comparison with other organizations that utilize an Agile strategy.

Table 4.23: SCO Score: Independent Samples t-Test Results

SC Strategies Compared	Statistical Results		
	t-stat	df	p-value
Efficient • Risk-Hedging	4.101	108	0.000
Efficient • Agile	5.652	128	0.000
Efficient • Responsive	2.924	141	0.004
Responsive • Agile	2.835	115	0.005
Risk-Hedging • Agile	1.410	82	0.162
Risk-Hedging • Responsive	-1.345	103	0.182

Note: In all cases "assume equal variances" was a valid assumption by the corresponding Levene's F-Statistic.

4.9 Structural Model

Structural equation modeling researchers recommend a two step approach—establishing fit with the measurement models before looking at the structural model (e.g., Anderson and Gerbing, 1988; Schumacker and Lomax, 2004). The SCO and SCOP measurement models were discussed above in §4.4 and §4.5 respectively. Figure 4.14 shows a simplified version of the structural model being estimated. It is simplified in that the individual

measurement items, error/disturbance terms, and initial regression weights of 1 are omitted from the figure. The results of the analysis are presented in Table 4.24.

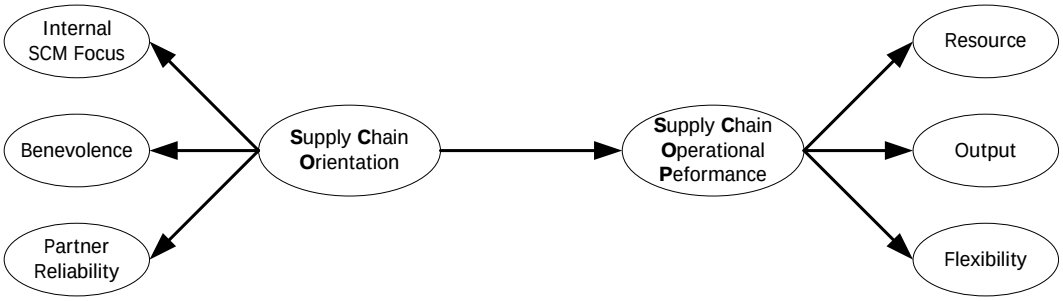


Figure 4.14: SCO → SCOP Structural Model

Table 4.24: Structural Model: SEM Estimates and Goodness-of-Fit

SCO → SCOP Model Path	Std. Weight	Critical Ratio	SCO → SCOP Model Path	Std. Weight	Critical Ratio
SCO → SCOP	0.568	3.549			
Resource ← SCOP	0.494	(FIXED)	Internal SCM Focus ← SCO	0.654	(FIXED)
Flexibility ← SCOP	0.822	4.389	Benevolence ← SCO	0.700	5.249
Output ← SCOP	0.892	4.564	Partner Reliability ← SCO	0.771	4.693

Only first and second order factors appear in this table,
p-values for all critical ratios are < 0.001.

Model	χ^2	DF	CMIN/DF	RMSEA	GFI	AGFI	CFI	TLI
SCO → SCOP	875.102	343	2.551	0.083	0.790	0.752	0.807	0.788

The SCO → SCOP model has a reasonably good fit with the data. The positive regression weight on the SCO → SCO path (0.568) is support for hypothesis H_2, that there is a positive relationship between SCO and SC Operational Performance (i.e., when SCO goes up by 1 standard deviation, SCOP goes up by 0.568 standard deviations).

4.10 TOPM as an Antecedent to SCO

As discussed in §2.6.1, the current structure of Top Management Support (TOPM) being a first order factor of SCO (i.e., SCO → TOPM) is thought to be inaccurate. In this research TOPM is hypothesized to be an antecedent to SCO, that is, TOPM → SCO. In order to assess if this is indeed the case, the structural model of Figure 4.15 was developed and estimated in AMOS. For clarity, other latent variables and paths have been removed from Figure 4.15. The results of the AMOS calculations are displayed in Table 4.25.

Figure 4.15: Top Management Support as an Antecedent to SCO

Table 4.25: TOPM Antecedent Model: SEM Estimates and Goodness-of-Fit

Model Path	Std. Weight	Critical Ratio	Model Path	Std. Weight	Critical Ratio
TOPM → SCO	0.738	6.534	SCO → SCOP	0.553	3.625
Internal SCM Focus ← SCO	0.702	(FIXED)	Resource ← SCOP	0.484	(FIXED)
Benevolence ← SCO	0.660	5.822	Flexibility ← SCOP	0.832	4.317
Partner Reliability ← SCO	0.773	5.391	Output ← SCOP	0.883	4.515

Only first and second order factors appear in this table,
p-values for all critical ratios are < 0.001.

Model	χ^2	DF	CMIN/DF	RMSEA	GFI	AGFI	CFI	TLI
TOPM → SCO	1176.832	487	2.416	0.079	0.773	0.738	0.820	0.805

Thus there is support for Hypothesis H_3, as the standardized regression weight on the TOPM → SCO path is 0.738. Interestingly, the regression weight on the SCO → SCOP path diminishes slightly from 0.568 to 0.553.

4.11 Conclusion

This chapter has undertaken an exploratory factor analysis to determine the underlying structure of the SCO data and determine a parsimonious set of measurement items for the SCO scale. Following on the EFA, confirmatory factor analysis was performed on each of the measurement models in turn. With the CFA complete, a full structural model was estimated. This model was estimated again through the inclusion of top management support as an antecedent to SCO. Table 4.26 summarizes the hypotheses tested in this chapter. The following chapter will discuss the implications of the findings of this chapter.

Table 4.26: Summary of Hypotheses Tested

Hypothesis		Status
H_1	SCO is reflective, 2nd order latent variable	Accept
H_2	Positive relationship: SCO $\rightarrow$ SCOP	Accept
H_3	TOPM is an antecedent to SCO	Accept
H_4	SCO is unchanged across supply chain position	Accept
H_5	SCO is unchanged across generic SC strategies	Reject

Chapter 5

Conclusions

> *Management is on the verge of a major breakthrough in understanding how industrial company success depends on the interactions between the flows of information, materials, money, manpower, and capital equipment.*
> —Forrester (1958, p. 37)

Before discussing the conclusions and implications of the analysis of the previous chapter, consider the following rhetorical questions: When does logistics evolve into *integrated* logistics? Why would purchasing transform into *strategic* purchasing? How does a distribution process develop from "just deliveries" to *just-in-time* deliveries? What causes the planning function to metamorphose into a *collaborative* planning function? In each of these cases, management has adopted a supply chain orientation—a management philosophy—the *implementation* of which results in the supply chain management practices identified in those questions.

The conclusions and implications of this thesis will be laid out as follows: the next section will discuss the conclusions associated with each of the five hypotheses. Following that, later sections explore the implications of these conclusions for academics and supply chain management practitioners; this chapter concludes with discussions about the limitations of this research and proposes a research agenda to build upon the findings of this thesis.

5.1 Conclusions About The Hypotheses

Five hypotheses were developed in §2.7 of the literature review. Four of the hypotheses (H_1 through H_4) were found to have evidence to support their claims. Hypothesis H_5 was rejected through the course of the analysis of Chapter 4. The conclusions and implications of each hypothesis in turn will be explored in the sub-sections which follow.

5.1.1 SCO as Reflective Second Order Latent Variable

This research provides support for the hypothesis that supply chain orientation (SCO) is indeed a reflective second order latent construct with three first order interrelated dimensions. The unobservable (i.e., latent) and reflective (versus formative) nature of the SCO construct was developed through a review of the literature in §2.4. The SCO construct's order was established through the exploratory factor analysis (EFA) of §4.3 and validated in the confirmatory factor analysis (CFA) work of §4.4. The three first order factors comprising SCO identified through the course of this analysis are *currently* labeled Benevolence, Internal SCM Focus, and Partner Reliability. I say 'currently' because I conclude shortly that Benevolence is more correctly designated as "Trust."

Benevolence

In the Mentzer et al. (2001) incarnation of SCO, Trust was considered a key factor in a supply chain orientation. By the time the Min and Mentzer (2004) operationalization of SCO occurred, Trust had been split into Benevolence and Credibility. Benevolence was described as "a firm's belief that its partner is interested in the firm's welfare, is willing to accept short-term dislocations, and will not take unexpected actions that would have a negative impact on the firm" (Min and Mentzer, 2004, p. 65). The Benevolence factor and its four measurement items (BENE1–BENE4) was the only factor of the Min and Mentzer (2004) SCO model to remain intact through the EFA and CFA processes. Here again is the wording of the Benevolence measurement items:

BENE1 When making important decisions, our supply chain members are concerned about our welfare.

BENE2 When we share our problems with our supply chain members, we know they will respond with understanding.

BENE3 In the future we can count on our supply chain members to consider how their decisions and actions will affect us.

BENE4 When it comes to things that are important to us, we can depend on our supply chain members' support.

Of the literature sources Min and Mentzer (2004) used to develop the Benevolence concept, only the Larzelere and Huston (1980) source—a Family Studies article concerned with "close relationships" like those found between spouses—used the word 'benevolence.' This may account for why those interviewed in the first part of this study guffawed at the use of the term 'benevolence' to describe a business relationship. Other terms like Empathy, Support, or Trust could be used to describe this set of measurement items.

Trust Revisited

In the supply chain management strategy development process, "Two or more firms in a supply chain enter into a long-term understanding... to do business with each other on mutually favourable terms with closely integrated and synchronized logistics processes." After entering into that understanding, "The firms work hard to develop high levels of trust and commitment to the relationship" (La Londe and Masters, 1994, p. 38). Commitment and trust is a recurring theme in other literature regarding inter-firm relationships (e.g., Achrol, 1991; Moorman et al., 1993; Morgan and Hunt, 1994). This high level of trust must be maintained in order to achieve SCM success with the strategy. The original SCO model of Mentzer et al. (2001) "proposed that trust has an effect on the sharing of risks and rewards" (p. 13).

In the Min and Mentzer (2004) model, "Trust, which consists of credibility and benevolence, determines cooperation as well as relationship commitment" (p. 65). No rationale is given for the logic to split one concept—trust—into two constituent components. Moreover, this statement implies some determinism or a causal relationship between trust and the concepts of cooperation and commitment. These four concepts, however, appear as unrelated constructs in the Min and Mentzer model.

In the interviews for this research, Donald noted that: "The trust factor becomes a very important variable in terms of how are we going to do business. The customers where there's the least amount of trust are the ones where we certainly have the most amount of difficulty performing and the least inclination to perform." For these reasons—a long established reputation for trust in company-to-company relationships, a lack of rationale for splitting trust, the benevolence term largely unused in management literature, and pragmatic importance of trust in a supply chain management setting—the Benevolence term is hereby renamed "Trust."

Thus, these findings support the notion that trust is important in business relationships, notably supply chain relationships (e.g., Achrol, 1991). An implication for supply chain practitioners is that when developing supply chain partnerships, there needs to be more to the relationship than just 'lowest delivered cost' or other strict economic measures.

Internal SCM Focus

The Internal SCM Focus factor developed out of measurement items from the SCM Capability and Measurement Propensity factors proposed as part of the qualitative research (§3.2.5). Companies with a SCO reflect that in Internal SCM Focus by:

- Fostering supply chain management expertise through formal training and career development programs.
- Doing collaborative planning, forecasting, and replenishment (CPFR) with upstream and downstream partners.
- Including supply chain related key performance indicators (KPIs) as part of the overall corporate KPIs, and engaging in benchmarking activities to compare their operations and processes against those of their competitors. Finally,
- Utilizing staff performance measurements to encourage and reward supply chain performance.

A dynamic capability is the ability to integrate and reconfigure the firm's resources into new configurations to meet the dynamics of the business environment (Eisenhardt and Martin, 2000). Supply chain orientation was shown to be a dynamic capability by Hult et al. (2008) in Section 2.3.2. Even though SCM is the implementation of SCO in the organization, its not a "one shot" project. Supply chain management, if it is to be successful, requires ongoing nurturing through formal training, continuing focus through regular KPI and benchmark reporting, and expanding relationships with suppliers and customers. The Internal SCM Focus factor of SCO reinforces this point.

The implication of this finding for supply chain management practitioners is to understand that SCM is an on-going continuous process, not a discrete project or program. Certain SCM aspects, for example the installation of a warehouse management system (WMS), are discrete, but a company with a SCO should be pressing their WMS for more and better information and real-time KPIs on a continuous basis.

Partner Reliability

The third factor developed through the EFA of §4.3 was "Partner Reliability"—a combination of Credibility, Commitment, and Cooperative Norms measurement items from the original Min and Mentzer (2004) SCO design. Partner Reliability captures these ideas:

- Promises made to our supply chain members by our business unit are reliable.
- Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.
- Our business unit is open in dealing with our supply chain members.
- We defend our supply chain members when outsiders criticize them.
- Our business unit is willing to make cooperative changes with our supply chain members.

Whereas the Trust factor establishes the 'tone' of the relationship (e.g., understanding, empathy, supportiveness), and Internal SCM Focus gives the company the tools needed to nurture the relationship, Partner Reliability speaks to ensuring on-going reliability and quality with SCM partners. Figure 5.1 illustrates this idea.

