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The Successful Implementation of Supply Chain Management Technology Initiatives: Technological Readiness as a Key Indicator

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THE SUCCESSFUL IMPLEMENTATION OF SUPPLY CHAIN MANAGEMENT TECHNOLOGY INITIATIVES: TECHNOLOGICAL READINESS AS A KEY INDICATOR

by

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(Under the Direction of Stephen M. Rutner)

ABSTRACT

The emergence of what is modern supply chain management (SCM) can be attributed to the revolutionary advances in information technology over the past three decades. Despite significant investment in supply chain management technology (SCMT) and the implementation process, many companies still experience considerable complications during SCMT implementation. There is a dearth of research concerning the implementation of SCMT. A proven path to supply chain technology implementation has yet to be established. In an effort to address this gap, this dissertation considers the role of technological readiness as a part of a comprehensive model for SCMT implementation. A model is proposed and empirically tested.

INDEX WORDS: Supply Chain Management, Logistics, Information Technology, Technological Readiness, Change Management, Fit, Implementation, Partial Least Squares (PLS-SEM)

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DEDICATION

This dissertation is dedicated to both my parents and my children. Mom and Dad; it’s difficult to properly express my thanks. My words don’t seem like enough. Suffice it to say, there is absolutely no way I come anywhere close to completing my Ph.D. without your unwavering love, encouragement and support, especially early on when life didn’t seem to be working out so well. It’s a blessing having you as my parents. I love you. I’ll never be able to thank you enough.

Samantha and Sabrina, I understand the journey to realize my personal goal sometimes seemed just as difficult for each of you as it was for me. It is my hope that while difficult, having a front row seat to see me finish my Ph.D. helped you see it’s never too late to chase a dream, you’re never too old to learn, and perseverance does pay. I want each of you to know, you girls make me proud every single day of my life. Being your father is a real privilege. Daddy loves you.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

An increasingly volatile business environment, including the globalization of competition, the shortening of product life cycles, increasing customer value expectations, and rapid advances in information technology (IT) has accelerated the rate of change and put increased pressure on companies to continually rethink and reconfigure their supply chains (Fine, 1998; Millikin, 2012; Monczka & Peterson, 2012). Often broad in scope, supply chain change initiatives frequently cross both functional and organizational boundaries providing a difficult context for executing change (Stank, Dittmann, & Autry, 2011). The implementation of supply chain management technology (SCMT) represents a significant portion of planned supply chain related change initiatives (Greer & Ford, 2009).

SCMT is defined as IT developed and implemented specifically for the purpose of managing some element or component of the supply chain, or IT used to support supply chain management efforts (Blankley, 2008; Radjou, 2003; Wu, Yeniyurt, Kim & Cavusgil, 2006;). SCMT, when adopted, reflects not only potential changes in supply chain business processes, but also frequently requires changes in the flow of information, the way employees do their work, as well as affecting the power structures, strategies, and tactics both within and outside the organization, depending upon the technology implemented. As a result, failure to properly understand and successfully implement

SCMT could possibly do more harm than good. Implementation failure has been identified as the cause of many organizations' inability to achieve the anticipated benefits of the technological innovations they adopt (Klein & Sorra, 1996).

A significant stream of research exists that investigates the many different aspects of SCMT and the resulting implications for selection and investment (Blankley, 2008), adoption (Bienstock & Royne, 2010), supply chain strategy, operations and how each of those factors potentially impact SCM (Esper & Williams, 2003; Patterson, Grimm & Corsi, 2004) competitive advantage and firm performance (Fawcett, Osterhaus, Mangan & Fawcett, 2008; Rai, Patnayakuni & Seth, 2006; Ranganathan, Teo & Dhaliwal, 2011; Sanders, 2005; Wu et al., 2006;). Although research has assisted in clarifying the reasons and methods by which a firm selects and adopts different supply chain management technologies, research on the subsequent implementation of SCMT has largely been ignored (Richey & Autry, 2009). While firms continue to make significant investments in SCMT and the implementation process, there is extensive evidence that many companies experience considerable complications, particularly during the adoption of a new technology (Piszczalski, 1997; Stocia & Brouse, 2013; Tebbe, 1997). There is little research discussing the implementation of technology initiatives within the domain of logistics and supply chain management. A proven path to SCMT implementation has yet to be established (Fawcett et al., 2008).

It has been stated that people issues are always more difficult to address than technical issues concerning the adoption and implementation of any technological innovation (Stank et al., 2011). Technological readiness could link the adoption of technology to the potential benefits that may accrue following implementation (Richey, Daugherty & Roath, 2007). Technological readiness is defined as the propensity of a person to embrace and use new technologies for accomplishing a goal. In his seminal work, Parasuraman (2000) developed a scale to assess people's readiness to interact with technology. Extending the work of Parasuraman (2000), Richey et al. (2007) further developed the construct of technological readiness as a firm level capability noting that; *"Future research should incorporate technological readiness and other constructs into a model of technological implementation"* (Richey et al., 2007, p. 212). This research will seek to understand the factors affecting successful SCMT implementation and examine the impact of technological readiness on the successful implementation of SCMT initiatives.

To summarize; despite significant investment in SCMT and the implementation process, many companies still experience considerable complications during SCMT implementation. There is a dearth of research concerning the implementation of SCMT. A proven path to supply chain technology implementation has yet to be established. In an effort to address this gap, this dissertation considers the role of technological readiness as a part of a comprehensive model for SCMT implementation. A model is proposed and empirically tested.

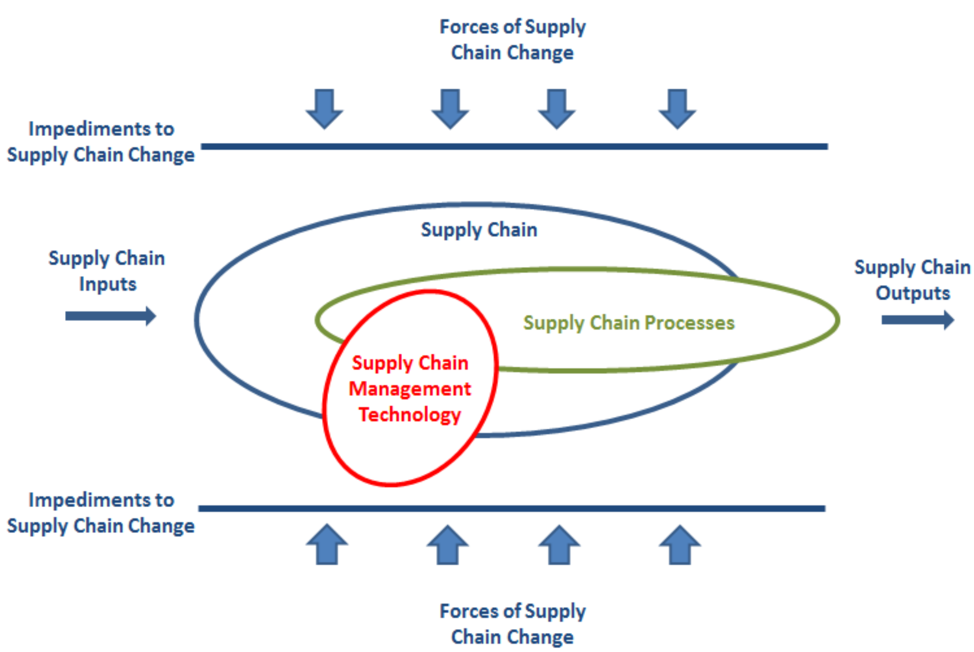
The first chapter provides the motivation for the study of technological readiness and SCMT implementation as follows. First, it provides the necessary background information to inspire the need for research into SCMT implementation. Second, it defines the study's objectives. Finally, it describes the study's potential contributions and the dissertation's organization.

1.1 Background

Continued advances in information technology (IT) have played a crucial role in the emergence of the modern supply chain (Fawcett, Wallin, Allred, Fawcett & Magnan, 2011; Fawcett, Wallin, Allred & Magnan, 2009; Hult, Ketchen & Slater, 2004). Firms continue to employ advances in SCMT to share information, collaborate, integrate business processes and improve supply chain relationships (Klein, 2007; Wladawsky-Berger, 2000;) each of which are held as strong tenets of current logistics and supply chain thought and have been shown to improve supply chain performance (Fawcett et al., 2008; Klein, 2007; Lee et al. 2000; Li, Yang, Sun & Sohal, 2008). The common thread throughout logistics and supply chain management (SCM) by which information sharing, collaboration and integration are accomplished within the modern supply chain is SCMT. Consequently, ensuring the right SCMT initiatives are selected and successfully implemented can play a pivotal role in firm success and should be a fundamental part of any effective supply chain strategy (Closs & Savitskie, 2003; Li et al., 2008; Stank et al., 2011).

Supply chain management has been described as the integration of business processes that span the spectrum from the raw material extractor to the end user to provide a product, information, and/or services to add value (Cooper, Lambert & Pagh, 1997 as cited by Richey, Roath, Whipple &Fawcett, 2010). SCMT represents defined business processes in which process owners use IT to improve the efficiency of their existing processes or use IT to reengineer older processes to improve current capabilities (Maciaszek, 2007). Scholars have noted that the implementation of SCMT has become a necessity for enhancing supply chain processes (Hanfield & Nichols, 1999; Lai, Wong & Chen, 2006). "Systems are templates that you lay over the top of processes, and what I'm saying is, make sure you understand the principles that drive the processes, get your processes right and then worry about the technology" (Interview with John T. Mentzer, July 1, 2005). Understanding the importance of SCMT and the importance of successful implementation to the business processes underlying supply chain management, a general research model is shown in Figure 1.

Figure 1. General Research Model

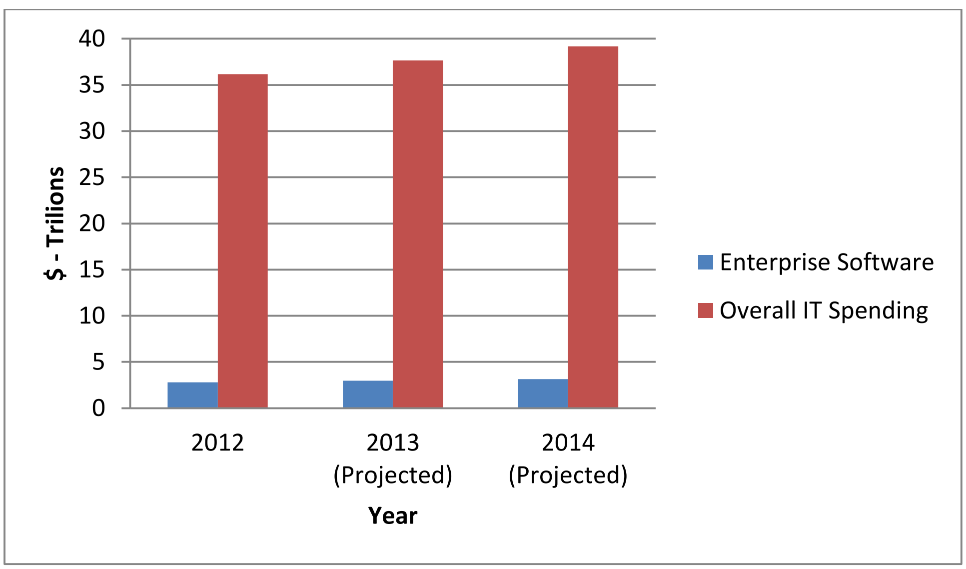


1.2 Importance of Supply Chain Management Technology (SCMT)

The success of almost any business relies on three key components; people, processes, and technology (Millikin, 2012). Certainly, the value and importance of SCMT as a resource is recognized by supply chain leaders (Thomas, Defee, Randall & Williams, 2011). By making possible the sharing of large amounts of information along the supply chain, including operational, tactical, and strategic planning data, SCMT, if properly implemented, has enabled the real-time integration of supply chain partners, provided organizations with forward visibility, and improved production planning, inventory management, and distribution (Li et al., 2008). Supply chain exemplars such as Wal-Mart, Amazon, and Proctor and Gamble use SCMT to share real-time information regarding inventory levels and flow rates with key suppliers (Lee, 2004), thus providing the ability to deliver significant improvements in performance, including faster new product development, lower costs, and shorter order fulfillment lead times (Cachon & Fisher, 2000; Fawcett et al., 2008; Hult et al., 2004; Radjou, 2003). Organizations that do not have strong SCMT capabilities may find it difficult to initiate and sustain the firm’s core competencies (Ravichandran & Lertwongsatien, 2005), consequently decreasing their competitive capabilities. The successful implementation of modern technology is considered crucial to the economic revenue and essential to the competitive position of a firm (Clemons, 1986; Joshi, 1990). Unfortunately, the path from selection and adoption to the successful implementation and use of SCMT can be wrought with difficulty. Many firms have adopted a specific SCMT only to have their investment not deliver the desired performance benefits (Fawcett et al., 2008). Lessons learned from a failed SCMT initiative often come at a heavy price (Sloane, Dittmann & Mentzer, 2010).