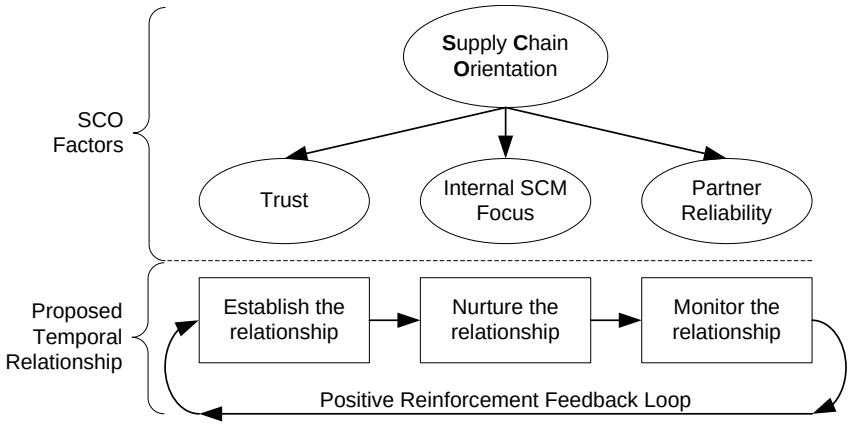


Figure 5.1: SCO and Related Factors

The implication for practitioners of this factor is that key ideas of Total Quality Management (TQM)—that quality is about understanding and improving the process, that reliability is about trusting the product will work as expected when required—are also tenets of an SCM relationship.

Purchasing and Logistics Agnosticism

As discussed in §2.1.2, the definition of 'supply chain management' used in this research needed to be 'agnostic' with respect to which literature stream—purchasing or logistics—it originated. That is, for inclusivity, it could neither emanate from a purchasing tradition or a logistics tradition. Moreover, it is neutral from other possible origins like marketing or operations. The agnosticism of SCM is engendered by an agnosticism in the supply chain orientation definition: "the extent to which there is a predisposition among chain members toward viewing the supply chain as an integrated entity and on satisfying chain needs in an integrated way" (Hult et al., 2008, p. 527).

The three SCO factors identified through the EFA and CFA processes are neutral with respect to purchasing or logistics origins. The agnosticism of SCO in this fashion will translate into an agnostic SCM when implemented.

5.1.2 The Nature of the SCO → SCOP Relationship

The outcomes of adopting an intangible orientation like SCO must manifest themselves in tangible, beneficial ways for the company, otherwise there is no benefit to the orientation adoption. To test whether an increase in SCO would result in tangible benefits to the company, the Supply Chain Operational Performance (SCOP) second-order latent variable was developed. SCOP is composed of three first-order factors: Resources, Output, and Flexibility (per Beamon, 1999). As §4.9 details, supply chain orientation was positively correlated with supply chain operational performance. The standardized regression weight was found to be 0.568 (see Table 4.24). That is, when SCO increases by 1 standard deviation, SCOP increases by 0.568 standard deviations. Hence a positive change in SCO results in a positive change in the operational performance of the supply chain as defined by the SCOP variable.

As shown by Gunasekaram et al. (2001), there is no shortage of supply chain management KPIs available for management to use. While this research established a positive relationship between SCO and SCOP, it is reasonable to assume that and increase in SCO would manifest itself in an increase in other measures of supply chain performance not captured in the "generic" Resources, Output, and Flexibility model of SCOP.

Consider these four operational metrics from the Gunasekaram et al. (2001) list of KPIs: quality of delivery documentation, efficiency of purchase order cycle time, frequency of delivery, and driver reliability for performance. For a company with a transportation function, these may be meaningful KPIs. For a company that has outsourced its transportation function to a third-party logistics provider (3PL), they may have no

interest in these measures—though the 3PL may be very interested in these KPIs. The generic Output factor—the goal being the achievement of a high level of customer satisfaction (Table 3.10)—can capture a portion of supply chain operational performance for both types of organizations.

A manager's perceived Likert-scale *level of agreement* with measurement item OUTP2 [Over the past two years, CYCLE TIMES (i.e., time required to produce a particular item or set of items) at your company have DECREASED] will provide far less operations management information than an actual set of operational cycle time KPIs. Hence the value of SCOP to an organization may be less in its role as a measurement tool, and more in the role of a categorization tool. That is, a manager can categorize their SCM KPIs into Output, Resource, and Flexibility groups. If they discover a particular group is under-represented, additional KPIs that address that SCOP requirement can be included.

5.1.3 TOPM as an Antecedent to SCO

Section 2.6.1 discussed the rationale for the change of Top Management Support (TOPM) in the SCO model from that of first-order factor of SCO (i.e., SCO → TOPM) to antecedent to SCO (TOPM → SCO). The rationale was that this research takes the position that top management support is not unique to SCO, but is a requisite condition for the success of the implementation of any corporate strategy. Hypothesis H_3 argued that TOPM be included as a antecedent to SCO.

Mentzer et al. (2001) describe Top Management Support as a concept "which includes leadership and commitment to change, is an important antecedent to SCM, and the absence of it is a barrier to SCM" (p. 65). As discussed in §2.6.3, the models of this research did not include a Supply Chain Management construct. This does not preclude TOPM from acting as an antecedent to SCO and the results of §4.10 found that this was indeed the case—there was evidence to support the hypothesis that TOPM is an antecedent to SCO.

The implication of this finding is that a firm must have strong top management support in order to have a strong SCO, the outcome of which is improved supply chain operational performance.

5.1.4 SCO Across the Supply Chain

As was shown in §4.8.2, supply chain orientation did vary from 'ultimate supplier' (Earth) to 'ultimate customer' (final consumption), however these differences were not statistically significant. This runs contrary to the theoretic asymmetry proposed by

Mentzer et al. (2001) who advanced that SCO would be most pronounced in the middle of a supply chain and non-existant on the ends (§2.7.4).

The implication for theory is that the asymmetric notion is not supported; instead, SCO can be found in equal measure throughout the supply chain. The implication for researchers and practitioners that SCO can be found in any region of the supply chain continuum is that SCO is not "middle of the chain" specific—all companies from extraction to retailer—can benefit from adopting a supply chain orientation. This result improves the generalizability of SCO to the entire chain. This finding also strengthens the agnosticism of supply chain orientation. That is, SCO was not higher upstream (purchasing / procurement focus) nor higher downstream (logistics focus).

5.1.5 SCO by Generic Supply Chain Management Stragegy

SCO was hypothesized to be static regardless of supply chain strategy. As demonstrated in §4.8.3 however, a statistically significant difference in SCO levels exists between the four generic supply chain strategies of Lee (2002). Moreover, the level of SCO for companies employing an 'efficient' SCM strategy was significantly different from the other three strategies. For the purposes of this discussion, only two diametrically opposed strategies—efficient supply chains with "LoLo" supply and demand uncertainties and agile supply chains with "HiHi" supply and demand uncertainties—will be addressed. Recall that those using an efficient supply chain strategy had a higher level of SCO (11.5 as calculated using Equation (4.1)) versus 9.3 in the case of agile chains.

One possible, plausible explanation for this difference is that efficient supply chains were identified earlier in the literature and have been studied longer than other supply chain types. This claim is based on the observation that the genesis of supply chain management was in the area of improved efficiency. For example grocery stores' and Wal-Mart's supply chains fall into this categorization. Other supply chain strategies like Agile came later and have not had the same degree of exposure and thought applied to them yet. There are other interpretations as well.

The fundamental tenets of supply chain orientation—trust, internal SCM focus, and partner reliability—exist between the companies in the supply chain partnership. It may be the case that SCO is stronger in the case of functional products (i.e., LoLo on supply and demand uncertainty scales) because the companies in the partnership can work on building the relationship. In the case of the agile supply chain strategy, companies are focused on the day-to-day operational issues associated with HiHi supply and demand uncertainties so there is less time or fewer resources committed to relationship building as time and resources are consumed 'fire-fighting.'

As Lee (2002) notes, efficient supply chains "utilize strategies aimed at creating the highest cost efficiencies in the supply chain" whereas agile supply chains "utilize strategies aimed at being responsive and flexible to customer needs" (p. 113). Stated another way, the SCM *processes* for each type of supply chain are very different. Perhaps there is a "natural" lower level of SCO required to be responsive and flexible in order to support agile supply chains while a natural, higher level of SCO is required to support efficient supply chains due to the constant focus on achieving cost efficiencies.

The implications for research of this finding is that future researchers need to be cognizant of these differences and apply either a *post hoc* approach (i.e., include the Uncertainty Framework measurement items to sort respondents by strategy) or an *ex ante* approach and only sample organizations that operate in similar supply or demand uncertainty environments. This is discussed further in §5.7.3. Of course, this does not preclude future research on *why* this phenomena was observed in the first place and if any of the explanations posited above is indeed correct.

The implications of these findings for practitioners are that companies in a competitive environment requiring an efficient supply chain may have to devote more resources to establishing a SCO than in other environments.

5.2 Conclusions about the Research Problem

Only in recent years have attempts been made at developing a formal theory of supply chain management (e.g., Chen and Paulraj, 2004a; Min and Mentzer, 2004), despite the many calls for such work (e.g., Croom et al., 2000; Ho et al., 2002; Li et al., 2006). The central research problem of this thesis was the *refinement* of the Supply Chain Orientation concept (refer to figure Figure 1.3 in Section 1.3). This refinement process was a four-pronged approach: to consider additional indicators, refined new and existing indicators, improve the understanding of the relationship between SCO and other concepts, and to address other related issues (e.g., RBV) to strengthen our understanding of SCO.

In order for this nascent construct to become more widely adopted and provide a strong foundation for supply chain management theory to be built upon it, the construct needed to be well defined and complete in its coverage. This research provided clarity of the definition of SCO, linked SCO to RBV as a theoretical foundation, used EFA and CFA to develop a parsimonious set of factors and measurement items, and tied SCO to an operational outcome, namely SCOP.

Table 5.1 compares the outcomes of this research with the criteria established by Wacker (1998). This is congruent with Wacker's virtue of 'Conservatism', namely that

"A current theory cannot be replaced unless the new theory is superior in its virtues" (p. 365). The table is focused on the comparison of the SCO construct as envisaged in this research. While a construct is *not* theory but rather one component among many, only the most important component—the SCO construct—will be evaluated.

Table 5.1: Virtues of 'Good' Theory (as applied to this research)

Virtue	Key Feature	Comment
Uniqueness	The uniqueness virtue means that one theory must be differentiated from another.	Mentzer et al. (2001)'s SCO construct and the SCO construct of this research differ significantly (e.g. RBV foundation).
Generalizability	The more areas that a theory can be applied to makes the theory a better theory.	This research's SCO construct was found to be applicable across the entire supply chain and independent of industry association membership.
Fecundity	A theory which is more fertile in generating new models and hypotheses is better than a theory that has fewer hypotheses.	This SCO hypothesized about the role of the Lee (2002) supply chain strategies; the findings of which will lead to future research.
Theory parsimony, simplicity, and efficiency	The parsimony virtue states, other things being equal, the fewer the assumptions the better.	The SCO construct of this research has half as many first order factors and less than half as many measurement items than the earlier SCO.
Internal consistency	Internal consistency means the theory has identified all relationships and gives adequate explanation.	Figure 2.10 and the surrounding discussion describes the mechanisms from going from an abstract SCO to an SCM function to the concrete SCOP measures.
Empirical riskiness	Any empirical test of a theory should be risky. Refutation must be very possible if theory is to be considered a 'good' theory.	This conceptualization of SCO may be completely wrong if the Hult et al. (2008) 'orientation of orientations' approach is found superior.
Abstraction	The abstraction level of theory means it is independent of time and space. It achieves this independence by including more relationships.	SCO was integrated into the larger RBV (and derivative theories) where Mentzer et al. (2001) did not.

NOTE: the 'virtue' and 'key feature' columns are from Table 1 of Wacker (1998).

As Table 5.1 documents, the incarnation of SCO as defined and refined in this research is superior to the previous description of SCO using the Wacker (1998) criteria.

5.3 Implications for Theory

The paper is meant only as a first cut at a huge can of worms.
—Birger Wernerfelt (1984, p. 180) in "A Resource-Based View of the Firm."

As Wacker (1998) argues, "Theories carefully outline the precise definitions in a specific domain to explain why and how the relationships are logically tied so that the theory gives specific predictions" (p. 363). The theoretical model of Figure 2.10 is reproduced here as Figure 5.2. This will provide an overview of the supply chain orientation framework of this research as the discussion regarding the theoretical implications of this thesis begins.

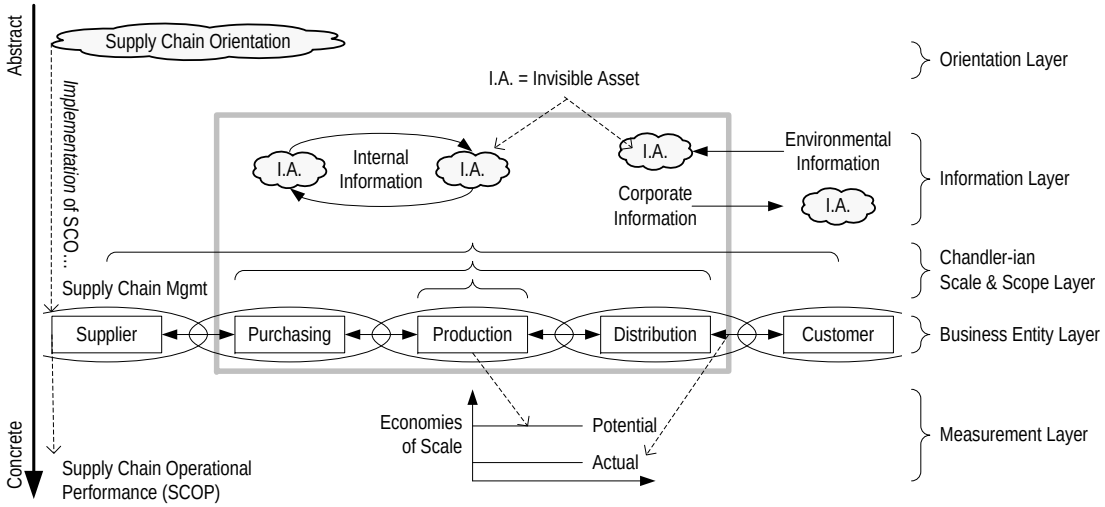


Figure 5.2: Theoretical Model: RBV and SCO

5.3.1 Measurement Layer

This discussion will start with the most concrete section, the Measurement Layer, and work up to the Supply Chain Orientation construct in the abstract Orientation Layer. The key construct of the Measurement Layer is the Supply Chain Operational Performance (SCOP) construct, developed from the ideas of Beamon (1999). As discussed in §5.1.2, SCOP can be used in the abstract to measure "overall" operational performance, but is better utilized as a tool for categorizing and organizing specific KPIs.

Using Figure 5.1 as a starting point and arranging the SCOP factors in a 1:1 correspondence with the SCO factors yields the diagram illustrated in Figure 5.3. The goal of Flexibility in the SCOP construct is "the ability to respond to a changing environment" (see Table 3.10). The corresponding SCO factor, Trust, is requisite here. Understanding and empathy would be required to understand the nature of the supply chain relationship. What may be a turbulent market to one partner may be business as usual to another. Presumably there were causal factors in the environment that lead the businesses to partner in the first place.

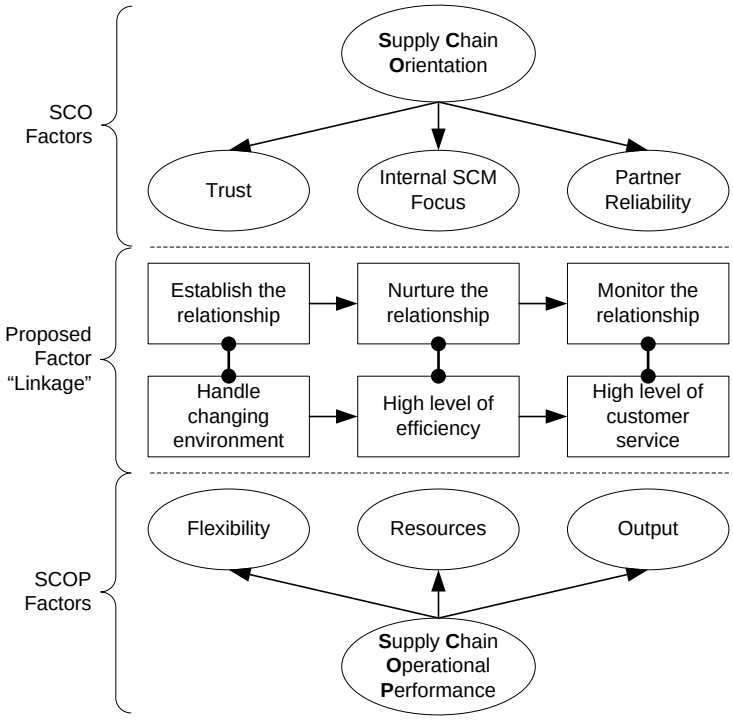


Figure 5.3: SCO and SCOP Factor Alignment

The Internal SCM Focus of the SCO construct is mapped to the Resource component of SCOP. Resource performance measures are concerned with high levels of efficiency. Both are internally focused and deal with the core aspects of the business. Finally, the Partner Reliability aspect of SCO corresponds to the SCOP notion of Output. The goal of Output is high levels of customer service. Customer service stems from the on-going reliability and quality with SCM partners as part of Partner Reliability.

As Beamon (1999) concludes, "Performance measurement selection is a critical step in the design and evaluation of any system. Generally, the larger and more complex the

system, the more challenging it becomes to measure effectively" (p. 289). The SCOP construct provides a 'generic' measurement tool of operational performance across three dimensions which map to the key factors of a SCO. Thus SCOP provides a mechanism to validate the presence of SCO.

A second theoretical contribution at the Measurement Layer is the operationalization of the Lee (2002) Uncertainty Framework. With this framework operationalized and available to other researchers, future studies can leverage this tool to sense which generic supply chain management strategies a given organization may be employing. This information could be correlated with other items of interest from the study.

Finally, knowing the physical characteristics of a production facility and the actual throughput will establish a measure of economies of scale and scope (Mahoney, 2005). Taking Mahoney's logic further, one could "measure" organizational capabilities in an objective, quantitative fashion.

5.3.2 Business Entity Layer

At the Business Entity Layer this research contributed a simple taxonomy—the so-called "Atomic" and "SCO" Views of a supply chain (Fig. 1.1). This research did not speculate about nor investigate the mechanisms associated with a change in point of view for an organization. Future research is called for to build an understanding of why and how a company transforms from taking an Atomic view to taking a SCO view—or vice versa. That is, future research could investigate those mechanisms that might be at work in the case where a company abandons a supply chain management strategy in favour of an Atomic View arms-length business relationship strategy with other companies. The factors of SCO—Trust, Internal SCM Focus, and Partner Reliability—are present in this business entity layer. For example, in the linkage between Supplier and a firm's Purchasing function, all three factors need to be available in some measure for supply chain management to occur. In the supply chain management "maturity model" of Lockamy and McCormack (2004), the highest level of maturity—so called Extended System—requires that "Trust, mutual dependency and *esprit de corps* are the glue holding the extended supply chain together" (p. 276; emphasis in the original). Trust is only mentioned at the highest level of maturity whereas this research posits that trust is integral to the establishment of the SCM relationship.

To aid in the understanding of the Business Entity Layer, the elements of Figure 5.1 can be re-cast as the "Sand-cone model" of Figure 5.4. To build a sand-cone in the physical world, one starts by pouring sand in one place. The base of the cone expands in order to support its growing height. It is not possible to have a taller sand-cone without

first having a wider sand-cone base. This requires the addition of more sand to the cone and so it goes. The sand-cone analogy has been applied to TQM and SCM processes in the past (e.g., Ferdows and De Meyer, 1990; Vokurka et al., 2002).

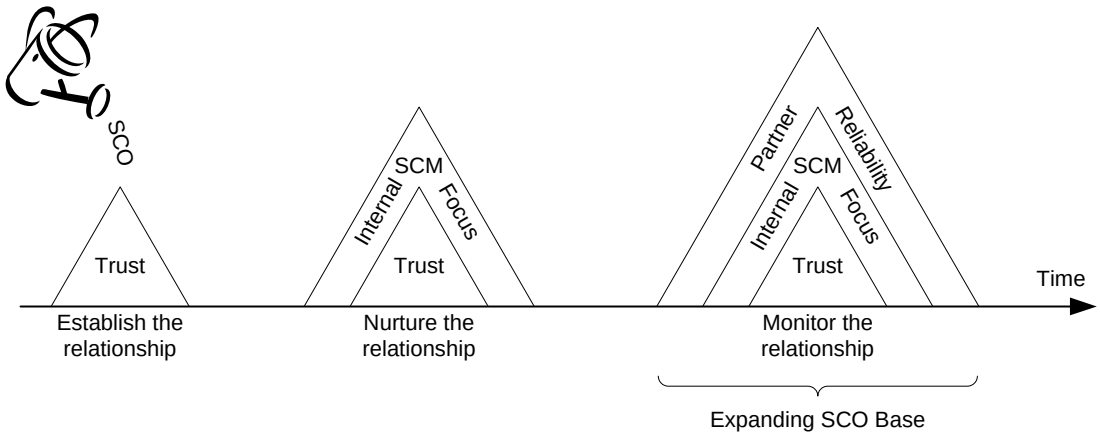


Figure 5.4: The "Sand-Cone" Model of Supply Chain Orientation

The SCO sand-cone, depicted in Figure 5.4 as a conic-section triangle, is gradually built up over time. As Vokurka et al. (2002) observe, "The sand cone model implies that the preceding capability contributes to the successive capabilities" (p. 18). In §5.1, the Trust element of SCO establishes the inter-company relationship, the Internal SCM Focus helps to nurture this relationship, and Partner Reliability ensures the monitoring of the relationship. What was labeled "positive reinforcement feedback loop" in Figure 5.1 is depicted here as an ever expanding SCO base. This increasing Supply Chain Orientation, when implemented as Supply Chain Management, will result in deeper and stronger inter-company SCM ties. Thus, the SCO model developed through this research is readily applicable to all of the links between business entities in the Business Entity Layer.

5.3.3 Chandler-ian Scale and Scope Layer

The Chandler-ian Scale and Scope Layer describes the mechanisms for the implementation of SCO into SCM, namely: "investment in production to achieve the cost advantages of scale and scope; investment in product-specific marketing, distribution, and purchasing networks; and investment in managerial talent and management structure to plan, coordinate, and monitor the firm's often dispersed operations" (Mahoney, 2005, p. 168).

Hence, if an organization wishes to implement a SCO, investments need to be made within the organization and across networks with partner organizations.

The investment in managerial talent is congruent with the fostering of SCM expertise through formal training and career development as part of the Internal SCM Focus. Likewise for the management structure for planning—it maps to the collaborative planning, forecasting, and replenishment element. Monitoring the firm's operations occurs with the Internal SCM Focus element of KPIs and Benchmarking as well as the Partner Reliability requirement in general.

5.3.4 Information Layer

The 'Invisible Assets' of the Information Layer represent the integration of the resource-based view with supply chain orientation. These invisible assets or invisible resources "are often a firm's only real source of competitive edge that can be sustained over time" (Mahoney, 2005, p. 184). Furthermore, "Invisible assets serve as a focal point of strategy development and growth" (ibid, p. 185).

Controlling information flow is key to the successful creation of invisible resources. Supply chain management is extremely information intensive. Controlling the flow of information in an SCM setting is a necessity for proper functioning of the supply chain, but has the added benefit of creating invisible resources as a by-product.

5.3.5 Orientation Layer

The largest contribution to theory of this research is the *refined* Supply Chain Orientation construct. Through the literature review, SCO was determined to be a unique strategic orientation. Additionally, the prior assumption that SCO was a second-order reflective latent variable was shown to be correct. As described in §5.2 above, the refined SCO construct was more 'virtuous' than the originally proposed SCO construct of Mentzer et al. (2001).

5.3.6 Implications for the Resource-Based View

One of the arguments made for the necessity of this research was to set SCO within a larger theoretical framework where Mentzer et al. (2001) and Min and Mentzer (2004) had not (§1.4). For the reasons given in §2.3.1, the resource-based view (RBV) was determined to be the most appropriate theoretical basis in which to link to SCO. This

approach is consistent with the work of Hult et al. (2008), from whom the SCO definition used herein originated.

The power of the RBV comes from its relatively sparse set of conceptual elements—e.g., resource, capability, dynamic capability—and the myriad of ways these elements can be used to describe a phenomena and make predictions. For example, SCO was established as a dynamic capability, that is, a class of capability used to create or reconfigure operational capabilities (Teece et al., 1997). The power of this reconfiguration ability is found in a trade magazine article from April of this year describing the impact of the eruption of Iceland's Eyjafjallajökull volcano on European trade:

> The vulnerability of global supply chains was evidenced yet again with this month's volcano in Iceland, which crippled air cargo throughout Europe for days. In South Carolina, the BMW Manufacturing Co. was forced to slow production because leather seat covers from South Africa and transmissions and other parts from Europe were grounded. The UK's Tesco experienced disruptions in produce and flower imports from Kenya. (Sowinski, 2010)

Other organizations, those with the (dynamic) capabilities in place to reconfigure their operations, were able to quickly adapt:

> The biggest integrators—UPS, DHL, and FedEx—moved as much freight as possible through Spain and neighboring southern European countries (ibid).

Thus, the RBV describes how SCM-focused companies like FedEx and others could quickly respond, while others (like Tesco) could not. That is, the logistics-based companies had the dynamic capability of 'flexibility' to reconfigure their supply network as a result of a disruption, whereas the other exemplar companies did not have this capability.

The contribution of this research to the RBV is two-fold. First, this research reinforces the findings of Hult et al. (2008) that SCO is a dynamic capability. If one were to regard the RBV as a countable set of resources, capabilities, and dynamic capabilities, the number of elements in that set has increased through this analysis. While not a true empirical test to satisfy the criticisms of Priem and Butler (2001), through the volcano example described above, anecdotal evidence is provided to demonstrate that companies with similar resources (e.g., air cargo capacity) can configure those resources differently to respond to changes in the external environment.

5.4 Implications for Methodology

The contributions of this research to methodology come in two areas. First, the development of the colour-coded chart of *all* survey responses (Fig. 3.12) aided in the understanding of the incoming data. One possible application could be the determination of abandonment rates from this data. From a verification and trouble-shooting perspective, the survey measurement item that was incorrectly coded was quickly identified and rectified before proceeding with downstream data analysis.

Second, the Thompson (2004) Parallel Analysis (PA) approach to determining the number of factors to retain in the exploratory factor analysis phase was utilized in this research. This method is not widely adopted by management researchers (Hayton et al., 2004), but through the completion of this thesis and subsequent article(s) extracted from this research, this method will be widely shared.

5.5 Implications for Policy and Practice

The main contribution of this research is that of a *refined* Supply Chain Orientation construct from the earlier conceptualizations of Mentzer et al. (2001) and Min and Mentzer (2004). Section 5.2 provided more detail about this refinement in the context of the Wacker (1998) criteria for "good" theory. The purpose of this section is to discuss the implications of this refined SCO construct for the practitioner community.

A central question in the strategic management literature (if not *the* central question) is why do some firms outperform others? This is not just an academic question, but one of primary importance to general managers as well. One simple way for managers to understand this is through the Owner-Operator (O-O) examples in §2.3.1. The implication being that it is not about the resources which a company possesses that contributes to success, but rather *how* the company uses those resources. More quantitatively however, managers can relate to the findings that an increased level of supply chain orientation results in increased Supply Chain Operational Performance (SCOP)—a very tangible measure.