SCMT represents a significant investment to an organization in both dollars and employee time (Blankley, 2008). Though information systems implementation projects have historically been plagued by failures (Kim & Kankanhalli, 2009) and many companies still experience significant difficulty in successfully implementing and realizing the full benefits of IT initiatives, spending on IT continues to increase. According to the Gartner research firm, worldwide spending on IT is projected to be $3.76 trillion in 2013, up 4.1% from 2012. Spending in enterprise software, a key segment in supply chain management, is forecasted to be $297 billion in 2013; a 6.4 % increase from 2012 (Gartner, 2013). Both overall spending on IT and enterprise software are expected to increase by 4.0% and 6.7% respectively in 2014 (Gartner, 2013).

Figure 2. IT Spending



** Gartner (March 2013)*

While spending on IT continues to increase, the failure rate of IT projects has remained relatively constant. According to the CHAOS report published by the Standish

Group, IT initiatives considered to be failed projects totaled between 18% and 24 % from the years 2004 through 2012 (Stocia & Brouse, 2013). During the same time period, the percentage of projects considered “challenged” ranged from 42% to 53% (Stocia & Brouse, 2013). Hence, recognizing the factors affecting successful SCMT implementation could provide for a reduction in failed SCMT projects, leading to significant cost savings and improved investment decisions.

1.3 SCMT Implementation

The implementation of SCMT has become progressively more important in the context of an increasingly globalized and competitive economy (Li et al., 2008). SCMT implementation refers specifically to the capability to acquire, process, and transmit the information needed for more effective organizational decision making (Li et al., 2008). This definition not only details the degree of a firm’s adoption of SCMT, but also speaks to the degree to which the technology has become embedded within the firm and across the supply chain to coordinate its business processes with its supply chain partners. Much of the literature concerning the implementation of SCMT deals specifically with enterprise resource planning (ERP) systems. There have been a number of studies detailing what are deemed critical success factors (CSF) of ERP implementation (Hong & Kim, 2002; Jarrar, Al-Mudimigh & Zairi, 2000; Umble, Haft & Umble, 2003). Most are presented as a “how to” manual for ERP selection and successful implementation. Typically, these studies detail factors that have historically been associated with successful project management (e.g. top management support of the project, an effective project team staffed full time with top business and information technology people, organization-wide commitment, etc.). While important, the success factors detailed within the ERP implementation literature do not deal specifically with firm capabilities, such as technological readiness, necessary to ensure successful implementation and intended benefits of any SCMT initiative are achieved.

In 2010, Sloane et al. published a book entitled *The New Supply Chain Agenda.* The authors collected data from the CEOs, boards of directors, and financial analysts of almost 400 companies in an effort to establish the principles that shape the foundations of an effective supply chain strategy. The authors identified five foundations, or “pillars” of a supply chain strategy focused on impacting firm financial performance. The five pillars identified include talent, technology, internal collaboration, external collaboration and managing supply chain change. Using the five pillars identified in *The New Supply Chain Agenda* and the associated academic research, Stank et al. (2011) summarized the findings of Slone et al. (2010) to identify critical knowledge gaps and provided suggestions for future research. Two of five pillars detailed in *The New Supply Chain Agenda*, information technology and change management, along with the discussions of Stank et al. (2011) form the basis for a model of SCMT implementation.

According to Stank et al. (2011), the interviews conducted for *The New Supply Chain Agenda* uncovered three important rules for avoiding failed SCMT implementations requiring supply chain professionals to ask key questions prior to any SCMT initiative to ensure the benefits of new SCMT project can be quantified. First, it is important to ascertain whether or not the SCMT project being undertaken has a clear business case. This speaks to the fit of the project to the strategy of the firm and provides the necessary momentum to ensure success (Stank et al., 2011). Second, providing for the appropriate change mechanisms and asking what is necessary to help better implement supply chain change initiatives such as SCMT projects must also be considered. Research has shown that effective change management is critical to successful implementations of technology and business process reengineering (Grover, Jeong, Kettinger & Teng, 1995). Finally, it is important to understand whether the organization is ready to accept the proposed change as a result of a new SCMT initiative. There have been a variety of organizational factors suggested which impact technology adoption and successful implementation (Patterson, Grimm & Corsi, 2003). As previously noted, technological readiness is a firm level capability which could link the adoption of technology to the potential benefits that may accrue following implementation (Richey et al., 2007). Change management, fit and technological readiness are detailed in the following sections and will be included in a proposed model for SCMT implementation success.

Change Management

As so much change in business involves technology, the importance of managing change well is at the forefront of today's supply chain challenges (Millikin, 2012). It is likely that firms who can manage change to leverage their resources and capabilities will remain competitive. Scholars have noted that there is less management control involved in complex supply chain change processes as compared to non-supply chain change processes, leading to less implementation success (Greer & Ford, 2009). By conceding that they spend valuable time fixing change related issues as a result of not doing things right the first time, supply chain managers have come to understand the importance of change management practices (Stank et al., 2011). Certainly, the application of change management practices and techniques to SCMT implementation can prepare the company for greater potential benefits than those initially planned (Madritsch & May 2009).

For the purposes of this research, change management is defined as the process, tools, and structures intended to keep a change or transition effort under control, taking individuals, teams, and organizations from a current state to a future one (Filicetti, 2007; Kotter, 2011). This would include formal process stages, a readiness for change, and the establishment of small successes through a phased implementation (dos Santos Vieira, Coelho & Luna, 2013). Change within the supply chain can be categorized as either planned or unplanned. Planned changes are conscious, organization-facilitated changes intended to modify organizational functions towards a more beneficial outcome (Lippit, Watson, Westley & Spalding, 1958). Planned change provides the organization with ample time to prepare the necessary resources to implement the change. Examples of planned changes would be the implementation of lean management and quality improvement initiatives such as “Six Sigma”, or the implementation of new SCMT. As previously noted, prior research has shown that effective change management is critical to successful implementations of technology and business process reengineering (Grover et al., 1995). Greer and Ford (2009) found that management control activities have a direct relationship with favorable implementation outcomes. Yusuf, Gunasekaran and Abthorpe (2004) detailed that successful implementation must be managed as a program of wide-ranging organizational change initiatives rather than simply a technology installation effort. Finney and Corbett (2007) completed a content analysis of the literature concerning ERP implementation critical success factors and compiled a list of the most frequently cited CSF. Change management emerged as one of the most widely cited CSF. The authors noted however that there is significant variance regarding what is encompassed by the construct.

The Concept of Fit

The concept of fit is considered one of the core research constructs to explain implementation success (Hong & Kim, 2002) and is extremely important to the implementation of modern large-scale enterprise systems, thus SCMT (Yusuf et al., 2004). As defined for this study, fit is the degree to which the needs, demands, goals, objectives, and / or structures of one component are consistent with the needs, demands, goals, objectives, and / or structures of another component (Nadler & Tushman, 1980). Research suggests that firms which are able to align SCMT to business processes will be able to better leverage their SCMT to gain positive financial outcomes (Teece, 1998; Foss, 1996). A number of studies have detailed the need for fit as one of the key goals in enterprise system implementation (Seddon, Calvert & Yang, 2010), though several scholars have noted that there has been little theory-based empirical research on the factors affecting fit (Chan, Sabherwal & Thatcher, 2006). In their study of warehouse management systems, Autry, Griffis, Goldsby and Bobbitt (2005) noted that implementation and usage of logistics information systems, a type of SCMT, has rarely been connected to the organization’s strategic objectives. Hong and Kim (2002) examined the failure rate of ERP from an organizational fit perspective, noting that successful ERP implementation significantly depends upon fit. Soh, Kien and Tay-Yap (2000) noted the problem of misfit; the gap between functionality offered by the technology and what is required by the organization.

Research has maintained that an organization is unable to realize the actual value of its IT investment due to the lack of fit between the business strategy and IT strategy (Choudhury, Kia, Venkataraman & Henderson, 1999). Providing a clear business case is considered necessary for SCMT success (Stank et al., 2011). It is important for supply chain managers to understand that new SCMT initiatives cannot fix a poor process or potential misfit without the difficult managerial change work or appropriate change management process to support it (Harrison & van Hoek, 2011). An "implementation gap" may arise, that is the lack of fit between the goals set by senior management and those set by lower levels of management (Larson & Gray, 2011), affecting the potential benefits of newly implemented SCMT. This leads to the potential for the construct of technological readiness as a possible indicator for successful implementation of SCMT by helping to close any potential "implementation gap". Improved fit could be achieved for those organizations with greater technological readiness.

As discussed in the previous sub-sections, both change management and the appropriate fit of any SCMT initiatives are deemed necessary to successful implementation. However, the human factor cannot be discounted. Successfully leveraging SCMT requires complimentary human resources or capabilities (Clements &

Row, 1991; Powell & Dent-Micallef, 1997). The construct of technological readiness could be the organizational capability necessary to provide for the successful implementation of SCMT. Technological readiness is discussed in the following section.

Technological Readiness

Parasuraman (2000) defined technological readiness as “a person’s propensity to embrace and use new technologies for accomplishing goals”. Four dimensions relevant to technological readiness were identified. These are optimism, innovativeness, discomfort, and insecurity. Optimism and innovativeness are considered contributors that increase technological readiness, while discomfort and insecurity are considered inhibitors which reduce technological readiness. Optimism relates to a positive view about technology and a belief that technology offers increased control, flexibility, and efficiency. Innovativeness often refers to the tendency to try out new things as would an early adopter of technology. Insecurity involves the distrust of technology and suggests skepticism with technology and its ability to work properly. Finally, discomfort consists of a perception of lack of control over technology and a feeling of being overwhelmed by the technology. Richey et al. (2007) later advanced the conversation regarding technological readiness to the firm level of analysis, stating that “firm technological readiness implies the firm possesses the ability to embrace and use new technological assets” (Richey et al., 2007, pg. 195).

Information systems have become so pervasive that they are now considered to be a requirement for doing business in today’s competitive marketplace. Few organizations in today's business environment will find success without some reliance upon IT (Dawe, 1994; Rogers, Daugherty & Stank, 1992). However, IT is strategically important not for itself, but for what it enables a firm to do. In his seminal article "IT Doesn't Matter" published in the *Harvard Business Review* in 2003, author Nicholas Carr initiated a firestorm of controversy by arguing that information technology had become a commodity and that any competitive advantage to be gained by IT and continued IT spending would eventually shrink. Best practices are now built into software or otherwise replicated and many of the IT-spurred industry transformations that are going to happen have likely already happened or are in the process of happening (Carr, 2003; 2004). "The opportunities for gaining strategic advantage from information technology are rapidly disappearing" (Carr, 2003, p. 48). In essence, Carr was stating that much of IT was going to become a commodity; nothing more than a cost of doing business. The more crucial aspect and differentiator would be the way in which the technology was implemented and used. Interestingly enough, although Carr received a tremendous amount of negative attention for his position in 2003, he was not the first to make this argument. Clemons and Row (1991) also portrayed IT as a commodity and easily imitated by competitors. The authors noted that, as such, resource-based theory predicts that any IT based competitive advantages would soon be eroded as the selection and adoption of a particular technology by other firms is easily duplicated (Carr, 2003, 2004; Powell & Dent-Micallef, 1997; Wu et al., 2006), given the appropriate financial resources. And merely investing in and adopting a certain technology does not necessarily guarantee success (Xing et al. 2010). Getting people to embrace and use new SCMT is always the more difficult task (Stank et al., 2011). Therefore, both the strategic and operational importance of a firm's or firms' technological readiness cannot be overstated (Richey & Autry, 2009). Technological readiness, as a firm capability, can be considered an operant resource. Defined by Constantin and Lusch (1994), operant resources are those employed by a firm to act on operand (more static) resources. Operant resources are intangible or invisible resources; often core competencies or organizational processes and capabilities and the source of competitive advantage (Vargo & Lusch, 2004). Conversely, operand resources are resources on which an operation or act is performed to produce an effect (Constantin and Lusch 1994). Operand resources are physical, such as raw materials. Operant resources can be human (skills and knowledge), organizational, (culture and competences) and relational (relationships with suppliers and customers). This leads to the question: To what degree does technological readiness impact the successful implementation of SCMT initiatives? As an operant resource, technological readiness could link technological adoption to the potential benefits, such as improved firm performance, that may ensue as a result of successful implementation and may provide greater explanatory power to predict the potential for the successful implementation of SCMT (Richey et al., 2007; Richey & Autry, 2009).

SCMT Implementation and Firm Performance

The impact of IT on firm performance has become one of the major concerns of both supply chain managers and researchers. It is generally accepted that IT plays a significant role contributing to improved performance of both the individual firm and the supply chain as a whole (Li et al., 2008). However, research into the direct impact of IT on firm performance has provided inconsistent results (Sanders, 2007). Devaraj and

Kohli (2003) detailed the relationship between financial performance and the actual usage of IT, finding that the greater the actual usage the better the financial performance of the firm. Powell and Dent-Micallef (1997) found that firm performance is enhanced by IT only when the technology is used to leverage preexisting, complementary human and business resources. Consistent with the idea that technology is important not for itself but for what it enables the firm to do, research by Tippins and Soh (2003) has indicated there is no direct connection between IT and firm performance. Using profitability as a measure, Hitt and Brynjolfsson (1996) also found no evidence that IT use led to increased performance. Though in their 1998 study, the authors found that performance is improved when investment in IT is integrated with complementary investments (Brynjolfsson & Hitt, 1998). Interestingly, each of the prior studies connecting IT to firm performance makes no mention of successful implementation. As IT is the conduit linking the business processes within the firm which adds value to the company (Porter & Millar 1985), improved performance will likely be enjoyed by those firms who have not simply invested in SCMT but those who have successfully implemented SCMT thus integrating SCMT into their business processes. Prior research indicating a link to IT and improved firm performance would appear to assume implementation was successful thus the firm is enjoying the intended benefits provided newly adopted SCMT.

Campo, Rubio & Yagüe (2010) noted that firms invest in IT assuming that technology will positively influence firm performance. However the benefits associated with SCMT, such as improved firm performance, may vary in the context of implementation. Technological readiness could link the adoption of technology to the potential benefits that may accrue following successful implementation (Richey et al., 2007). Technological readiness may not only be a potential indicator of successful SCMT implementation, but may also act as a tipping point for the justification of investment in technology initiatives, thus permitting supply chain professionals to better quantify SCMT investment.

1.4 Research Questions and Objectives

The previous discussion provides the foundation for the development of a model for SCMT implementation and elaborates the role of technological readiness as a potential indicator for the successful implementation of SCMT. The analysis identifies various issues that provide the justification for this study. The research questions, justification and objectives are listed in Table 1.

Table 1: Research Questions, Justification and Objectives

Research Questions	**Research Justification**	**Research Objectives**
What factors influence the successful implementation of and supply chain management technology initiatives?	A proven path to logistics and supply chain information technology implementation has yet to be established (Fawcett et al. 2008).	Provide a comprehensive view of and proposes a parsimonious model for supply chain management technology implementation.
How can managers improve decision making concerning supply chain management technology initiatives?	Technological readiness could link the adoption of technology to the potential benefits that may accrue following implementation (Richey et al. 2007).	Investigate technological readiness as a potential indicator not only of successful implementation, but as a tipping point for the justification of investment in technology initiatives.
What dimensions of performance are related to the successful implementation of logistics and supply chain management technology?	Supply chain executives / managers often struggle to quantify the benefits of new technology (Stank et al. 2011).	Examine the impact of successful supply chain technology implementation on diverse dimensions of performance.

1.5 Research Contribution

This research will make a number of potential contributions. First, although technology has been acknowledged as a necessary element to the modern supply chain, implementation failure has been increasingly identified as the cause of many organizations' inability to achieve the anticipated benefits of the technological innovations they adopt. A proven path to supply chain information technology implementation has yet to be established (Fawcett et al., 2008). This research will fill a gap in the literature through the development of a model of SCMT implementation. A model is proposed and empirically tested.

Second, supply chain executives / managers often struggle to quantify the benefits of new technology (Stank et al., 2011). The field is ready for normative models that would prescribe how supply chain managers should go about lauding the potential benefits of SCMT investments (Parent & Reich 2009). Identifying the factors affecting successful SCMT implementation could lead to a reduction in failed SCMT projects, providing greater insight into a potential tipping point with regard to investment in SCMT leading to significant cost savings, improved investment decisions and the ability to quantify the potential benefits of SCMT investment. Technological readiness may act as a key indicator.

Third, transforming the supply chain to drive value requires careful attention to change management. Both scholars and supply chain managers recognize that change management issues could make or break supply chain change efforts. Yet there has been very little structured research in SCM related change management (Stank et al., 2011). This is a noticeable gap in the logistics and supply chain literature. This dissertation will answer the call to explore the theoretical elements associated with supply chain change and their impact on SCMT implementation success (Stank et al., 2011).

Fourth, most empirical studies asses IS success at the individual level (Urbach, Smolnik & Riempp, 2009). The literature indicates that the majority of research regarding Task-Technology-Fit theory, one of the theoretical paradigms used in this dissertation, has been conducted at the individual level of analysis (Goodhue & Thompson, 1995; Lippert & Forman, 2006; Wu et al., 2007). However, the theory offers a theoretical mechanism for linking system and task level phenomena to both individual and group level outcomes (Furneaux, 2012). Research from an organizational level could build a more comprehensive model for success. Thus, there would seem to be additional opportunities to conduct empirical research at other levels of analysis.

1.6 Structure of the Dissertation

This dissertation has 5 chapters. Chapter 2 is a review and the synthesis of the relevant literature whereby the various literature streams which detail the issues to be investigated. It will also further identify the gap in the current literature that this study intends to fulfill, proposes a research model and provides the specific hypotheses. Chapter 3 and elaborates the methodology and its appropriateness within the context of the study. It also elucidates on the instrument and addresses the measurement and data collection related issues. Construct validity, along with the analysis and interpretation of the results are addressed in Chapter 4. Finally, Chapter 5 presents discussion, implications for research and practice, limitations of the study, and the conclusion.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter develops and discusses the theoretical foundation for the research and examines the literature streams which contribute towards the development of the research model. The main objective is to build upon the existing work in various research domains to recognize the relevant gaps and understand how this study contributes towards filling the gaps in the existing literature. Socio-technical system and the Task-Technology-Fit Theory are discussed to develop the conceptual model. Constructs relevant to this research are discussed as they relate to each theory. Research hypotheses are proposed.

2.1 The Importance of Technology in Supply Chain Management

SCM requires some level of coordination across organizational boundaries including the integration of business processes and functions within organizations and across the supply chain (Cooper et al., 1997). Information technology has likely had the single greatest impact on the evolution of the modern supply chain management (Thomas et al., 2011). Fawcett et al. (2008) note the emergence of what is modern SCM can be attributed to the revolutionary advances in information technology over the past three decades. Some scholars argue that it is impossible to achieve an efficient, competitive, and collaborative supply chain without SCMT noting that; “IT (SCMT) is like a nerve center in supply chain” **(**Gunasekaran & Ngai 2004, pg. 270). The business processes associated with SCM are considered mission critical for many organizations (Bala, 2013) and the reliance of SCMT to help achieve mission critical SCM processes is widely recognized. SCM has even been referred to by some researchers as “a digitally enabled inter-firm process capability” (Rai et al., 2006, p. 226). Identified as one of the primary facilitators of what has been termed a supply chain excellence strategy (Stank et al., 2011), *SCMT is defined as both IT developed and implemented specifically for the purpose of managing some element or component of the supply chain, or IT used to support supply chain management efforts (Blankley, 2008; Radjou, 2003; Wu et al., 2006)*. Table 2 details many of the different types of supply chain technology.