The notion of SCOP, however, is not intended to provide the practitioner community with a single metric for the successful management of a supply chain. Rather, its main function is to serve as a categorization tool to ensure that the KPIs and metrics a manager is using are allocated across three key areas—Resource, Flexibility, and Output.

One potential implication for managers is an improved understanding of the temporal aspects of SCO. For example, monitoring of a SCM partnership will not be successful

unless trust and nurturing precede it in time. This thesis also argued that SCM is the implementation of SCO—that is, the orientation must come first before showing up as supply chain management practices.

If a manager or management team has decided to adopt a SCO and is having difficulty with its implementation, this research can provide some guidance. Temporal aspects aside, using the regression weights of Table 4.24 would indicate that for a given level of SCO, more of that will be reflected in Partner Reliability (standard weight = 0.771) than will be reflected in Internal SCM Focus (0.654). Thus a manager struggling with a SCO implementation would be advised to focus on the elements of the Internal SCM Focus first in order to achieve supply chain management.

Portions of the survey instrument itself can be utilized by management at a strategic level. For example, the first twenty questions which assess the supply and demand uncertainty per the model of Lee (2002) can provide some initial insight into whether or not the supply chain strategy adopted meshes with the "theoretical" strategy suggested by Lee. This assessment could have taken place prior to this research; this is the first time the Lee model was contextualized into a survey instrument.

Managers of businesses that require an efficient supply chain for their functional products (e.g., grocery stores), need to be aware that they require a higher level of SCO than for other supply chain strategies. This may be due in part to the constant focus on driving costs out of the system. By "higher level of SCO," I mean that managers must invest more time and effort into developing and building trust with their SCM partners, nurturing the SCM relationship, in addition to monitoring it through KPIs and so forth.

The implication of Top Management Support (TOPM) as an antecedent is also of importance to practitioners. While the results indicated a slight drop in the SCO → SCOP path with TOPM as an antecedent (regression weight = 0.553) versus without (0.568), the TOPM → SCO relationship was quite strong (0.738). Effective supply chain management requires an ongoing commitment from senior management and this is validation of this notion.

To reiterate, SCO was found to be comprised of three factors. Trust is important in business relationships, and in the context of SCO, needs to be addressed first. The implication for managers is that this relationship must be built upon trust before SCM occurs. Nurturing the relationship is the role of Internal SCM Focus. The practical implications of this are:

- Managers must develop their supply chain management capacity through formal training and developmental career opportunities. The Canadian Supply Chain Sector Council (CSCSC), an umbrella organization of SCM related industry associ-

ations, states clearly part of its mission is "to develop solutions to the human resource challenges faced by stakeholders" CSCSC (2010).

- Upstream and downstream partners need to be involved in collaborative planning, forecasting, and replenishment (CFPR) activities. Innovative strategies like Vendor-Managed Inventory (VMI) should also be explored.

- Use a variety of supply chain related key performance indicators (KPIs) and perform benchmarking activities on an ongoing and regular basis. The KPIs should fall into the Resource, Flexibility, and Output categories discussed by Beamon (1999).

In discussing generic business strategies, Porter (1985) observes that "unless a firm strictly separates the units pursuing different generic strategies, it may compromise the ability of any of them to achieve its competitive advantage" (p. 18). The implication of this is that it may be suboptimal for a company to purse multiple strategies simultaneously. If a company is going to pursue a low-cost producer strategy (say), then SCM with a focus on efficiency may be an integral part of that strategy and hence SCO would be a recommended choice of orientations to pursue.

If, however, a company wishes to pursue a differentiation strategy, it may be optimal for them to chose an alternate orientation like Market Orientation and focus their energies there foregoing SCM efficiencies. SCM is not a strategy, but rather one tool of many to achieve the company's strategy.

5.6 Limitations

Section 1.6, Research Scope, framed this research as being limited to 'the examination of supply chain orientation in continuous, long-term supply chains associated with Canadian-based for-profit enterprises, either public or privately held.' The further reduction of scope to manufacturing enterprises is perhaps the most serious limitation of this research. That is, the narrow focus on Canadian manufacturers precludes generalization of the results to other for-profit sectors (e.g., non-manufacturing business, service industries) and to the broader spectrum of non-profit organizations (e.g., governmental agencies, non-governmental organizations (NGOs), and humanitarian logistics organizations). These other sectors may also benefit from the adoption of a supply chain orientation and the associated accrual of SCM benefits.

Second, the assessment of SCO and SCOP was relatively simplistic. A senior manager was asked to think about their organization's SCM situation in very broad, general

terms. Within an organization, SCO may vary greatly by product line, strategic business unit, or geographic location. This would be reflected in a variety of supply chain management practices and varying degrees of strength of supplier- and customer- relationships across the enterprise. This variety is not able to be captured by a few Likert-type survey questions.

Finally, this research's main data gathering method—mail survey methodology—resulted in a low response rate as discussed in §3.5.4. This raises concerns of potential non-response bias; however, the results of §3.5.8 did not find evidence of this bias. Additional survey waves or intensive follow-up with non-respondents would have strengthened this research. Further, the small number of respondents implies that caution be exercised before generalizing the results to larger populations. Thus definitive conclusions should not be drawn from this single research study. Further research is called for to extend the findings of this research. The next section addresses this call.

5.7 Implications for Future Research

5.7.1 Competing SCO Models

This research began in 2006 after the work of Min and Mentzer (2004) was published. In the Fall of 2008, at about the time this research's survey instrument was launched, the Hult et al. (2008) model was posited. Had that paper appeared earlier or the survey happened later it may have been possible to incorporate the ideas from the Tennessee School of Thought, the findings from the qualitative interviews for this research, and the "orientation of orientations" thinking of Hult et al. together into a hybrid model.

An obvious next step in the development of supply chain orientation as a working construct for theory building is resolving the findings of this research with the "orientation of orientations" thinking of Hult et al. (2008). Figure 5.5 illustrates these two competing SCO conceptualizations.

The orientation of orientations model of Hult et al. had some overlap with the Stakeholder Orientation of this research in terms of Customer, Competitor, and Supplier orientations. However, three important factors—Logistics, Operations, and Value-Chain orientations—or factors analogous to these, were not captured in the design of this research hence it was not feasible to develop a framework roughly congruent that that of Hult et al.'s model for testing purposes. Hence further research is warranted to develop the 'definitive' SCO construct. One lesson from the Marketing literature is that anytime MO is discussed, differing opinions (e.g., Kohli and Jaworski, 1990; Narver and Slater, 1990) need to be constantly reconciled.

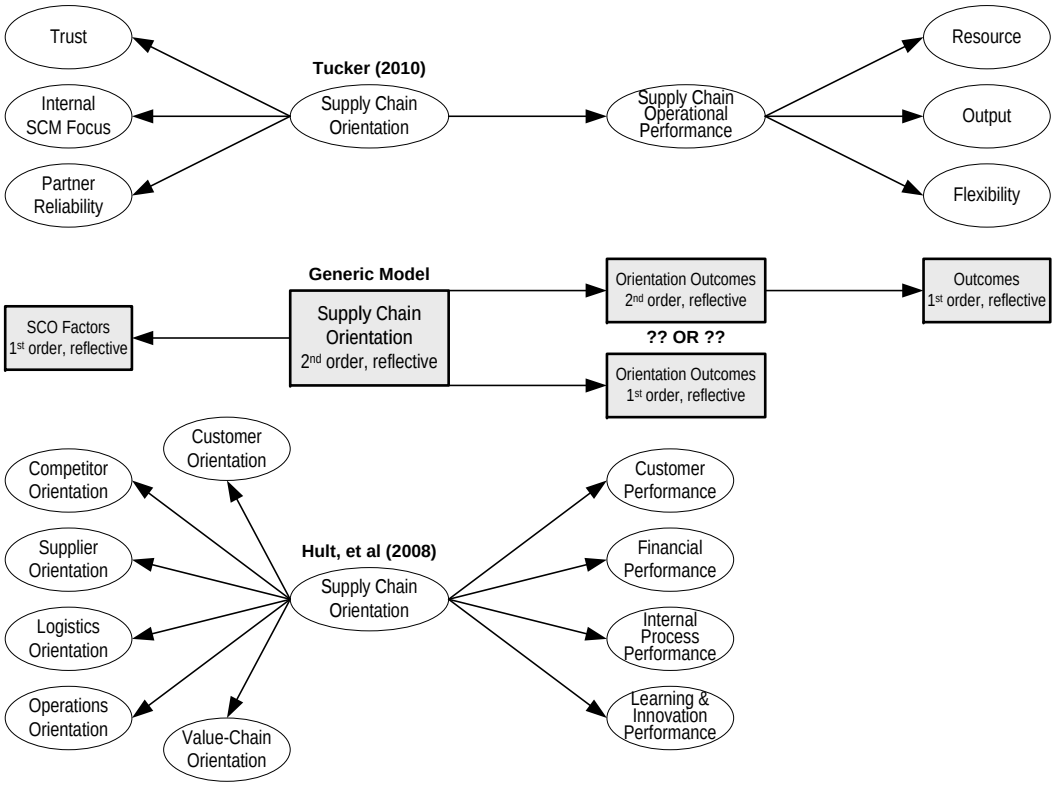


Figure 5.5: Two Models of Supply Chain Orientation

5.7.2 SCO in Other Settings

As mentioned in §5.6, this research concerned itself with Canadian manufacturing companies. With this refined SCO now complete, one could apply the SCO → SCOP model to other industry sectors and/or other supply chain settings (e.g., Humanitarian Logistics).

Supply chain orientation in a macro-level context of other non-manufacturing industries would have many of the same characteristics of SCO as developed in this research—continuous, long-term supply chains, motivated by a profit motive. Research in these areas would be valuable for broadening and validating the findings of this thesis. The survey design of this research would be an appropriate method to employ for this approach.

Rather than examine SCO from a single informant / single company perspective, an interesting approach would be to examine SCO on a micro-level; i.e., multiple informants

within a given supply chain. How / why does SCO vary from company to company in the chain; how / why does SCO vary with the business units of a single company? For this approach, a case study method would be called for. As Larson and Halldorsson (2002), noted "Case study methods may be more useful than surveys, to further understanding of SCM. Researchers should be encouraged to consider alternative research methodologies to enhance and enrich the SCM body of thought" (p. 42). This method also reduces the issue of "resource contention" raised in §3.6.2.

In both the macro- and micro- level SCO research streams proposed, the profit motive is an important consideration, as is the fact that the supply chains being studies have been in existence for some time. In the case of humanitarian logistics, those assumptions are missing. There is no profit motive. No humanitarian logistics supply chain exists until the disaster strikes. Supply chain infrastructure is severely compromised or non-existant, yet supply chain management eventually starts to function. How can these differences inform SCO? How can lessons from humanitarian logistics be applied to for-profit supply chains or vice-versa?

5.7.3 SCO and Efficient SC Strategy

The result of Hypothesis H_5 was unexpected, but opens up a rich vein of research question development. First among these is "why would SCO be higher for an efficient supply chain strategy over other strategies?" Some possible explanations were given, but all need to be properly researched. Perhaps SC Strategy is a moderator of the SCO → SCOP relationship? The data for performing this analysis is available as part of my research, but due to time constraints, this avenue has not been pursued.

Perhaps the question Fisher (1997) so famously asked—what is the right supply chain for your product?—needs to be updated to "what is the right supply chain *orientation* for your product." That is, perhaps there is no "one-size-fits-all" universal supply chain orientation, but rather variations on the SCO management philosophy based on market conditions. Hence an ESCO (Efficient Supply Chain Orientation) or an ASCO (Agile Supply Chain Orientation) might be objects of study. If the implementation of SCO is supply chain management, then working backwards—different SCM styles could appears as the result of different SCO implementations. By extension, does Market Orientation (MO) apply all marketplaces or would one expect to see MO differences between turbulent and stable markets (to use the uncertainty framework approach)?

Between having competing SCO models to reconcile, alternative supply chain settings in which to apply SCO, and an unexpected research result teeming with research questions, there is no shortage of exciting future research opportunities for developing our understanding of supply chain orientation.

5.8 Conclusion

This research set upon the call by Min and Mentzer (2004) to "refine the suggested indicator variables, add additional indicator variables, and further investigate the relationships among the SCM-related concepts" (p. 84) as it related to the concept of Supply Chain Orientation. This research accomplished those objectives by developing a parsimonious SCO construct with three factors—Trust, Internal SCM Focus, and Partner Reliability. This construct was found to be a second-order reflective latent variable. The outcome of SCO was a positive increase in Supply Chain Operational Performance (SCOP). Top management support was found to be an antecedent to SCO. SCO was found to remain relatively static across the supply chain. However, it was found that generic supply chain strategy could differentiate SCO. This unexpected and important finding will open up new research into supply chain orientation going forward.

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Appendix A

Interview: Recruitment Materials

A.1 Recruitment E-mail

E-mail Subject Line:
Supply Chain Management Research Study – University of Waterloo

Participant Name,

My name is Trent Tucker and I am a PhD student at the University of Waterloo in the Management Sciences department. I am currently working on fulfilling the dissertation requirement of my PhD. My research is focused on supply chain management, specifically how a company's "worldview" influences the adoption of supply chain management practices. This research project is being carried out under the supervision of Dr. Rod McNaughton.

I am seeking your participation in the form of an interview. Since your company is a member of the **SCM organization**, I would like to include your company as one of several companies to be involved in my study. I believe that because you are actively involved in the management and operation of your company, you are best suited to speak to this supply chain management topic. Your participation in this study is entirely voluntary. Should you wish to participate, we can arrange a time to meet at a convenient location. The interview is expected to last an hour and will take the form of an informal discussion. In addition to taking notes by hand, I plan to record the meeting on a digital voice recorder.

This project has been reviewed and has received ethics clearance through the Office of Research Ethics at the University of Waterloo. Should you have any questions about the study, please contact either myself, Trent Tucker, at trtucker@engmail.uwaterloo.ca

or Dr. Rod McNaughton (519) 888-4567 ext. 32713, rmcnaughton@uwaterloo.ca.

Thank you for your time,
Trent Tucker
University of Waterloo
Management Sciences
trtucker@engmail.uwaterloo.ca
(519) 886-6654

A.2 Recruitment Telephone Script

P = Potential Participant; **I** = Interviewer

I - May I please speak to [**Participant Name**]?

P - Hello, [**Participant Name**] speaking. How may I help you?

I - My name is Trent Tucker and I am a PhD student in the Management Sciences department at the University of Waterloo. I am currently conducting research under the supervision of Dr. Rod McNaughton on supply chain management. As part of my thesis research, I am conducting interviews with supply chain management professionals to get their perspective on how a company's "worldview" influences the adoption of supply chain practices.

I am seeking your participation in the form of an interview. Since your company is a member of the **SCM organization**, I would like to include your company as one of several companies to be involved in my study. I believe that because you are actively involved in the management and operation of your company, you are best suited to speak to this supply chain management topic. Is this a convenient time to give you further information about the interviews?

P - No, could you call back later (agree on a more convenient time to call person back).

OR

P - Yes, could you provide me with some more information regarding the interviews you will be conducting?

I - Background Information:

- I will be undertaking interviews starting April, 2007.
- The interview would last about one hour, and would be arranged for a time convenient to your schedule.
- Involvement in this interview is entirely voluntary and there are no known or anticipated risks to participation in this study.
- The questions are quite general, and the interview will be more like a informal discussion about supply chain management and general business practices, versus proprietary processes.
- In addition to taking notes by hand, I plan to record the meeting on a digital voice recorder.
- You may decline to answer any of the interview questions you do not wish to answer and may terminate the interview at any time.
- With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis.
- All information you provide will be considered confidential.
- The data collected will be kept in a secure location and disposed of in five years time.
- If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact Dr. Rod McNaughton at 519-888-4567, Ext. 32713.
- I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes in the Office of Research Ethics at 519-888-4567, Ext. 36005.
- After all of the data have been analyzed, you will receive an executive summary of the research results.
- With your permission, I would like to mail/fax you an information letter which has all of these details along with contact names and numbers on it to help assist you in making a decision about your participation in this study.

P - No thank you.

OR

P - Sure (get contact information from potential participant i.e., mailing address/fax number).

I - Thank you very much for your time. May I call you in 2 or 3 days to see if you are interested in being interviewed? Once again, if you have any questions or concerns please do not hesitate to contact me at my home phone number (519) 886-6654.

P - Good-bye.

I - Good-bye.

Appendix B

Interview Consent Form

Before the interview, the participant will be provided with an information letter detailing the study and a consent form. These documents will provided together, on University of Waterloo letterhead, and follow this template:

University of Waterloo
Date

Dear **Participant Name**:

As mentioned in our [e-mail exchange / telephone conversation] of [date], I am providing you with this information letter and consent form.

My name again is Trent Tucker, and my area of research is Supply Chain Management. More specifically, my research is focused on how a company's "worldview" influences the adoption of supply chain management practices. The data collected during the interview phase of the research will contribute to the development of a survey to be used in the second phase of my research. This research project is being carried out under the supervision of Dr. Rod McNaughton.

I am seeking your participation in the form of an interview. Since your company is a member of the **SCM organization**, I would like to include your company as one of several companies to be involved in my study. I believe that because you are actively involved in the management and operation of your company, you are best suited to speak to this supply chain management topic.

Participation in this study is voluntary. It will involve an interview of approximately one hour in length to take place in a mutually agreed upon location. You may decline to

answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time by advising the researcher. With your permission, the interview will be recorded to facilitate collection of information, and later transcribed for analysis. All information you provide is considered completely confidential. Your name will not appear in any thesis or report resulting from this study, however, with your permission anonymous quotations may be used. Data collected during this study will be retained for five years in a locked facility and then confidentially destroyed. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at (519) 886-6654 or by e-mail at trtucker@engmail.uwaterloo.ca. You can also contact my supervisor, Dr. Rod McNaughton at 519-888-4567 ext. 32713 or email rmcnaughton@uwaterloo.ca.

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes of this office at 519-888-4567 ext. 36005, using reference number ORE#12859.

I hope that the results of my study will be of benefit to those organizations, like yours, directly involved in the study, to the larger Canadian Supply Chain Sector Council and its affiliates, as well as to the broader research community. I very much look forward to speaking with you and thank you in advance for your assistance in this project.

Yours Sincerely,

Trent Tucker
Student Investigator

CONSENT FORM

I have read the information presented in the information letter about a study being conducted by Trent Tucker of the Department of Management Sciences at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be tape recorded to ensure an accurate recording of my responses.

I am also aware that excerpts from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher. This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Office of Research Ethics at 519-888-4567 ext. 36005.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

___ YES ___ NO

I agree to have my interview recorded.

___ YES ___ NO

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

___ YES ___ NO

Participant Name: _____ (Please print)

Participant Signature: _____

Student Investigator: Trent Tucker

Student Signature: _____

Date: _____

Appendix C

Interview Script

Interview Documentation

Date: _____ Time: _____

Location: _____ Organization: _____

Participant: _____ Position: _____

Other Comments:

Before we begin, I would like to thank you for agreeing to participate in this discussion — I appreciate you taking time out of your schedule to assist in this research effort. As mentioned in the information letter, I am researching how a company's "worldview" influences the adoption of supply chain management practices.

The format of the interview will be focused and somewhat structured. I will start by asking a question and you can take your time to collect your thoughts and respond. I may ask follow-up or clarifying questions based on your response. The overall interview will consist of approximately fifteen questions and as much discussion as you would like. You will also have the opportunity to provide general comments, thoughts and feedback both throughout the interview and at the end.

Let's begin with some introductions…

Introduce myself —
Academic — undergrad in math, MBA, now a PhD student
Professional — distribution at Imperial Oil, global logistics at Methanex, consulting to Union Gas, etc.

Interviewee introduction —
Years of experience
Types of firms
Positions held
Industry association membership

Q: My research on your company prior to this interview leads me to believe that **Corporation Name** is in the **Industry** industry, with products that could be best characterized as **product characteristics**. Further, I would describe the industry as **industry characteristics** (e.g. stable / volatile, established / emerging, commodity driven / product driven. etc), and hence the nature of your company's supply chain would be **supply chain characteristics** (e.g. efficient, responsive, agile, etc).

Could you take a few moments to just verify that I have described the nature of your firm, its products, which markets you compete in, and the role of supply chain management in the firm described adequately?
☞ Rationale: establishes initial parameters. Clarifies firm + product + SCM role for later questions.

Q: Is supply chain management viewed as being more strategic or more tactical in this company?
☞ Rationale: establishes scope of SCM in this firm.

Q: When I used the term "worldview" in the business context, what came to mind?
☞ Rationale: open ended question to establish if the participant and the interviewer are in general agreement on the key terminology.

If there is strong divergence on this point, I would clarify by interjecting: "By 'worldview' I mean how a company views itself in its business world. That is, does a company see itself as a discrete entity with arms length customers and suppliers or does a company see itself as part of a business continuum where suppliers and customers and the company are tightly integrated together. I don't want to elaborate any more on this point,

since I want to hear your thoughts on supply chain management."

Q: If I used a term like "supply chain orientation", what comes to mind?
☞ Rationale: open ended question to provoke a naïve, practitioner based definition of SCO.

Q: As I understand it, "supply chain orientation" means {*repeat back their description*} this to you? We will be using this idea of supply chain orientation for the rest of this interview.

Q: If we look at two companies competing in the same business, one with a supply chain orientation and one without, how could we tell which company had the orientation and the other didn't?
☞ Rationale: as above, naïve definition of results and/or antecedents.

Q: Based on your experience and looking **internally** at a company and its management, what attributes or characteristics would the company's management have to possess for a company to have a supply chain orientation? [Prompt: for example, trust, would be a example of such an attribute – a company in a SCM relationship places a great deal of trust in its suppliers to deliver]
☞ Rationale: see what sort of internal attributes are discussed. Do they mesh with the Min and Mentzer (2004) model {credibility, benevolence, commitment, norms, compatibility, top management support}?

Q: Again, based on your experience, but looking **externally** at a company in its business environment, what attributes or characteristics of the business environment would need to exist for a company in that environment to possess a supply chain orientation? [Prompt: for example, low profit margins is a characteristic of the retail industry – because of this, WalMart is focused on squeezing costs out of every point in the supply chain]
☞ Rationale: see what sort of external antecedents are mentioned.

Q: What are some supply chain management "best practices?" Would any of these practices be more likely to be found in a company with a supply chain orientation than a company that doesn't have a supply chain orientation? Why would this be the case?
☞ Rationale: establishes a list of best practices and ties specific practices to SCO.

Q: Could a company have a supply chain orientation without a supply chain management function?

Q: Or, alternatively, could a company have a supply chain management function but not a supply chain orientation?
☞ Rationale: establishes (or refutes) precedence, optionality, and relationship between SCO and SCM.

Q: Consider this simple supply chain – a supplier, a company, and a customer. In which company(s) would you expect to find a supply chain orientation?
☞ Rationale: examines the Min and Mentzer requisite condition that SCO exist across all members of a supply chain from a practitioner perspective.

Q: Now that we've talked about supply chain orientation at some length (in very general terms with some examples), is there anything about your original definition of {*original description*} you would like to modify?
☞ Rationale: allows for refinement of naïve definition, may spawn new ideas.

Q: If I wanted to measure supply chain orientation somehow, how could I do that?
☞ Rationale: naïve ideas about measurement theory as applied to SCO; useful for identifying antecedents and/or results parameters.

Q: Based on your experience and in your opinion, can a company's view of the world, what ever view of the world they choose, shape or influence the performance of that company? [Prompt: that is, what role does management's philosophy or worldview have on business results?]
☞ Rationale: Is there some validity to this notion of strategic orientations from a practitioner perspective or is this only in the academic realm?

Q: There is an existing concept called "supply chain orientation". It is made up of these factors:

- Credibility – a firm's belief that its partner stands by its word, fulfills promised role obligations, and is sincere.
- Benevolence – a firm's belief that its partner is interested in the firm's welfare, is willing to accept short-term dislocations, and will not take unexpected actions that would have a negative impact on the firm.
- Commitment – an implicit or explicit pledge of relational continuity between exchange partners.
- Cooperative norms – the perception of the joint efforts of both the supplier and

distributor to achieve mutual and individual goals successfully while refraining from opportunistic actions.

- Compatibility – i.e. compatible corporate culture and management techniques of each firm in a supply chain are necessary for successful SCM, and
- Top Management Support – leadership and commitment to change.

Are these concepts you would use to describe supply chain orientation, or a company's "worldview"?
☞ Rationale: tests existing Min and Mentzer model in a qualitative way.

Q: Are there other attributes, like those mentioned, that must exist in a company or be exhibited by management for a company to achieve supply chain management success?
☞ Rationale: possible model extensions.

Q: Again, thank you for your time and input. Your comments are greatly appreciated. I just want to {clarify / reiterate / expand upon} the following point(s):
• key points of discussion...

Q: Do you have any additional questions or anything else you would like to ask?

Appendix D

List of Interview Participants

The anonymized list of interview participants appears in Table D.1. This table contains the same information as Table 3.1 in the Methodology chapter, along with interview dates and notes regarding data capture. As before, pseudonyms are used for the interview participants and the companies they work for have been disguised. Their job titles have not been disguised or anonymized.

Table D.1: Anonymized List of Interview Participants

Pseudonym	Actual Job Title Generic Company Description	Date of Interview	Detail
Andy	Vice President Operations Canadian / North American Integrated 3PL	2007-May-17	○ ☎ ✇
Betty	Director – Global Supply Chain Global Base Chemicals Manufacturer	2007-May-24	● ☎ ✇
Charles	VP Commercial/Logistics Global Food Company	2007-Jun-06	● ☺ ✇
Donald	Senior Director – Strategic Customer Services Large Canadian Food Company	2007-Jun-06	● ☺ ✇
Edward	President & CEO Large North American Logistics Services Company	2007-Jun-11	○ ☎ ✇
Frank	Director – Operations Large Global Snack & Ready Foods Company	2007-Jun-21	○ ☺ ✇
Gary	Chief Operating Officer Warehousing & Logistics for Large Global Retailer	2007-Jun-29	○ ☎ ✇
Harold	President & CEO Logistics Focused Large Crown Corporation	2007-Aug-23	○ ☺ ✇
Ivan	Production Control & Purchasing Global Automotive Assembly Company	2007-Sep-07	○ ☎ ✍

Legend:
● personal contact, ○ referred contact.
☺ in person interview, ☎ telephone interview.
✇ interview audio recorded then transcribed, ✍ interview notes taken by hand.

Appendix E

Survey Invitation E-mail

To: [**Email**]
From: trtucker@engmail.uwaterloo.ca
Subject: Supply Chain Management Survey — University of Waterloo

Body of E-mail Message:
To: [**FirstName**], [**CustomValue**]
From: Trent Tucker, UW PhD Student Researcher
Re: SCM Research Survey Invitation

[**FirstName**]:

I am writing to inform you that you have been selected to participate in a survey on Supply Chain Management and Supply Chain Operational Performance. One aspect of the survey – Supply Chain Orientation – has not been examined in Canada yet, so this is an exciting time for innovative research in an important Canadian industry. I invite you to click on:

http://www.surveymonkey.com/s.aspx

to find out more information about the survey, more information from UW's Office of Research Ethics, and start the survey itself. The survey will take about 20 minutes to complete. In return, after all the data is in and if you agree, I will e-mail you a customized 3-page "Report Card" which details your firm's Supply Chain Operational Performance scores against the industry scores. Thanks for your time, and I look forward to your

supply chain management input and insight.