Table 2: Supply Chain Technology

Supply Chain Technology	**Definition**	**Key Benefit(s)**
Advanced Planning and Scheduling Systems	Hardware and software components supporting a manufacturing management process via which raw materials and production capacity are optimally allocated to meet demand.	Reduces inventory and labor; optimizes fixed costs
Analytical Scorecarding	Software applications that facilitate the alignment of human and physical resources with business strategies and allow constant monitoring of performance versus targets	Keeps tactical activities aligned with predetermined strategic goals
Automated Materials Handling	Hardware and software systems that automate the firm’s materials handling function	Increase in productivity, reduced cost f material handling
Automatic Replenishment Systems	Systems supporting the exchange relationship in which the seller replenishes or restocks inventory automatically based on actual product usage and stock info provided by the buyer	Reduced commitment to inventory holdings
Capacity Planning Systems	Systems that predict the types, quantities, and timing of critical resources needed within an infrastructure to meet forecasted workloads	Reduce excess inventory levels
Collaborative Production Management Systems	Integrated software applications that provide process – based manufacturers a means by which to facilitate and track performance within the context of multi-group collaboration efforts.	Reduce task and resource redundancy; align tasks and goals across collaborating workgroups
Customer Relationship Management Systems	Systems designed to capture customer features and apply those features to marketing activities	Greater customer loyalty
Customer Replenishment Systems	Electronic software / hardware linkages that alert suppliers related to customer inventory shortages / problems and facilitate inventory replenishment	Reduce inventory in the supply chain as a whole
Distribution Resource Planning	A planning philosophy and related technologies that permit the planning of all resources within a	Effective and efficient deployment of finished

	distribution firm; an integrated approach to scheduling and delivery and controlling inventory in a logistics system.	goods inventories throughout the often complex distribution network. Better coordination between marketing and manufacturing. Reduction of freight cost, distribution cost, lower inventories
E-Procurement	Electronic systems that facilitate the inter-organizational sales and purchasing of supplies, work and services	Reduces investment in otherwise routine but expensive purchase transactions
Electronic Data Interchange	Components enabling the electronic transfer from computer to computer of commercial /administrative transactions using agreed data structure standard	Speed and accuracy of data transmission
Enterprise Resource Planning	Configurable information systems packages that facilitate integration of information and processes within and across organizational functions	Integrates business functions; allows data to be shared across company
Geographic Information Systems	Hardware and software systems that store, link, analyze, and display geographically referenced information (i.e., data identified according to location)	Modeling supply and delivery points and product routing optimization
Intelligent Agent Purchasing Systems	Purchasing systems capable of flexible autonomous action within a business environment designed to meet organizational purchasing goals and objectives	Reduce time and tedium associated with routine purchases
Intranet / extranet	Private data networks within and across firms and using internet-like protocols securely share information across functions or business units	Brings together all of the business functions and the extended enterprise; suppliers, partners, customers into the information loop; critical or firm’s quick response and strategic movement
Lean Manufacturing Systems	Technological systems and related grounding philosophies that support company improvement via waste elimination	Reduce waste and variable costs
MRP/MRP II	A technology-enabled methodology for planning all of the resource requirements of a manufacturing company	MRPI: Increased productivity; MRPII: Gains in productivity. Dramatic increase in customer service
Network Management Systems	Systems employing a variety of tools, applications, and devices to assist human network managers monitoring and maintaining computer networks	Configuration, Accounting, Fault, Security, and Performance
Operations/Logistics Scheduling Systems	Model-based software applications that promote the efficient and effective scheduling of processes dependent on fixed /limited logistics assets	Optimizes equipment and facility usage based on costs
Order Management Systems	Systems that receive customer order information and inventory availability data that facilitate tactical planning	Cost effective customer order management and better customer service through the integration of CRM and SRM

		applications
Performance Management Systems	Software applications (“dashboards”) and associated management techniques designed to optimize performance of humans or machines toward a predefined task set	Reduce error-related costs through constant real-time performance measurement
Physical Distribution Management Systems	Systems that integrate individual efforts related to the physical distribution function(typically, order processing, stock levels, warehousing and transportation)	Improved customer service
Point of Sale	Computers and related equipment placed at sales locations that collect real-time sales data, process payment, and reconcile sales transactions with inventory management	Streamlines the replenishment process
Quality Management Systems	Hardware and software applications that in combination are designed to provide or control the structure, processes, and resources needed for quality management initiatives	Improves product/service quality
RFID	A radio-enabled hardware component useful for tracking and identification using radio waves	Improves efficiency of inventory location and management processes
Transportation Management/Execution Systems	A software system designed to manage firms’ transportation assets and functionality	Reduces transportation assets; provides greater customer service
Transportation Scheduling Systems	A software systems that facilitates scheduling for transportation assets	Reduces storage and handling costs
Warehouse Management Systems	Hardware/software configurations or packages that allow for the efficient and effective operation of storage functions such as shipping, receiving, put-a-way, and picking	Reduces storage and handling costs

** Autry et al. 2013*

Many organizations struggle with technology. Any firm can purchase technology. (Fawcett et al., 2008). However supply chain professionals often find it difficult to quantify the benefits of new technology investment proposals (Stank et al., 2011). According to Parent and Reich (2009), research is needed detailing normative models on how supply chain managers can detail the benefits of potential supply chain technology investments to top managers within the firm. Implementation of SCMT for achieving an effective supply chain strategy necessitates a suitable framework based on theoretical analysis (Gunasekaran & Ngai, 2004). Successful implementation of SCMT may hinge SCM employees (Bala, 2013) and their technological readiness.

The implementation of SCMT requires extensive changes to SCM processes, and prior research and practitioner's literature have documented considerable challenges that organizations may face when accepting and rountinizing these changes. Organizations continue to employ advances in SCMT in innovative ways to share information, improve collaboration and supply chain relationships, and integrate business processes (Klein, 2007; Wladawsky-Berger, 2000), all of which are recognized as crucial to SCM and strong tenets of current logistics and SCM thought. Information sharing, collaboration and integration are discussed in the following sections.

Information Sharing

The flow of information is at the heart of the supply chain concept (Thomas, Esper & Stank, 2010). Although there are a number of impediments to information sharing within supply chain, such as concerns over confidentiality, timeliness and accuracy of information, the differing technologies between supply chain partners, or a potential mismatch in alignment, the benefits of greater information sharing through improved SCMT linkages have been outlined in much of the prior research (Lee & Whang, 2000). In their study of supply chain inventory management and the value of shared information, Cachon and Fisher (2000) noted that supply chain costs were reduced with the sharing of both demand and inventory information among supply chain partners. Lee et al. (2000) addressed the value of sharing demand information for a simple two-level supply chain with non-stationary end demands. Their analysis suggested that the value of demand information sharing can be quite high, reducing inventory and gaining cost reductions when demands are significantly correlated over time. In their study regarding information technology and its use to enhance the supply chain, Fawcett et al. (2007) reviewed two dimensions of information sharing, connectivity and willingness to share, and determined both are critical to an information sharing capability and found to positively impact operational performance. Zhou and Benton Jr. (2007) investigated the effect of information sharing and supply chain practice on supply chain performance. Their findings indicate both are crucial to achieving good supply chain performance. Finally, Klein et al. (2007) found that firms achieved greater performance when information is shared among supply chain partners. Information sharing improves coordination between supply chain processes to enable the material flow and reduces inventory costs, leading to increased collaboration and increased levels of supply chain integration (Li & Lin, 2004). Continued innovations in IT have made feasible the real-time sharing of information and the integration of information flows within in the supply chain, positioning IT as a key driver of supply chain collaboration (Huang & Gangopadhyay 2004). Richey et al. (2007) described collaboration as the driving force behind effective supply chain management. Collaboration is discussed in the following section.

Collaboration

Defined as the ability to work across organizational boundaries to build and manage unique value-added processes to better meet customer needs, supply chain collaboration involves the sharing of resources, information, people, and technology among supply chain members to create synergies for competitive advantage (Fawcett et al., 2008). Examples of collaborative supply chain processes include collaborative planning, forecasting, and replenishment (CPFR), vendor managed inventory, and JIT manufacturing (Lambert, Cooper & Pagh, 1998; Richey & Autry, 2009). Mentzer et al. (2000) proposed that supply chain collaboration can deliver powerful advantages providing the right enablers are in place and that barriers can be overcome. The authors interviewed 20 supply chain executives from leading companies across a range of industries. Technology was identified as one of eleven key enablers of supply chain collaboration. One of the executive respondents from the study noted: "It's not the be all and end all, but advanced technology is essential to enabling a collaborative relationship across the supply chain". In their attempt to answer the question of how managers can overcome the barriers that impede supply chain collaboration, Fawcett et al. (2008) conducted 51 interviews of senior managers across four SC positions, including retailers, finished goods assemblers, direct material suppliers, and service providers. Each of the senior managers interviewed were responsible for their company's supply chain initiatives. Based on their analysis, the authors developed a model for effective supply chain collaboration. This analysis included the identification of the top 25 requirements / practices for effective SC collaboration. The single most mentioned requirement for SC collaboration, identified in 44 of the 51 interviews was better information systems. Collaboration, along with information sharing and shared technology, is the basis for integration within the supply chain (Akkermans, Bogerd & Vos, 1999). Integration is detailed in the following section.

Integration

Supply chain integration (SCI) includes the integration of internal functions along with customer and suppliers (Stank, Keller & Closs, 2001). SCI refers to “the degree to which an organization strategically collaborates with its supply chain partners and manages intra- and inter-organizational processes to achieve effective and efficient flows of products, services, information, money, and decisions, with the objective of providing maximum value to its customers” (Zhao, Huo, Flynn, & Yeung, 2008, p.7). Partly due to continued advances in IT, firms are engaging in unprecedented levels of integration efforts (Porter, 2001). Serving as a key enabler of SCI, the implementation of SCMT can integrate both internal and external supply chain processes (Li et al., 2008). IT, including SCMT, allows multiple organizations to coordinate their activities in an effort to truly manage the supply chain (Hanfield & Nichols, 1999; Frohlich &Westbrook, 2001).

A number of previous studies have come to a consensus that SCI can lead to improved firm performance. In their seminal work “Arcs of Integration: An International Study of Supply Chain Strategies”, Frohlich and Westbrook (2001) defined what they deemed the five “arcs” (levels) of integration. Using survey responses from over 700 companies throughout the word, the authors distilled five different integration strategies. The integration strategies outlined included inward-facing, periphery-facing, supplier-facing, customer-facing and outward facing. Companies with the least amount of either upstream or downstream integration were determined to employ the inward-facing strategy. Companies with the greatest amount of integration, that is strong integration on both the supply and customer sides, employed the outward-facing integration strategy.

The authors concluded companies with the greatest “arc” of integration, those companies employing the outward-facing strategy having intense relationships with both suppliers and customers in the supply chain, will achieve the greatest performance benefit.

Using three dimensions of integration, those being customer, supplier and internal, Flynn, Huo and Zhao, (2010) analyzed the effect of SCI on performance. The authors surveyed manufacturing firms in China. Their results indicate that all three dimensions of SCI are important for both the operational performance (on-time delivery, order fulfillment, customer service) and business performance (sales, profit, return on investment) in a manufacturing context. ERP systems, a prominent type of SCMT designed and implemented to facilitate integration by providing a standardized IT infrastructure across levels and functions, have been found to have a positive relationship to organizational performance (Hitt, Wu & Zhou, 2002). Vickery, Jayaram, Droge and Calantone (2003), using what they called integrative information technologies as an antecedent, examined the relationship between SCI, customer service and firm performance. Their results indicated a positive relationship between SCI and firm performance when mediated by customer service. In their study of the relationship between SCMT implementation, SCI, and supply chain performance, Li et al. (2008) surveyed 182 Chinese companies. The survey results supported the view that SCI was positively affected by the implementation of SMCT, leading to improved supply chain performance. The successful implementation of SCMT enables the firm to develop the capabilities of information sharing, collaboration and integration necessary through the mission critical processes.

2.2 SCMT Implementation

It has been noted by both practitioners and scholars alike that the implementation of SCMT has become important in the context of an increasingly globalized and competitive economy (Li et al., 2008) and a necessity for enhancing supply chain processes (Hanfield & Nichols, 1999; Lai et al., 2006). SCMT can be a complex technical and organizational innovation, involving much more than just an adoption decision or installation of hardware (Iivari, 1986). SCMT represents defined business processes in which the process owners use IT to improve the efficiency of their existing processes or to reengineer older processes to improve current capabilities (Maciaszek, 2007). Though the importance of successful SCMT implementation to the business processes underlying supply chain management seem to be clear, a proven path to SCMT implementation has yet to be established (Fawcett et al., 2008).

Adoption versus Implementation

Important to any discussion regarding the implementation of SCMT; a clear distinction must be drawn between the terms IT/IS adoption and implementation. Researchers have defined adoption and implementation in a variety of ways. In some instances, the terms have been used synonymously. Some research regarding IT/IS adoption or implementation does not provide an explicit definition however one could be implied. For example, in his seminal research to determine better measures for predicting and explaining the determinants of information technology use, Davis (1989) provided a definition for adoption as essentially the extent of use, though this definition was never explicitly stated within his research. Tables 3 and 4 provide definitions of both adoption and implementation presented in the literature.