Trent Tucker, MBA
PhD Candidate
University of Waterloo, Management Sciences
T: +1.519.886.6654 • E: trtucker@engmail.uwaterloo.ca

Note: some e-mail clients 'wrap' the web link inside the message and cut off parts of the URL. If the above link does not work, please copy and paste this full link into your browser's address field:

http://www.surveymonkey.com/s.aspx?sm=WZcagKsj7TnvTWRsRc2URA_3d_3d

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
http://www.surveymonkey.com/optout.aspx

The SurveyMonkey.com tool allows for four fields in the mailing list:

Email The e-mail address of the recipient. Required. Must be unique and a valid e-mail address.

FirstName Can be *any* text. In this case, it was set up as *salutation, first name, last name*, so a FirstName entry would appear as "Mr. Trent Tucker."

LastName Can be *any* text. In this case, it was used as a tracking field of the form: AAA-99999999. The AAA was a three letter code denoting which list was used (e.g. WST for Western Canada) and the 99999999 was the Scott's Company ID number.

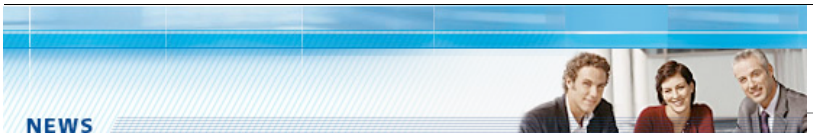
CustomValue Again, can be any text. In this case, it was used for the company name, e.g. "UW Researchers, Inc."

The boilerplate opt-out text in the last paragraph is required per the SurveyMonkey.com Terms of Service and was added automatically to all outgoing e-mail messages.

Appendix F

Survey Invitation: PMAC

The following document is a screen capture of the invitation sent to PMAC's membership in November. The URL is: http://www.pmac.ca/news/nov_2008_supply_chain_survey.asp



Participate in new supply chain survey – and receive a free customized report

November 2008

Take part in ground-breaking research on "supply chain orientation" by completing an online survey, conducted by Trent Tucker, PhD Candidate at the University of Waterloo.

Supply chain orientation is about how a company views the world through its relationships with suppliers and customers and how that "worldview" impacts a company's supply chain operational performance. According to Tucker, this is the first time that this area of SCM has been studied in Canada.

The survey will take about 20 minutes to complete, and in return you can choose to receive, by e-mail at the conclusion of the study, a customized three-page "Report Card" detailing your firm's supply chain operational performance score.

Our profession of supply chain management cannot advance without innovation, and innovation cannot happen without research. So please take this opportunity to support the work of one of Canada's SCM researchers.

Complete the survey now.

Appendix G

Survey

The following document is a PDF version of the survey created by the SurveyMonkey.com website.

UW Supply Chain Mgmt Survey

University of Waterloo Office of Research Ethics Information Page

University of Waterloo Office of Research Ethics Information Page

This web-based survey is being conducted by Trent Tucker as part of my PhD dissertation, under the supervision of Professor Rod McNaughton, Department of Management Sciences at the University of Waterloo, Waterloo, Ontario, Canada.

My research is focused on supply chain management, specifically how a company's "worldview" influences the adoption of supply chain management best practices.

I am seeking your participation in this 20 minute web-based survey. Your participation in this survey is entirely voluntary.

- You may decline any questions that you do not wish to answer.
- You can withdraw your participation at any time by not submitting your responses.

Furthermore,

- There are no known risks from participating in this survey.
- All information that you provide will be kept private and confidential. Survey data will be anonymized and retained for five years on a personal computer and then confidentially destroyed.

This project has been reviewed by, and received clearance from the UW Office of Research Ethics. In the event you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes (ssykes@uwaterloo.ca) at +1.519.888.4567, Ext. 36005. Refer to ORE #15167.

Thank you for your consideration and participation in this research survey.

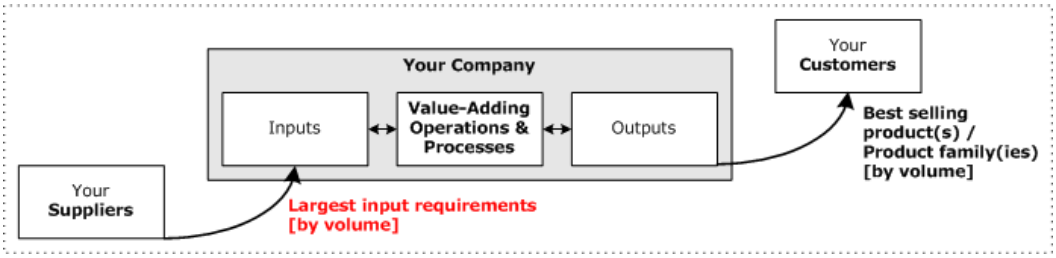
Yours Sincerely,

Trent Tucker, MBA
Student Investigator
trtucker@uwaterloo.ca

Supply Characteristics (1/2)

Supply Characteristics (1/2)

Figure 1. Supply Characteristics



UW Supply Chain Mgmt Survey

For this section refer to Figure 1 above. Please think about your company's largest input requirements (by volume) that are sourced from external suppliers. In this context please tell me about your company's Supply Characteristics:

Q1

	Limited Supply Sources	...	..	.	..	...	More Supply Sources
Supply Sources	}	}	}	}	}	}	}

Q2

	Unreliable Suppliers	...	..	.	..	...	Reliable Suppliers
Supplier Reliability	}	}	}	}	}	}	}

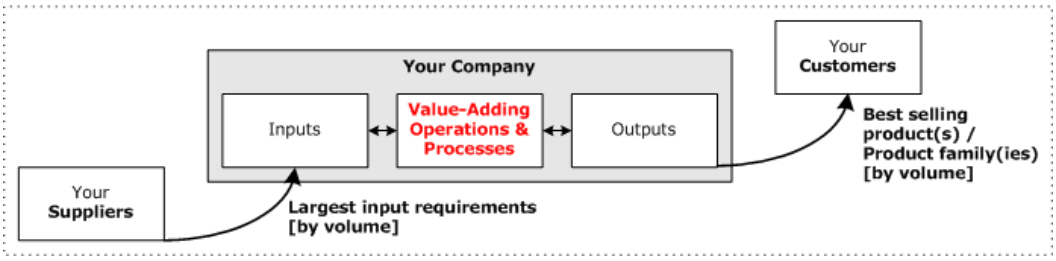
Q3

	Variable Lead Time	...	..	.	..	...	Dependable Lead Time
Lead Time	}	}	}	}	}	}	}

Supply Characteristics (2/2)

Supply Characteristics (2/2)

Figure 2. Operations & Processes



For this section refer to Figure 2 above. Please think about the operations and processes used to transform inputs into your company's products. In this context, please tell me about your company's Operations & Processes:

Q4

	Inflexible	...	..	.	..	...	Flexible
Flexibility	}	}	}	}	}	}	}

UW Supply Chain Mgmt Survey

Q5

	Difficult to Changeover	...	..	.	..	...	Easier to Changeover
Changeover	}	}	}	}	}	}	}

Q6

	Vulnerable to Breakdowns	...	..	.	..	...	Less Breakdowns
Breakdowns	}	}	}	}	}	}	}

Q7

	Potential Capacity Constrained	...	..	.	..	...	Less Capacity Constraint
Capacity	}	}	}	}	}	}	}

Q8

	More Process Changes	...	..	.	..	...	Less Process Changes
Process Changes	}	}	}	}	}	}	}

Q9

	Potential Quality Problems	...	..	.	..	...	Less Quality Problems
Quality Problems	}	}	}	}	}	}	}

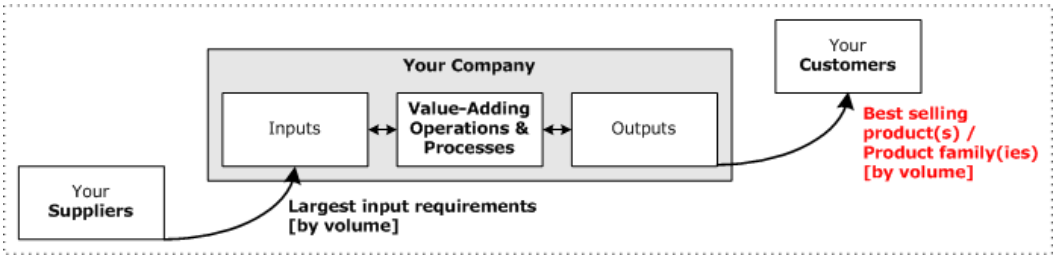
Q10

	Variable and Lower Yields	...	..	.	..	...	Stable and Higher Yields
Yield	}	}	}	}	}	}	}

Demand Characteristics (1/2)

Demand Characteristics (1/2)

Figure 3. Demand Characteristics



UW Supply Chain Mgmt Survey

For this section refer to Figure 3 above. Please think about your company's best selling product(s) / product family(ies) [by volume] and use this context to tell me about the Demand Characteristics of your company's products:

Q11

	Low Demand Uncertainties	...	..	.	..	...	High Demand Uncertainties
Demand Uncertainty							

Q12

	Lower Volumes per SKU	...	..	.	..	...	Higher Volumes per SKU
Volumes / SKU							

Q13

	Low Product Variety	...	..	.	..	...	High Product Variety
Product Variety							

Q14

	Low Inventory Cost	...	..	.	..	...	High Inventory Cost
Inventory Cost							

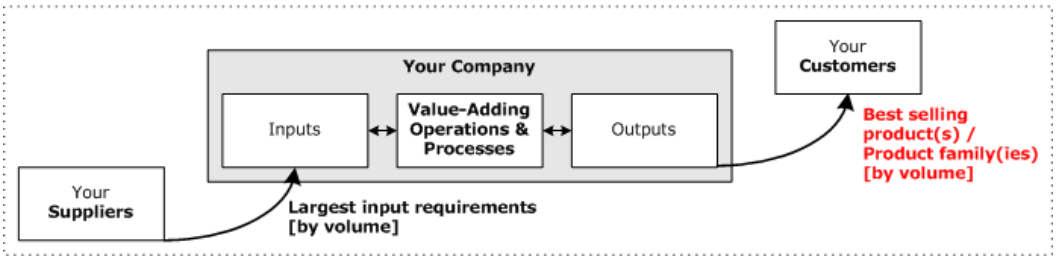
Q15

	Low Profit Margins	...	..	.	..	...	High Profit Margins
Profit Margin							

Demand Characteristics (2/2)

Demand Characteristics (2/2)

Figure 3. Demand Characteristics (same as last page)



UW Supply Chain Mgmt Survey

For this section refer to Figure 3 above. Please think about your company's best selling product(s) / product family(ies) [by volume] and use this context tell me about the Demand Characteristics of your company's products:

Q16

	Low Stockout Cost	...	..	.	..	...	High Stockout Cost
Stockout Cost	☐	☐	☐	☐	☐	☐	☐

Q17

	Low Obsolescence	...	..	.	..	...	High Obsolescence
Obsolescence	☐	☐	☐	☐	☐	☐	☐

Q18

	Difficult to Forecast	...	..	.	..	...	More Predictable Demand
Demand Forecast	☐	☐	☐	☐	☐	☐	☐

Q19

	Short Selling Season	...	..	.	..	...	Long Product Life
Product Life	☐	☐	☐	☐	☐	☐	☐

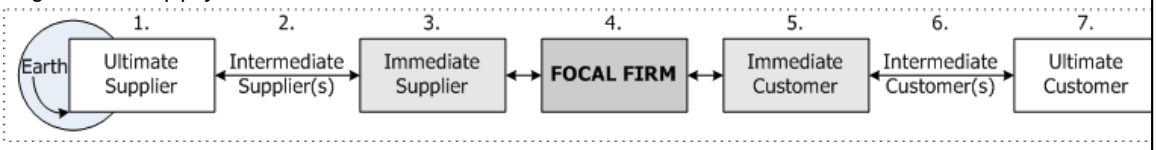
Q20

	Variable Demand	...	..	.	..	...	Stable Demand
Demand Variability	☐	☐	☐	☐	☐	☐	☐

Supply Chain Position

Supply Chain Position

Figure 4. Supply Chain Position



Please refer to the simplified supply chain diagram in Figure 4 above. Where in this diagram would your company "fit"? That is, are you closer to the "Ultimate Supplier" end of the spectrum, or closer to the "Ultimate Customer" end, or somewhere in the middle?

Here's an example of a familiar product to illustrate this idea. Consider the computer mouse that may be in your hand at this moment. In this case, Logitech or Microsoft – the mouse manufacturer – would be in position 4: the Focal Firm. Here is a description of the upstream suppliers and downstream customers *relative* to the Focal Firm.

1. The *Ultimate Supplier* would be a firm which extracts hydrocarbons from the earth.
2. There may be any number of *Intermediate Suppliers* (e.g. refinery, chemical plant, plastic & resin manufacturer, etc).
3. The *Immediate Supplier* would be the company which supplies the Focal Firm with plastic pellets or injection moulded mouse bodies.
4. The *Focal Firm* is as described above – in this case the computer mouse manufacturer.
5. The *Immediate Customer* for the computer mice may be a large electronics wholesaler (say).
6. *Intermediate Customers* for this product may be distributors, computer manufacturers (e.g. bundling the mice with their product), retailers, etc. These companies do NOT have a direct business relationship with the Focal Firm.
7. The *Ultimate Customer* is the last entity in the supply chain; typically the place where the product is *consumed* or title is no longer transferred.