Table 3: Definitions of Adoption

Author (Year)/Source	**Adoption Definitions**
Zaltmen et al. (1973) / Book	The decision to accept and use an innovation.
Klein and Sorra (1996) / AMR	A decision typically made by senior organizational managers that employees within the organization will use an innovation in their work
Damanpour (1991)/AMJ	The generation, development, and implementation of new ideas, behaviors, or technologies.
Groover and Goslar (1993)/JMIS	Involves the decision to commit resources to an innovation.
Thong and Yap (1995)/Omega	Applying computer hardware and software solutions that provide support of operations, management, and decision-making in organizations.
Palvia (1996)/IM	The effectiveness and success of IT based on acceptance of or satisfaction.
Tan et al. (2009)/IMDS	Application of information and communication tools including computer hardware, software, and networks for connecting to the internet.

Table 4: Definitions of Implementation

Author (Year)/Source	**Implementation Definitions**
Thompson (1965)/Book	The extent to which development, feedback, and adjustment activities are performed to ensure an innovation becomes ingrained within business activities.
Zmud and Cox (1979)/MISQ	A series of related activities involving different tasks designed to realize the intended benefits of an MIS.
Lucas (1981) / Book	An on-going process which includes the entire development of the system from the original suggestion through the feasibility study, systems analysis and design, programming, training, conversion, and installation of the system.
Cooper and Zmud (1990)/MS	An organizational effort directed toward diffusing appropriate information technology within a user community.
Groover and Goslar (1993)/JMIS	Includes development and installation activities to ensure that the expected benefits of the innovation are realized.

Klein and Sorra (1996) / AMR	The transition period during which targeted organizational members become increasingly skillful, consistent, and committed in their use of an innovation. Implementation is the critical gateway between the decision to adopt the innovation and the routine use of the innovation within an organization.
Li et al. (2008)/IJPE	The capability to acquire, process, and transmit the information needed for more effective organizational decision making.

Many supply chain managers likely do not distinguish between adoption and implementation (Patterson et al., 2003). However, given this research is concerned with implementation success, it is important to make the distinction. Adoption is concerned with the decision regarding selection of a particular SCMT. Many of the definitions of adoption included in Table 3 include the word decision within the definition. *For the purpose of this research, adoption is defined as the generation, development, and implementation of new ideas, behaviors, or technologies (Damanpour, 1991, p. 556).* Adoption essentially subsumes implementation in the context of this research.

Definitions of implementation vary according to context. Typically, implementation is characterized as the installation activities necessary to ensure expected benefits of a technical innovation are realized (Grover & Goslar, 1993). *For the purpose of this research implementation refers specifically to the capability to acquire, process, and transmit the information needed for more effective organizational decision making (Li et al., 2008, p. 2).* This definition not only details the degree of a firm's adoption of SCMT, but also speaks to the degree to which the technology has become embedded within the firm and across the supply chain to coordinate its business processes both within the firm and with its supply chain partners.

2.3 What is Implementation Success?

Research assessing the implementation success, or success of an information system (IS), has been ongoing for over three decades (Gable, Sedera & Chan, 2008). One approach to comprehending implementation has been to develop models of the implementation process. IT / IS project implementation has been researched as an identifiable series of events that are intended to lead to some outcome that benefits the organization (Lucas, 1981; Markus & Robey, 1988; Sabherwal & Robey, 1993). These models take the process itself as the phenomenon of interest rather than the variables describing the antecedents and conditions surrounding the process.

The most highly cited process model of IS implementation is that of Cooper and Zmud (1990). Based upon the organizational change, innovation and diffusion literatures, Kwon and Zmud (1987) proposed a staged model of implementation activities. Extending the work of Kwon and Zmud (1987), Cooper and Zmud (1990) developed a well-accepted process model of IT implementation. Their model characterizes the overall implementation process without examining the specific sequence of events involved. The stages of their model are initiation, adoption, adaptation, acceptance, routinization, and infusion. The description of each stage of the Cooper and Zmud (1990) model is listed Table 5. The first three stages of their model characterize the initiation and initial implementation of an information system. The last three stages characterize the levels of implementation and could be used as a measure of implementation success.

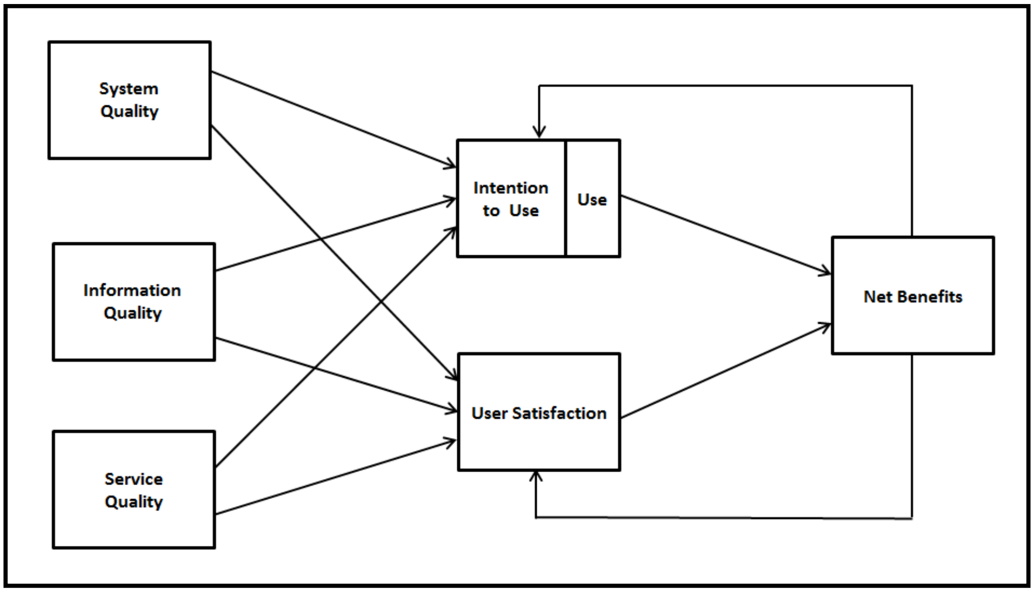
Table 5. A Model of the IT Implementation Process

Stages	Description
1.Initiation	The process of selecting an IS to be used in the organization.
2. Adoption	Securing support and resources for IS implementation
3. Adaption	All activities required to make the IS available for use in the organization.
4. Acceptance	the process of convincing employees to use the IS
5.Routinization	Characterizes the IS's transition to a normal part of work activity when other business processes are adjusted to coincide with the IS.
6. Infusion	The reaching of increased effectiveness through full integration of the IS into the business and full utilization of its potential.

**Cooper and Zmud (1990)*

The most widely cited and still the most dominant success model in IS research has been the model put forth by DeLone and McLean (1992). The authors identified six dimensions of IS success. Those dimensions included system quality, information quality, use, user satisfaction, individual impact, and organizational impact. DeLone and McLean (2003) presented an updated version of their model ten years after their original model. The updated version altered their original model by adding the construct of service quality, changing the dimension of use to intention to use, and collapsing the dimensions of individual and organizational impact into the dimension of net benefits (DeLone & McLean, 2003). The DeLone and McLean (1992; 2003) model has been used in prior research as a model of IS / implementation success. The updated DeLone and McLean (2003) model is presented in Figure 3.

Figure 3. Model of Information System Success



** DeLone and McLean (2003)*

Of particular interest to this research is the success variable of net benefits. For the purpose of this research net benefits is defined as the extent to which IS are contributing to the success of individuals, groups, organizations, industries, and nations (DeLone & McLean 2003). Many of the example measures used to determine net benefits are of importance to SCM. Some examples include increased productivity, cost reduction, increased profit, improved efficiency, increased sales and improved decision making.

Researchers have developed additional models; adopting some of the constructs included in the DeLone and McLean model (1992; 2003). Thong (2001) developed a model of IS implementation for small businesses using two of the constructs from the original DeLone and McLean (1992) model, user information satisfaction and organizational impact, as a measure of IS implementation success. Gable et al. (2008)

provided an additional model for IS success. Consolidating and extending the earlier research of Gable, Sedera and Chan (2003) and Sedera and Gable (2004), the authors re-conceptualize IS success as a model of IS-Impact. *IS-Impact is defined as a measure of an information system at a point in time of the stream of net benefits from the IS, to date and anticipated, as perceived by all key user groups (Gable et al., 2008, p.381).* The model of Gable et al. (2008) seeks to answer two important questions for evaluating IS success. Those questions are: “Has the IS benefitted the organization or had a positive impact?” and “Is the IS worth keeping or does it need changing?” This provides a holistic measure of success by not only including measures of current impact (looking backward) but also measures of quality (looking forward). The authors argue that a holistic measure for the evaluation of information systems should measure both the net benefits to date, or current impact, along with the probable future impacts. Similarly, Davern and Kaufmann (2000) distinguished between potential value of IT and the realized value of IT. The potential value represents the value opportunity available if IT is successfully implemented. Realized value is that which can be measured after successful implementation. SCMT implementation success will be measured using the construct of IS-Impact as developed by Gable et al. (2008). *For the purpose of this research, implementation success refers to realizing the benefits of the SCMT (Zmud & Cox, 1979, p. 38).* Given this definition for implementation success and understanding that IS success, as defined for this study using the IS-Impact model of Gable et al. (2008), considers the net benefits provided by SCMT, it is appropriate to view implementation success and IS success as synonymous. The goal of IS, thus SCMT, as described by Keen (1987) is the effective design, delivery, use and impact of information technologies in organizations and society (Petter, DeLone & McLean, 2012). Robey (1987) indicated that an important area where research in IS implementation can make a contribution, both in theory and practice, is in the organizational impact of IS, noting that "It's surprising the 'impact' and 'implementation' have not had a longer shared history". SCMT implementation success only has meaning to the extent that the technology can impact the organization (Thong, 2001).

The benefits of SCMT can vary in the context of implementation (Auramo, Kauremaa & Tanskanen, 2005). For example, in their discussion of the benefits of EDI, Walton and Gupta (1999) noted some benefits are dyadic while some are individualistic depending upon supply chain partners. The magnitude of change could differ depending upon a slight or significant process change. As noted earlier, newly implemented SCMT represent defined business processes in which the process owners use IT to improve the efficiency of their existing processes or use IT to reengineer older processes to improve current capabilities (Maciaszek, 2007). IT resources that are complimentary with organizational processes form organizational and / or inter-firm capabilities (Wade & Hulland, 2004; Wiengarten, Humphreys, Cao, & McHugh, 2013). When SCMT is aligned with organizational processes, higher order capabilities will be created (Wiengarten et al. 2013). The capabilities created provide the benefits associated with successfully implemented SCMT.

The role of information systems has changed considerably since their introduction more than 60 years ago, as have the key stakeholders and expected benefits of investing in and implementing new SCMT (Petter et al. 2012). Organizations want to make certain their information systems are effective and provide the intended benefits. In their study to identify the best practices of supply chain management and the relevance of SCM research, Thomas et al. (2011) interviewed 149 practicing managers to identify those issues with the greatest impact. Information technology was a common issue cited by the participants. Poorly informed decision making as a result of information systems limitations prevented effective information sharing and collaboration, thus effective integration, leading to sub-optimal supply chain performance (Thomas et al., 2011). Recognizing that effective information sharing, collaboration and integration are essential to the modern supply chain, SCMT has a distinct relationship to modern supply chain management.