Thus, if your company is an injection moulding machine tools manufacturer, you might select 2 (Intermediate Supplier) as your position in the supply chain. Or, if your company is a direct mail custom computer company, you might select 5 (Immediate Customer) if you're buying mice directly from Microsoft or Logitech.

For this section,

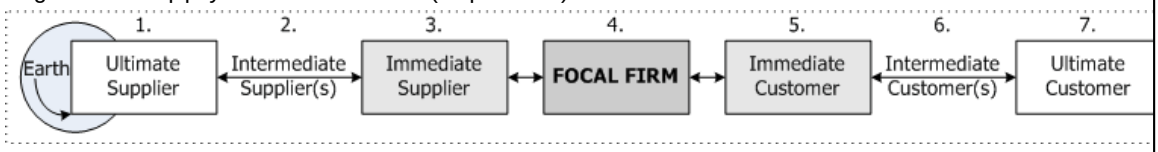
- Please think about your company's largest input requirements (by volume) that are sourced from external suppliers – at what stage of assembly / manufacture do these inputs arrive?
- Please think about the operations and processes used to transform those inputs into your company's products – how does your company transform these inputs into your products? Finally,
- Please think about your company's best selling product(s) / product family(ies) [by volume] – does the product leave in bulk, or ready for retail packages, etc? What is the nature of the main customer(s) of your product?

Where, in the supply chain depicted, would you position your company?

Q21

	1. Ultimate Supplier	2. Intermediate Supplier(s)	3. Immediate Supplier	4. Focal Firm	5. Immediate Customer	6. Intermediate Customr(s)	7. Ultimate Customer
Supply Chain Position							

Figure 4. Supply Chain Position (repeated)



UW Supply Chain Mgmt Survey

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q22 Our company fosters supply chain management expertise through formal training and career development programs.							
Q23 Our company has eliminated functional silos that result in ineffective processes and delays of information in our organization structure.							
Q24 Supply Chain Managers / Directors are part of our company's Senior Executive team.							
Q25 Our company is able to share data and information EXTERNALLY with our suppliers and customers through electronic data interchange (EDI) or other integrated computer systems.							
Q26 Our company is able to share data and information INTERNALLY across internal functional areas through enterprise resource planning (ERP) or other integrated computer systems.							
Q27 Our company does collaborative planning, forecasting, and replenishment with our SUPPLIERS.							
Q28 Our company does collaborative planning, forecasting, and replenishment with our CUSTOMERS.							

SCO Antecedents: Measurement Propensity

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q29 Our company includes supply chain related key performance indicators (KPIs) as part of our overall corporate KPIs.							
Q30 Our company engages in benchmarking activities to compare our operations and processes against those of our competitors or service providers in our industry.							
Q31 Our company measures our ability to deliver against Marketing's promises to our customers.							
Q32 Our company uses staff performance measurements that encourage and reward supply chain performance.							

SCO Antecedent: World View

UW Supply Chain Mgmt Survey

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q33 At our company, "putting the customer first" are not just words but actions.							
Q34 We understand the business of our suppliers.							
Q35 We understand the business of our customers.							
Q36 Our suppliers understand our business.							
Q37 Our customers understand our business.							
Q38 At our company, Supply Chain Management is a core business function.							
Q39 At our company, we actively seek out supply chain management best practices of others in our industry for adoption.							
Q40 At our company, we are aware of world wide trends in supply chain management and actively seek to understand the impact of these trends on our business.							

Supply Chain Orientation • BENE / CRED / COMM (1/2)

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q41 When making important decisions, our supply chain members are concerned about our welfare.							
Q42 When we share our problems with our supply chain members, we know they will respond with understanding.							
Q43 In the future we can count on our supply chain members to consider how their decisions and actions will affect us.							
Q44 When it comes to things that are important to us, we can depend on our supply chain members' support.							
Q45 Promises made to our supply chain members by our business unit are reliable.							
Q46 Our business unit is knowledgeable regarding out products and/or services when we are doing business with our supply chain members.							
Q47 Our business unit does not make false claims to our supply chain members.							
Q48 Our business unit is open in dealing with our supply chain members.							
Q49 We defend our supply chain members when outsiders criticize them.							
Q50 We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.							

Supply Chain Orientation • COMP / NORM / TOPM (2/2)

UW Supply Chain Mgmt Survey

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q51 Our business unit's goals and objectives are consistent with those of our supply chain members.	☐	☐	☐	☐	☐	☐	☐
Q52 Our CEO and the CEOs of our supply chain members have similar operating philosophies.	☐	☐	☐	☐	☐	☐	☐
Q53 Our business unit is willing to make cooperative changes with our supply chain members.	☐	☐	☐	☐	☐	☐	☐
Q54 We believe our supply chain members must work together to be successful.	☐	☐	☐	☐	☐	☐	☐
Q55 We view our supply chain as a value added piece of our business.	☐	☐	☐	☐	☐	☐	☐
Q56 Top managers repeatedly tell employees that this business unit's survival depends on its adapting to supply chain management.	☐	☐	☐	☐	☐	☐	☐
Q57 Top managers repeatedly tell employees that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to this business unit's success.	☐	☐	☐	☐	☐	☐	☐
Q58 Top managers repeatedly tell employees that sharing valuable strategic/tactical information with our supply chain members is critical to this business unit's success.	☐	☐	☐	☐	☐	☐	☐
Q59 Top managers repeatedly tell employees that sharing risk and rewards with our supply chain partners is critical to this business unit's success.	☐	☐	☐	☐	☐	☐	☐
Q60 Top management offers various education opportunities about supply chain management to line employees.	☐	☐	☐	☐	☐	☐	☐

Supply Chain Operational Performance: Resource

In the following questions, the term *efficient* is defined as: "achieving maximum productivity with minimum wasted effort or expense".

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q61 Ignoring inflation and increased energy costs, our manufacturing costs TODAY have DECREASED compared to these same manufacturing costs at this time two calendar years ago; i.e. our product costs less to produce today than two years ago.	☐	☐	☐	☐	☐	☐	☐
Q62 Our business unit has become more efficient with respect to manufacturing.	☐	☐	☐	☐	☐	☐	☐
Q63 Ignoring inflation, our inventory costs (i.e. total value held in inventory both work-in-process and finished goods) TODAY have DECREASED compared to these same inventory costs at this time two calendar years ago.	☐	☐	☐	☐	☐	☐	☐
Q64 Our business unit has become more efficient with respect to inventory.	☐	☐	☐	☐	☐	☐	☐
Q65 Ignoring inflation and increased energy costs, our distribution costs TODAY have DECREASED compared to these same distribution costs at this time two calendar years ago.	☐	☐	☐	☐	☐	☐	☐
Q66 Our business unit has become more efficient with respect to distribution.	☐	☐	☐	☐	☐	☐	☐

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Supply Chain Operational Performance: Output

For the following questions, "over the past two years" means the past two calendar years,
i.e. compare your current output with that of two years ago.

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q67 Over the past two years, PRODUCTION LEVELS (i.e. number of items produced) at your company have INCREASED.							
Q68 Over the past two years, CYCLE TIMES (i.e. time required to produce a particular item or set of items) at your company have DECREASED.							
Q69 Over the past two years, AVAILABILITY (i.e. reduced back-orders / stockouts, improved available-to-promise) at your company has INCREASED.							
Q70 Over the past two years, the number of ON-TIME DELIVERIES (i.e. product shipped to customers) at your company has INCREASED.							
Q71 Over the past two years, the LEAD TIME (i.e. elapsed time between customer order receipt and order delivery) at your company has DECREASED.							

Supply Chain Operational Performance: Flexibility

For the following questions, "over the past two years" means the past two calendar years,
i.e. compare your current output with that of two years ago.

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q72 Over the past two years, the VOLUME FLEXIBILITY (i.e. the ability to change the output level of products produced) at your company has INCREASED.							
Q73 Over the past two years, the DELIVERY FLEXIBILITY (i.e. the ability to change planned delivery dates) at your company has INCREASED.							
Q74 Over the past two years, the MIX FLEXIBILITY (i.e. the ability to change the *variety* of products produced) at your company has INCREASED.							
Q75 Over the past two years, the NEW PRODUCT FLEXIBILITY (i.e. the ability to introduce and produce new products -- including modification of existing products) at your company has INCREASED.							

Stakeholder: Customer / Competitor

UW Supply Chain Mgmt Survey

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q76 Competitive strategies are based on understanding customer needs.							
Q77 Customer satisfaction is systematically and frequently assessed.							
Q78 Our commitment of serving customer needs is closely monitored.							
Q79 Close attention is given to after-sales service.							
Q80 Our objectives and strategies are driven by the creation of customer satisfaction.							
Q81 Sales people share information about competitors.							
Q82 Top management regularly discuss competitors' strengths and weaknesses.							
Q83 We achieve rapid response to competitive actions.							
Q84 Customers are targeted when we have an opportunity for competitive advantage.							

Stakeholder: Competitor / Supplier *NEW*

Please indicate the extent to which you *Agree* or *Disagree* with each of the following statements:

	Strongly Disagree			Neutral			Strongly Agree
Q85 Our objectives are driven by creating shareholder wealth.							
Q86 Senior managers have regular meetings with shareholders.							
Q87 We regularly compare our share value to that of our competitors.							
Q88 We regularly carry out public relations aimed at shareholders.							
Q89 Designated managers have responsibility for aiming to satisfy shareholders' interests.							
Q90 Our company has long-term agreements with suppliers.							
Q91 We regularly provide our major suppliers with our business plans and demand projections.							
Q92 Our operations people regularly confer with our suppliers' contact people on issues like quality.							
Q93 Our suppliers have a vested interest in the success of our company.							

Demographics Section: Company

Demographics Section (1/2): Company

Q94

	Number of Employees
Number of Employees	

UW Supply Chain Mgmt Survey

Q95

Year of Incorporation

Q96

Annual Sales

Annual Sales (Canadian $$)

Q97 Total Sales "split" (must add to 100)

Percentage of total sales from inside Canada

Percentage of total sales from outside Canada

Q98 Your firm's Canadian headquarters is located in...

Province / Region

Province / Region

Q99

Primary Market interest

Primary Market Interest

Other - Please Specify

Demographics Section: Respondent

Demographics Section (2/2): Respondent

Q100 Your current job title:

Q101

Education Level

Highest educational qualification

Q102

Number of years experience *in this industry...*

Q103

Number of years experience *with this company...*

UW Supply Chain Mgmt Survey

Q104 I am a member of / my company is a member of these supply chain professional organization(s) [check all that apply].

- APICS - The Association for Operations Management
- Canadian Institute of Traffic and Transportation (CITT)
- Canadian Supply Chain Sector Council (CSCSC)
- Purchasing Management Association of Canada (PMAC)
- Supply Chain & Logistics Association Canada (SCL Canada)
- NOT A MEMBER of one of these organizations

I am / my company is a member of:

Q105 I would like to receive a supply chain management "Report Card" that compares my survey results with other Canadian manufacturing companies who have also completed this survey? Note: The e-mail address you provide will ONLY be used for delivery of the "report card" and will NOT be used for any other purpose.

- Yes
- No

If you chose "Yes", please provide an e-mail address of where this report card should be sent:

Q106 Please use this space to provide any other comments or feedback.

Appendix H

Post-Survey "Report Card"

Question Q105 of the survey offered a supply chain management "report card" on an opt-in basis to respondents to the survey.

> I would like to receive a supply chain management "Report Card" that compares my survey results with other Canadian manufacturing companies who have also completed this survey. Note: The e-mail address you provide will ONLY be used for delivery of the "report card" and will NOT be used for any other purpose. [○ YES | ○ NO]
>
> If you chose "Yes", please provide an e-mail address of where this report card should be sent: [*blank text field for e-mail address*]

If the respondent opted in *and* supplied a valid e-mail address, they received a report card in PDF format. A redacted version of an actual company report card appears on the next page.

Supply Chain Management
PhD Research Survey

Supply Chain Orientation "Report Card"

Prepared For: Mr. [redacted] [redacted] Corp. ([redacted]@[redacted].com)
Prepared By: Trent Tucker, University of Waterloo (trtucker@engmail.uwaterloo.ca)

Mr. [redacted]:

Thank you again for completing the online Supply Chain Orientation (SCO) Survey. What follows is a summary of results for [redacted] Corp., based on your responses to the SCO Survey. This "report card" is intended to be descriptive only – summarizing your survey responses and putting them into the context of all the surveys received from manufacturing companies across Canada.

This document makes no judgment regarding the management style at [redacted] Corp.. The information contained herein is considered private and confidential between you as a survey participant and myself as the principal researcher. All data contained in my dissertation, and any subsequent publications or presentations will be aggregated and/or anonymous – a reader will not be able to identify an individual respondent or their company from the survey data.

Thank you again for your support of this research by taking the time to complete the survey. For social science researchers in management, the workplace is our laboratory, and your expertise is a primary source of our data. I sincerely appreciate your commitment to this effort.

Trent Tucker, MBA
PhD Candidate
University of Waterloo, Management Sciences
Telephone: +1.519.886.6654

*This research is being carried out under the supervision of Dr. Rod McNaughton and this "report card" and research project has been reviewed and received ethics clearance through the Office of Research Ethics, University of Waterloo +1.519.888.4567 ext 36005 or ssykes@uwaterloo.ca (ORE# 15167).