2.4 What makes SCMT unique?

"Compared to other value chain processes in organizations, SCM processes are considered relatively unique because of their cross-functional, inter-organizational, and global nature, inherent complexity, intense global competition, and environmental uncertainty" (Davis, 1993 as cited by Bala, 2013, pg. 3) thus, technology has a distinct relationship to core tenets of supply chain management. To enable the collaboration and ultimately the integration considered necessary to compete in today's modern supply chain organizations must be able to quickly and inexpensively share information (Fawcett et al., 2008). From a practitioner perspective, managers acknowledge that modern supply chains are built on a platform of sophisticated information technology. They understand future success will likely be even more dependent on their ability to harness the power of emerging technology (Fawcett et al., 2008). The studies of Mentzer et al. (2001) and Fawcett et al. (2008) provide strong evidence that supply chain managers recognize the need for proper SCMT selection and implementation for an effective supply chain strategy.

As opposed to the practitioner perspective, from an academic perspective the distinctiveness of SCMT can be seen in the theoretical development within the discipline of logistics and supply chain management. Attempts to define and develop a "theory of logistics / supply chain management" have lead scholars to offer different perspectives concerning what should be included as a critical element or construct of any logistics / supply chain framework or theory. In an early effort to develop a conceptual framework for SCM, Cooper et al. (1997) attempted to determine the management components common to the business processes employed within the supply chain. Entitled "Supply Chain Management: More Than a New Name for Logistics", the authors synthesized the literature through 1996 and found; "The greatest agreement among authors is the need for information systems integration" (Cooper et al., 1997, p. 2). The components suggested for their framework were identified and presented in Figure 4. Interestingly, of the ten suggested SCM components identified in their research, the only component common to all of the studies cited in their research was information flow facility structure. Although SCMT is not specifically mentioned, the inference of its use is clear. "The kind of information passed among channel members and the frequency of information updating has a strong influence on the efficiency of the supply chain" (Cooper et al., 1997, p. 8).

Figure 4: Identified SCM Components

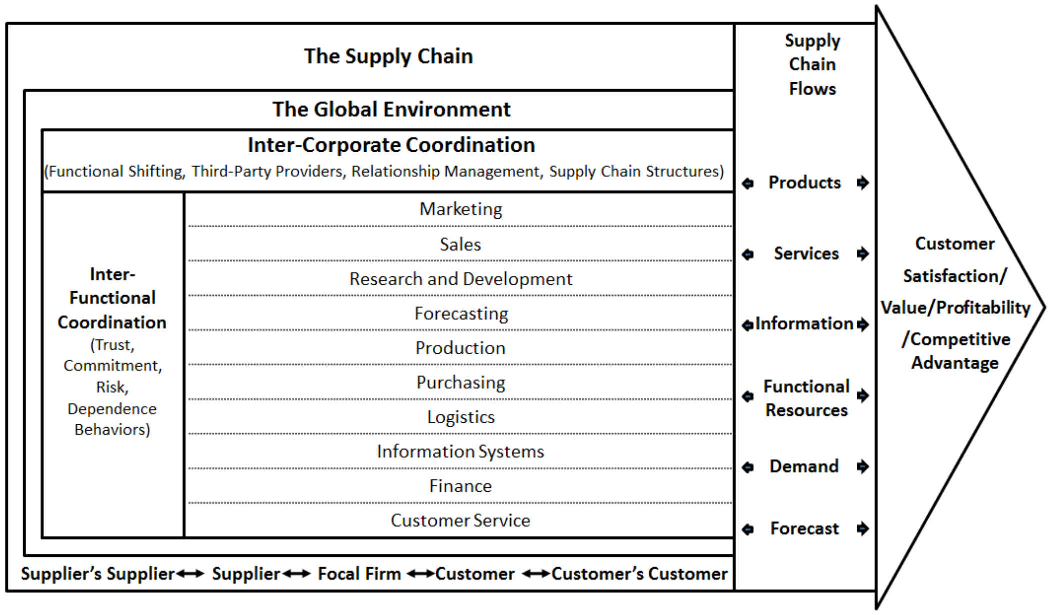
Identified Supply Chain Management Components Based on the Literature

	Planning and Control	Work Structure	Organiza - tion Structure	Product flow facility structure	Infor- mation flow facility structure	Product Structure	Manage- ment Methods	Power and leader- ship structure	Risk and reward structure	Culture and attitude
Houlihan (1985)	X	X	X	X	X	X	X			X
Jones and Riley (1985)	X	X	X	X	X		X			X
Stevens (1989)	X	X	X	X	X					X
Ellram and Cooper (1990)	X	X		X	X				X	
Lee and Billington (1992)		X		X	X					
Cooper and Ellram (1993)	X	X	X	X	X		X	X	X	X
Hewitt (1994)	X	X	X	X	X				X	
Scott and Westbrook (1991)		X		X	X	X				
Towill, Naim and Wikner (1992)	X	X		X	X	X				
Hammer (1990)	X	X	X	X	X		X		X	X
Andrews and Stalick (1994)	X	X	X		X		X	X	X	X
Cooper and Gardner (1993)	X	X		X	X				X	X
Lambert, Emmelhainz and Gardner (1996)	X				X		X		X	X

**Cooper et al. (1997)*

Noting the ambiguity with regard to a consensus definition of SCM among both practitioners and academics, Mentzer et al. (2001) examined the SCM research prior to 2001 in an effort to identify and provide a clear definition of the factors that contribute to effective SCM. The authors stated that “an SCM philosophy suggests the boundaries of SCM include not only logistics but also other functions within a firm and within a supply chain to create customer value and satisfaction” (Mentzer et al., 2001, p.7). SCM requires the management of multiple business functions. “The functional scope of SCM encompasses all the traditional intra-business functions” (Mentzer at al., 2001, p.17). Their model is provided Figure 5.

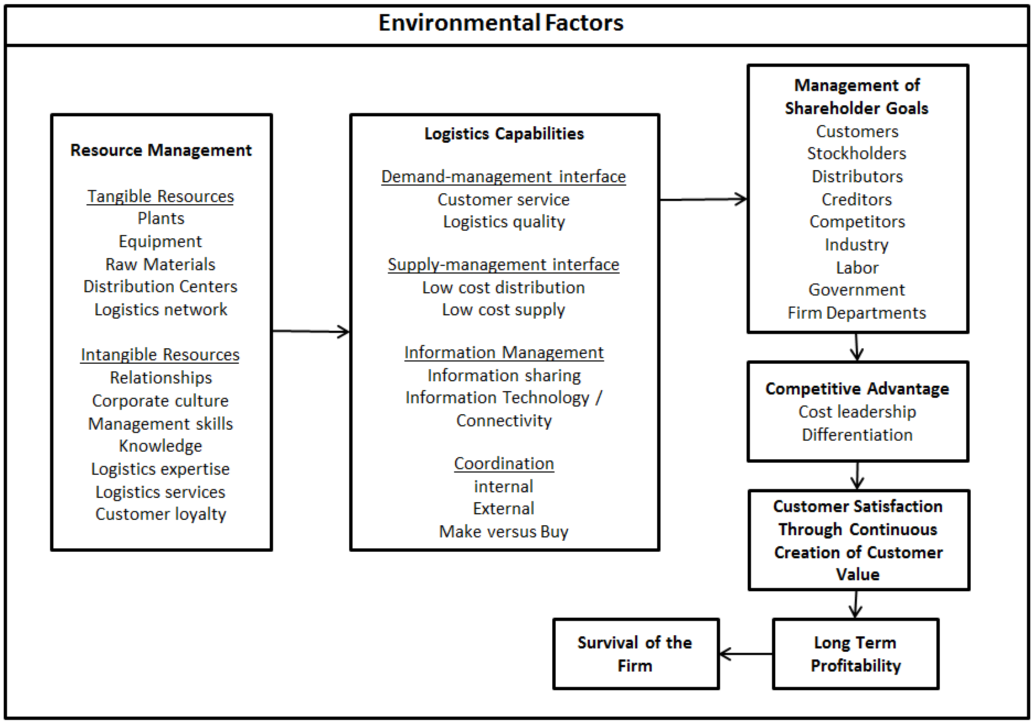
Figure 5: A Model of Supply Chain Management



**Mentzer et al. (2001)*

Additional research by Mentzer, Min & Bobbitt (2004) offered what they termed a unified theory of logistics. Based on the theories of the firm (examples include Transaction Cost Economics, Resource Base View, Knowledge Based View), the authors attempted to explain the different aspects of logistics activities within the supply chain. The boundary-spanning logistics capabilities identified are considered necessary help a firm cooperate with supply chain partners and create customer value. The model for their unified theory is provided in Figure 6. Both information sharing and information technology are included as elements within the logistics capabilities construct identified in the model.

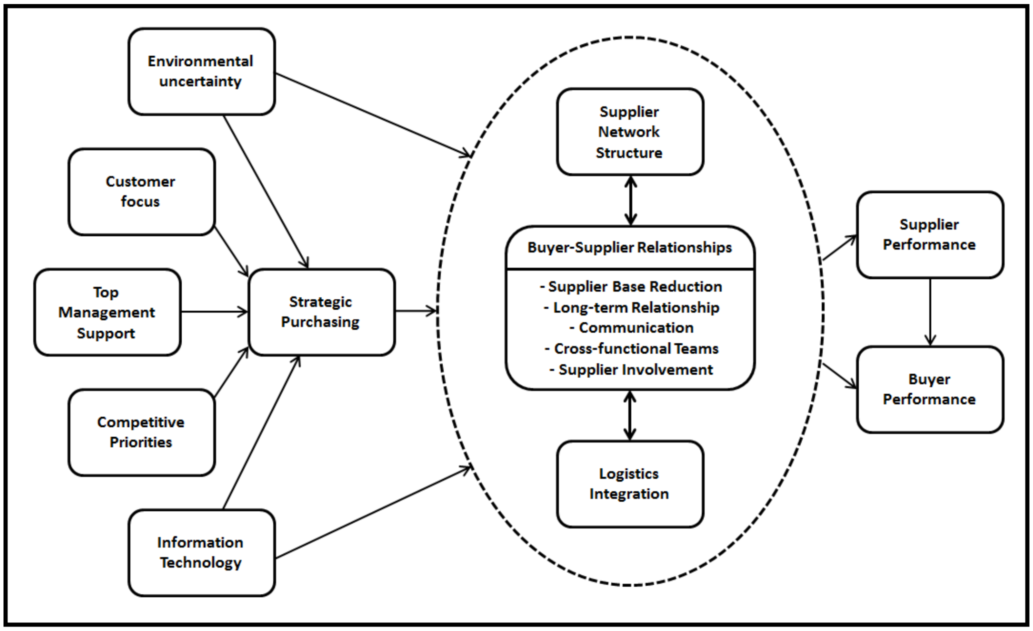
Figure 6. A Unified Theory of Logistics



**Mentzer el al. (2004)*

Finally, in their seminal article "Towards a theory of supply chain management: the constructs and measurements" Chen and Paulraj (2004) analyze over 400 research articles from diverse disciplines to identify the key constructs in a proposed research framework of SCM. The research framework presented includes information technology as a necessary SCM construct, citing that IT provides the necessary linkage to foster collaboration, enhance efficiency by providing real-time information in critical areas of product availability, inventory levels, production requirements, and shipment status. The model is shown in Figure 7.

Figure 7. A Research Framework for Supply Chain Management



**Chen and Paulraj (2004)*

A common theme present throughout these seminal logistics and supply chain management works is the recognition that IT (SCMT) is not merely a support function, but necessary to the practices and processes within the supply chain which are considered essential to creating the capabilities needed for firm survival and remaining competitive. Higher-order capabilities can be created when SCMT is aligned with organizational processes (Weingarten et al. 2012). The distinctiveness of SCMT lies in the fact that it is an integral part of what encompasses the modern supply chain, necessary to enable the mission critical processes which help to form the necessary firm capabilities recognized as the core tenants of the SCM discipline.

2.5 Theoretical Foundation

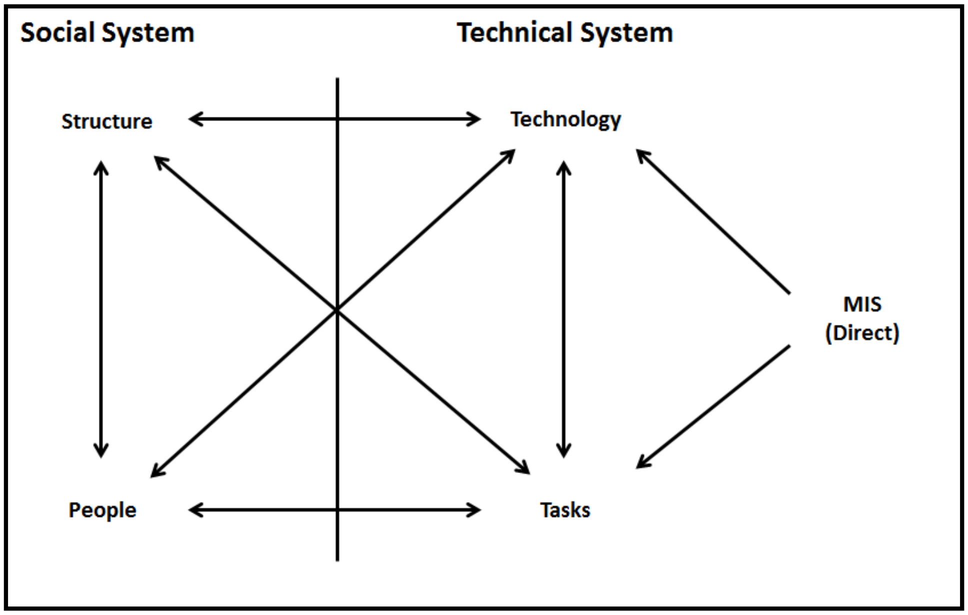
Crucial to the examination of any phenomenon is a theoretical lens through which the phenomenon can be viewed. Scholars have long argued that it seems unlikely a single theoretical explanation can describe all types of innovations including the adoption, hence the implementation, of different types of technological innovation (Kimberly & Evanisko, 1981; Lai & Guynes, 1997; Thong, 1999; Zhu, Kraemer & Xu, 2006b) As a result, two paradigms provide the basis for the development of the proposed model of supply chain management technology implementation and the impact of technological readiness on the successful implementation of SCMT initiatives. The first is socio-technical systems theory (STS), an influential theory from organizational behavior. STS has been widely used to study the implementation of information technology and technology related change in organizations. The second is the Task - Technology - Fit Theory (TTF) (Goodhue, 1995). Having its roots organization contingency theory, the TTF explicates that outcomes depend upon the degree of fit or alignment between the information systems and the tasks that must be performed. Although the literature indicates that the majority of research regarding TTF has been conducted at the individual-level of analysis (Goodhue & Thompson, 1995; Lippert & Forman, 2006; Wu, Shin & Heng, 2007), TTF has been widely used in IS research and employed at various levels of analysis (Fuller & Dennis, 2009; Goodhue & Thompson, 1995; Lippert & Forman, 2006; Wu et al., 2007; Zigurs, Buckland, Connolly & Wilson, 1999). The theory offers a theoretical mechanism for linking system and task-level phenomena to both individual and group-level outcomes. Thus, there appear to be additional opportunities to conduct empirical research at other levels of analysis (Furneaux, 2012). Both STS and

TTF offer insight into the understanding of how fit, change management and technological readiness impact SCMT implementation success.

Socio-Technical Systems Theory

A socio-technical system is any unit within an organization composed of two independent but related sub-systems: a technical sub-system and a social sub-system, having a common goal to accomplish (Bostrom & Heinen, 1977; Rousseau, 1977). The technical sub-system comprises the devices, tools, and techniques needed, while the social sub-system comprises the knowledge, capabilities, and attitudes needed to achieve the necessary goal. STS theory suggests a change in the arrangement of one of the sub-systems brings instability in the overall system, thus the components of the sub-systems will not be aligned and overall system performance will deteriorate. As a result, negative reactions related to technology could occur (Bala, 2013). It is the fit between these two sub-systems which affects the success of an implementation (Bostrom & Heinen, 1977 as cited by Venkatesh, Bala & Sykes, 2010).

Figure 8. Socio-Technical Systems



** Bostrom and Heinen (1977)*

The implementation process often overlooks cultural aspects and underestimates employee reticence (Fawcett et al., 2008). Richey et al. (2008) stated that IT is almost worthless if the organization is not ready for its implementation. Technological readiness is a potential key to realizing implementation success. Building on the work of Parasuraman (2000), Richey et al. (2007; 2008) further developed the concept of technological readiness as an operant resource which links technological adoption to the potential benefits, such as improved firm performance, that may ensue as a result of successful implementation. As discussed previously, operant resources are those intangible or invisible resources; often core competencies or organizational capabilities and the source of competitive advantage (Vargo & Lusch, 2004). Conversely, operand resources are resources on which an operation or act is performed to produce an effect (Constantin & Lusch, 1994). Bostrom and Heinen (1977) detailed how STS could be applied to the implementation of information and communications technology within an organization. Understanding that firm capabilities are considered intangible organizational resources, (Eisenhardt & Martin, 2000; Fawcett et al., 2011; Teece, Pisano & Shuen, 1997), technological readiness can be viewed as an organizational capability comprised within the social sub-system of STS.

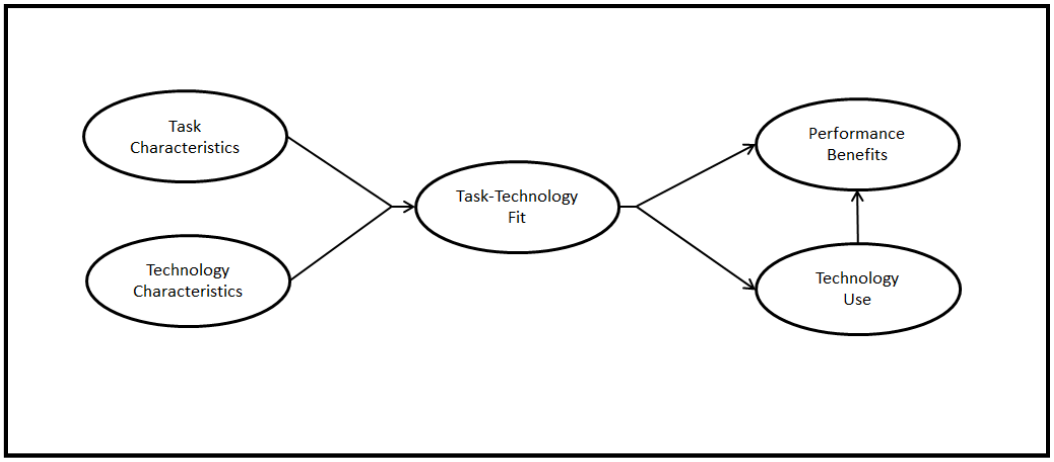
STS theory indicates that a change in either the technical or the social sub-system provides for volatility in the overall system, thus the components of the sub-systems will be misaligned. As a result, appropriate change methods and techniques are needed (Appelbaum, 1997). It is widely accepted that a process for the management of change is necessary for the success of IT/IS implementation (Sutanto, Kankanhalli, Tay, Raman & Tan, 2008). Change management is the process, tools, and structures intended to keep a change or transition effort under control, taking individuals, teams, and organizations from a current state to a future one (Filicetti, 2007; Kotter, 2011). It includes formal process stages, with the establishment of small success through a phased implementation as a part of the formal process, and embraces the need for user readiness (dos Santos Vieira et al., 2013). An important influence on the effectiveness of change process is the interdependent relationship among three dimensions: the technology, the organization and the change model (Orlikowski & Hoffman, 1997).

The Task - Technology - Fit Theory

Although most definitions of TTF suggest that it represents the degree of alignment between the information systems and the task the must be performed, there are differences reflecting some of the specific contexts in which the theory has been applied. The initial definition from Goodhue (1995) states the extent that “technology functionality matches task requirements and individual abilities” (Goodhue 1995, pg. 1829). Wu et al. (2007) stated TTF was “the degree to which an organization’s information systems functionality and services meet the information needs of the task” (Wu et al., 2007, pg. 168). For the purpose of this research, the definition of TTF detailed by Klaus, Gyires & Wen, (2003) is used which states: “TTF is the match or congruence between an information system and its organizational environment” (Klaus et al., 2003, pg. 106).

It has been observed within the literature that two of the more significant outcomes of interest to IS researchers are the extent to which information systems are used and the performance benefits provided by such use (DeLone & McLean, 1992; Gable et al., 2008). Technology use and performance benefits will result when the information system is aligned with the goals of the organization and the characteristics of a technology are well-suited to the tasks that must be performed (Goodhue & Thompson, 1995; Wu et al., 2007). The impact of TTF on performance is posited as occurring directly or indirectly through technology use.

Figure 9. Task-Technology-Fit Theory

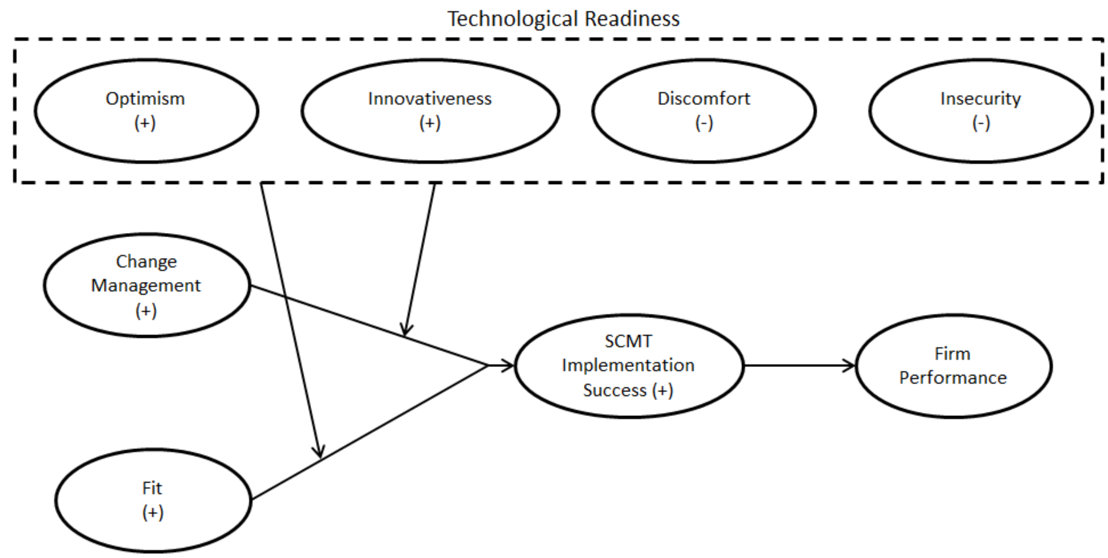


** Goodhue (1995)*

Socio-Technical Systems and the TTF Theory

To summarize, both STS and the TTF provide the basis for the development of the proposed model of supply chain management technology implementation and the impact of technological readiness on the successful implementation of SCMT initiatives. STS theory suggests that with a change in the technical or the social sub-system brings instability in the overall system, thus the components of the sub-systems will not be aligned and the overall system performance will deteriorate. In contrast, the TTF explicates that outcomes depend upon the degree of fit or alignment between the information systems and the tasks that must be performed. Figure 10 presents the research model. The following sections detail each construct in the SCMT implementation model and how each are informed by the theories discussed.