Part I: Supply Chain Orientation Supply chain orientation is defined as "the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain." Said another way, "a company possesses a Supply Chain Orientation if its management can see the implications of managing the upstream and downstream flows of products, services, finances, and information across their suppliers and their customers." Supply chain orientation is made up of six key factors: **credibility** (a firm's belief that its partner stands by its word) and **benevolence** (a firm's belief that its partner is interested in the firm's welfare). You can think about credibility and benevolence together as "trust" in your SCM partners. **Commitment**, i.e. a pledge of relational continuity between exchange partners, **cooperative norms** (the perception of the joint efforts of both the supplier and distributor to achieve mutual and individual goals successfully while refraining from opportunistic actions) and **compatibility** (in terms of compatible corporate culture and management techniques of each firm in a supply chain) round out the next three factors. Finally, **top management support**, which includes leadership and commitment to change, is the final important characteristic.

Based on the data you entered in the online survey, the following averages (scored out of 100) have been calculated as follows:

Supply Chain Orientation (SCO) Factor	Your Company's Average	Average of All Respondents
Credibility	82.1	79.6
Benevolence	71.4	65.2
Commitment	85.7	77.0
Cooperative Norms	81.0	79.0
Compatibility	71.4	67.3
Top Management Support	77.1	60.8

Notes:
The scale in the original survey was anchored "strongly disagree" to "strongly agree." The closer a score is to 100, the stronger the agreement with the underlying measurement items.
(*) indicates that one or more of the measurement items was not answered (partial missing data).
(**) indicates that *all* of the measurement items were not answered (complete missing data).

It has been demonstrated that having a supply chain orientation ***within*** an organization is critical to realizing the benefits of supply chain management ***across*** organizations.

The supply chain orientation described in Part I is adapted from Soonhong Min and John Mentzer's 2004 Journal of Business Logistics article "Developing and Measuring Supply Chain Management Concepts."

Part II: Antecedents to Supply Chain Orientation In my PhD research to date, I have determined that there are three antecedents to supply chain orientation, namely: SCM capability, measurement propensity, and world view.

SCM Capability looks at the degree to which an organization is capable of undertaking SCM activities. E.g. Does the company develop SCM expertise through formal training and development? Is the company readily able to communicate with its trading partners through integrated information technologies?

Measurement Propensity examines to what degree a business measures (quantitatively) its activities, with a specific focus on SCM key performance indicators and benchmarking, and

World View which starts out small (putting customers first) then extends throughout the supply chain, and finally looks at the larger picture: worldwide trends in SCM.

Based on the data you entered in the online survey, the following averages (scored out of 100) have been calculated as follows:

Supply Chain Orientation (SCO) Antecedent	Your Company's Average	Average of All Respondents
SCM Capability	65.3	58.6
Measurement Propensity	85.7	56.7
World View	83.9	72.4

Part III: Supply Chain Operational Performance Finally, adopting a supply chain orientation and/or supply chain management practices must have some benefits for the organization, otherwise time, money, and other resources will be under utilized. Supply chain operational performance can be broken down into three key areas:

- effective **resource** utilization,
- **flexibility** (volume, delivery, product mix, and new product flexibilities), and
- **output** (in terms of production levels, cycle times, availability, on-time deliveries, and lead time).

Based on the data you entered in the online survey, the following averages (scored out of 100) have been calculated as follows:

Performance Factor	Your Company's Average	Average of All Respondents
Resource Utization	71.4	61.1
Flexbility	85.7	69.4
Output	82.9	71.3

The ideas for this part of the survey came from Benita Beamon's 1999 International Journal of Operations and Production Management article entitled "Measuring supply chain performance."

Again, thank you for your time and effort in completing this survey. I hope this "report card" snapshot of your survey responses has been useful to you. If you require further detail on any of the points contained herein, please feel free to contact me via e-mail (trtucker@engmail.uwaterloo.ca) or telephone (+1.519.886.6654).

Appendix I

Survey: Demographic Data

I.1 Company Demographics

I.1.1 Comparison of Demographics: Firm Size/Age

Table I.1: Number of Employees, Estimated Sales, Company Age Comparison

Employees	Scott's	Survey	Estimated Sales	Scott's	Survey	Firm Age	Scott's	Survey
1 to 10	46.5%	38.6%	< $1 Million	32.2%	30.1%	< 3 years	1.0%	2.9%
11 to 50	39.8%	34.1%	$1-5 Million	43.1%	32.0%	3 to 5	1.9%	6.2%
51 to 100	8.0%	9.0%	$5-10 Million	12.6%	12.1%	5 to 10	7.3%	13.4%
101 to 250	4.4%	9.9%	$10-25 Million	8.2%	10.2%	10 to 20	27.7%	28.7%
251 to 500	1.0%	1.8%	$25-50 Million	2.5%	5.8%	20 to 30	29.1%	24.4%
501 to 1000	0.3%	2.2%	> $50 Million	1.4%	9.7%	30 to 40	16.8%	11.5%
1001+	0.1%	4.5%				40 to 50	7.5%	6.7%
						50 to 75	6.3%	3.8%
						75 to 100	1.6%	1.4%
						100+ years	0.8%	0.0%

Q94 Number of Employees (CANSIM categories), Q95 Year of Incorporation (free form), and Q96 Annual Sales (CANSIM categories).

I.1.2 Canadian Sales, Firm Headquarters

Table I.2: Proportion of CDN Sales, Location of Firm's CDN HQ

Proportion	Count	Percent	Province / Region	Count	Percent
100% Canadian	43	18.9%	Ontario-Golden Horseshoe	62	27.3%
90 to 99%	48	21.1%	Ontario-Southwestern	49	21.6%
80 to 89%	21	9.3%	British Columbia	27	11.9%
70 to 79%	16	7.0%	Quebec	24	10.6%
60 to 69%	11	4.8%	Ontario-Eastern	22	9.7%
50 to 59%	10	4.4%	Alberta	16	7.0%
40 to 49%	7	3.1%	Ontario-Northern	6	2.6%
30 to 39%	13	5.7%	New Brunswick	5	2.2%
20 to 29%	11	4.8%	Saskatchewan	4	1.8%
10 to 19%	19	8.4%	Manitoba	4	1.8%
1 to 9%	9	4.0%	Newfoundland & Labrador	3	1.3%
100% Export	4	1.8%	Nova Scotia	1	0.4%
			Prince Edward Island	0	0.0%
			Yukon, NWT, Nunavut	0	0.0%
Not specified	15	6.6%	Not specified	4	1.8%

Q97 Total Sales "split" (must add to 100),
Q98 Your firms's Canadian headquarters is located in (set categories).

I.1.3 Primary Market Interest

Table I.3: Primary Market Interest (Q99)

Market	Count	Percent
Manufacturing	77	33.9%
Other – Please Specify (Details in Table I.4)	35	15.4%
Medical/Biotechnology/Chemical	11	4.8%
Mining/Petroleum/Gas	11	4.8%
Automotive	10	4.4%
Electrical Equipment	10	4.4%
Furniture and Wood Products	10	4.4%
Transportation	9	4.0%
Environment	8	3.5%
Wholesale/Retail	7	3.1%
Construction	6	2.6%
Service Industry	6	2.6%
Defence	5	2.2%
Information Technology and Telecommunications	5	2.2%
Primary and Fabricated Metal	4	1.8%
Aerospace	2	0.9%
Agriculture	2	0.9%
Consumer Products	2	0.9%
Forestry	2	0.9%
Food and Beverage Manufacturing	1	0.4%
Not specified	4	1.8%

Table I.4: "Other" Primary Market Interest (Q99) – Detail

Market	Count	Percent
Custom Fab. (pneumatics, coatings, tool & die)	9	4.0%
Government & Gov't Services (airport, security, etc)	6	2.6%
Energy (offshore prod'n, nuclear plants, chemicals)	5	2.2%
High Tech (electronics, electronic products & services)	3	1.3%
Supply Chain related services (VAR, 3PL, Procurement)	3	1.3%
Heathcare (dental, pharmacueticals, HABA)	3	1.3%
Heavy Industry (capital equipment, mine dewatering)	3	1.3%
Green Tech (sustainable infrasrtructure, hydrid tech)	2	0.9%
Other (Amusement industry)	1	0.4%

I.2 Respondent Demographics

Table I.5: Current Job Title (Q100)

Title	Count	Percent
President	83	36.6%
Manager	23	10.1%
Director	14	6.2%
VP / EVP	14	6.2%
Owner	13	5.7%
CEO / CXO	11	4.8%
General Manager	11	4.8%
Operations Manager	11	4.8%
Supply Chain Manager	10	4.4%
Buyer / Purchaser	9	4.0%
Controller	5	2.2%
Other (e.g. project leader)	5	2.2%
Not specified	18	7.9%

Table I.6: Highest Educational Qualification (Q101)

Qualification	Count	Percent
No Formal Qualification	8	3.5%
High School	27	11.9%
College Diploma	75	33.0%
Undergraduate Degree	54	23.8%
Graduate Degree	45	19.8%
Not specified	18	7.9%

Table I.7: Years of Experience. . . (Q102/3)

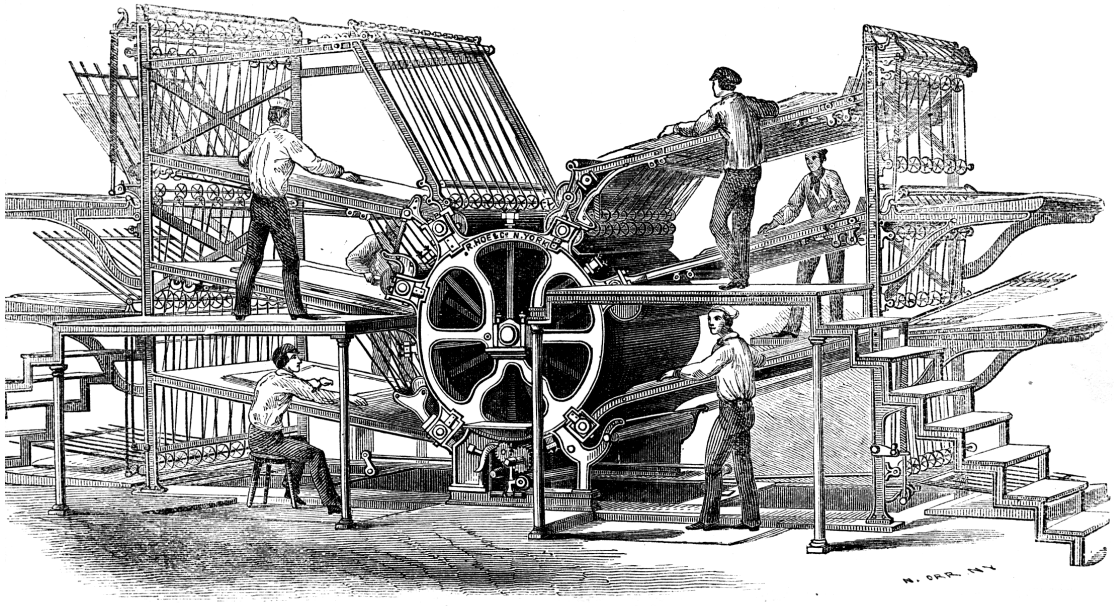
	. . . in this industry		. . . with this company	
<3 years	15	6.6%	37	16.3%
3 to 5 years	4	1.8%	17	7.5%
5 to 10 years	32	14.1%	46	20.3%
10 to 20 years	58	25.6%	63	27.8%
20 to 30 years	71	31.3%	41	18.1%
30 to 40 years	24	10.6%	4	1.8%
>40 years	4	1.8%	0	0.0%
Not specified	19	8.4%	19	8.4%

Table I.8: Supply Chain Organization Membership (Q104)

Organization		Count
The Association for Operations Management	APICS	6
Cdn. Institute of Traffic and Transportation	CITT	12
Canadian Supply Chain Sector Council	CSCSC	2
Purchasing Management Ass'n of Canada	PMAC	31
Supply Chain & Logistics Ass'n Canada	SCL Canada	5
Cdn. Federation of Independent Business	CFIB	5
Canadian Manufacturers & Exporters	CME	2
Institute for Supply Management	ISM	3
National Institute of Gov't Purchasing	NIGP	2
The Logistics Institute	P.Log	4
Professional Engineering Associations	(various)	6

Colophon

If I have seen further it is only by standing on the shoulders of giants.
—Sir Isaac Newton



Six-cylinder Printing Press[1]
Then, as now, it takes a lot of people and a lot of gear to produce a document.

The famous quotation at the top of the page is truly applicable here. Although my family may believe the pace of completion was glacial at times, this thesis is in many ways a product of many tools and technologies that have come together at this point in time. I can't imagine sitting in my Herman Miller Aeron chair solving structural equation models with only a pencil, paper, and my trusty HP 11C!

[1]Public domain image from Wikimedia Commons

Top of the heap, my loyal and constant companion, my MacBook, running both OS X and Windows XP. Open source tools under OS X: TEXShop for editing, BibDesk for citation management, and of course the brilliant LATEX for typesetting. PHP was used to create the colourful snapshot of all data. Can't forget the FireFox browser, which spent a lot of time pointing to the UW and WLU library websites, Google Scholar, and SurveyMonkey.com. Regular toolset includes BBEdit for text editing, Adobe Acrobat Pro for all things PDF (especially optical character recognition!), the Microsoft Office suite of product (especially MS-Excel). PhD defence presentation was prepared using Apple's Keynote presentation software, Prezi, Processing, with stock photography licenced from iStockPhoto.com.

On the Windows XP side (running under Parallels), SPSS 15.0 "Grad Pack" for the bulk of the statistics work, SPSS 17.0 for heavy lifting, and AMOS 7 for SEM were used. Microsoft's Visio drawing package is a dream to work with especially for all of the visuals found herein.

This whole project started when I said to myself…"Let's see. There's *market orientation*, *learning orientation*, and *entrepreneurial orientation*. I wonder if there is such things as…"