Figure 10. Research Model



2.6 Change Management

Change management is defined as the process, tools, and structures intended to keep a change or transition effort under control, taking individuals, teams, and organizations from a current state to a future one (Filicetti, 2007; Kotter, 2011). Many firms have concluded that effecting business process change is critical to leverage their core competencies, improve firm capabilities and achieve competitive advantage (Kettinger & Grover, 1995). Given the constant pressure of the global business environment forcing organizations to rethink and reconfigure their supply chains (Fine, 1998; Millikin, 2012; Monczka & Peterson, 2012), the importance of a formal method of change management cannot be understated. Although change is an implicit aspect of business improvement within the supply chain, supply chain managers concede they often live in a vicious cycle of fixing issues that could have been avoided and find themselves ill-equipped to accomplish proper change management (Stank et al., 2011).

Researchers have suggested a number of models for managing changes within an organization (Nadler & Tushman, 1980; Tichy, 1983; Burke & Litwin, 1992; Kotter, 1995). The majority of these models have their roots in the research of Lewin (1947). Lewin (1947) advanced the idea that planned change progresses through three distinct phases: the unfreezing phase, the movement phase, and the refreezing phase. The first phase, unfreezing, provided for the destabilization of existing organizational equilibrium to prepare for coming changes. The second phase, movement, provides for the modification of existing organizational behavior. The third and final phase, refreezing, institutionalizes the changes and the new behavior becomes accepted within the organization (Lewin, 1947; Greer & Ford, 2009). Lewin's model of change recognizes the need to discard old behavior, structures, processes and culture before successfully adopting new approaches (Bamford & Forrester, 2003). Lewin's model is presented in Figure 11.

Figure11. Model for Organizational Change

** Lewin (1947)*

Perhaps the most prominent process model of change management was developed by Kotter (1995). First published in the Harvard Business Review in a 1995, and further enhanced in his 1996 book *Leading Change*, the model of Kotter (1995) became an immediate success and continues to be widely cited. According to Kotter (1995), the eight steps to transforming an organization through a process of change management are as follows:

Table 6. Eight Steps to Transform Your Organization

1.	Establish a sense of urgency about the need to achieve change. People will not change if they cannot see the need to do so.
2.	The creation of a guiding coalition. Assemble a group with power energy and influence in the organization to lead the change.
3.	Develop a vision and strategy. Create a vision of what the change is about and tell people why the change is needed and how it will be achieved.
4.	Communicate the change vision. Tell people, in every possible way and at every opportunity, about the why, what and how of the changes.
5.	Empower broad-based action. Involve people in the change effort, get people to think about the changes and how to achieve them rather than thinking about why they do not like the changes and how to resist them.
6.	Generate short-term wins. Seeing the changes happening and working and recognizing the work being done by people towards achieving the change is critical.
7.	Consolidate gains and produce more change. Create the momentum necessary for change by building on successes. Invigorate people through the changes and develop people as change agents.
8.	Anchor new approaches in the corporate culture. This is critical to long-term success and institutionalizing the changes. Failure to do so may mean that changes achieved through hard work and effort slip away with people's tendency to revert to the old and comfortable ways of doing things.

**Kotter (1995)*

Kotter's model has received some criticism as he formulated it based on his personal experiences, rather than being grounded empirically. According to Doyle (2002) there is evidence to suggest that, with only a few exceptions, existing practice and theory within the literature are mostly supported by unchallenged assumptions about the nature of contemporary organizational change management. However, the process model outlined by Kotter remains a key reference in the field of change management.

References to change management within the operations and supply chain improvement literature are scarce (Atilgan & McCullen, 2011). Research by Greer and Ford (2009) identified that there is less management control involved in complex supply chain change processes as compared to non-supply chain change processes. This lack of management control, perhaps due to complexity of SCM, leads to less implementation success. The authors also found that management control activities have a direct relationship with favorable implementation outcomes. Additionally, the authors determined that there were no significant differences between supply chain and non-supply chain change initiatives. Examples of supply chain related change initiatives include just-in-time implementation, the development of a new market channel and supply chain information systems development. Examples of non-supply chain related change initiatives include the implementation of a new safety program, corporate restructuring, corporate merger and the implementation of a new quality improvement program. The authors did not find significant differences in usage of change process factors related to problem analysis, action planning skill development and behavior management when implementing supply chain management and non-supply chain management change. Atilgan and McCullen (2011) completed a qualitative, action research project to determine how a company's feedback presentation sessions and implementation team-work added value to the established quick scan audit methodology (QSAM) and investigate the effect of increasing employee participation in QSAM with a view to increasing its potential as a change management tool. This research was oriented around diagnosis and improvement of a company production-planning process using an adapted QSAM procedure. On the basis of a single case study conducted in a UK food-manufacturing company, the authors found that change management appears to be compatible with QSAM supply chain audit where conducted as a means of driving organizational improvement.

According to the framework provided by Kotter (1995), empowering others to create the momentum necessary by building on successes to induce more change are necessary steps to successful organizational change. In an SCMT implementation context, when a technology is first adopted, one of the predominant system development approaches is known as iterative system development (Maciasek, 2007). Iterative systems development provides for the development activities involved (analysis, design, and implementation) to be repeated with subsequent iterations continuing to refine the system so the end result closer to what ultimately needed and provides the desired benefits to the organization. This method also permits those most likely affected by any system change to be included in the change process. Including stakeholders creates a sense of empowerment, as they now have input into how the system change in implemented (Maciasek, 2007).

Effective organizational design, including the implementation and use of SCMT, must link together the design of business processes and the work systems. This is the cornerstone of STS. Utilized as what has been termed an intervention strategy for effective change (Appelbaum, 1997), an effective change management philosophy is critical when changes to one or the other sub-systems occurs. Stank et al. (2011) noted that supply chain professionals often find themselves ill-equipped to manage change due to a lack of a disciplined change management approach. Much of the prior research is based on case studies designed to identify critical success factors. Although Greer and Ford (2009) did note that change management control activities have a direct relationship with favorable implementation outcomes, empirical evidence in the literature regarding the antecedent of change management leading to positive SCMT implementation outcomes is limited. As the need to utilize SCMT to remain viable and pace of technological change continues to accelerate (Fine, 1998; Millikin, 2012; Monczka & Peterson, 2012), the establishment of small successes through an iterative development methodology (dos Santos Vieira et al., 2013) and the inclusion of a formal change management process is posited to be crucial to SCMT implementation success. Thus, the following hypothesis is offered.

H1: Change management will have a positive impact on SCMT implementation success.

Though organizational strategies for implementation success should include a strategy for change and change management techniques (Al-Mashari & Zairi, 2000; Aladwani, 2001), specifying a clear business case for technology initiatives is considered necessary for SCMT implementation success (Stank et al., 2011). Many companies view technology as the silver bullet, investing in SCMT as the solution to competitive challenges. Managers get caught up in the quest for the latest technology, overspending on a poor solution that is difficult to implement (Fawcett et al., 2008). SCMT cannot fix a potential technology / process misfit. The concept of fit is discussed in the next section.

2.7 The Concept of Fit

Fit remains an important issue used to discuss congruence among seven business elements, incorporating strategy, structure, systems, style, staff, shared values, and skills, and as a precondition of organizational success and considered vital to improved organizational performance (Das & Narasimhan, 2001). Described by many as a normative concept to explain the importance of coordinating complex organizational elements for the effective implementation of a selected strategy, the concept of fit has long been investigated in the business literature (Venkatraman & Camillus, 1984). *Fit is defined as the degree to which the needs, demands, goals, objectives, and / or structures of one component are consistent with the needs, demands, goals, objectives, and / or structures of another component (Nadler & Tushman, 1980).* Additional words and phrases used in the literature to identify fit include matched with, contingent upon, congruence, alignment and co-alignment (Venkatraman, 1989).

Research has argued that an organization is unable to realize the actual benefits of its IT investment due to the lack of fit between the business strategy and IT strategy (Choudhury et al., 1999). Kearns and Saberwal (2007), in their research regarding knowledge considerations (i.e. IT managers participation in business planning and business managers participation in IT planning) alignment and information technology, found support for the value of business – IT alignment as an antecedent to business impact of IT. Their model included both the mediating variables of IT project planning quality and implementation problems associated with IT projects. Their research highlights the importance of proper project planning and implementation with regard to alignment and the business impact of IT. The requirement that technology be compatible with the organization, its strategy, structure, processes, and tasks is one of the more consistent findings in the literature (Rodrigues. Stank & Lynch, 2004; Tornatzky & Klein, 1982).

As part of the organizational fit, firms work to revamp their business processes and make changes to their supply chain strategies (Motwani, Madan, & Gunasekaran, 2000; Byrd & Davidson, 2003; Gunasekaran & Ngai, 2004). Strategy within the supply chain mirrors the nature of the particular supply chain and establishes its specific objectives and goals (Fisher, 1997; Lee, 2002). Implementation, including SCMT implementation, answers the question of how strategies will be realized given available technological resources. When top management formulates a strategy, it sets the direction for the organization. However, strategy implementation is often left to functional managers. To be successful, an organization needs a clear understanding of its competitive priorities and must realize that equal focus on all priorities is not possible (Larson & Gray, 2011). Though the strategy implementation process is not as clear as strategy formulation, managers realize that without proper implementation, success is virtually impossible. Given these broad constraints, more detailed-level strategies and objectives are developed by functional managers giving rise to a potential strategy disconnect and a potential implementation gap. The implementation gap refers to the lack of consensus, or fit, between the priorities and goals set by senior level management and those independently set by lower levels of management (Larson & Gray, 2011). The lack of strategic fit often frustrates the potential beneficial effects of SCMT by both individual companies and supply chain partners (Kearns & Lederer, 2003; Seggie, Kim & Cavusgil, 2006).

Few today would question the importance of strategic IS fit (Chan et al. 2006). Alignment between business and IS strategy is advocated by top-level executives (Setia & Patel, 2013). However several scholars have noted that there has been little theory-based empirical research on the factors affecting fit (Chan et al. 2006). Prior research in IS suggests that achieving alignment between business and IT is essential to improving firm performance (Reich & Benbaset, 1996; 2000). Based on the need for technology to be compatible with organizational strategy, structure, processes and tasks (Tornatzky & Klein, 1982; Rodrigues et al., 2004), the idea that fit between IT and a complementary resource, such as technological readiness, is what ultimately creates a potential competitive enhancing resource (Wiengarten et al. 2012) and the implementation of SCMT is crucial for enhancing mission critical supply chain processes (Hanfield & Nichols, 1999; Lai et al., 2006), the following hypothesis is offered.

H2: Fit (alignment) will have a positive impact on SCMT implementation success.

Richey et al. (2007; 2008) posited that technological readiness could link technological adoption to the potential benefits that may result from successful SCMT implementation and may provide greater explanatory power to predict the potential for the successful implementation of SCMT. Improved fit could be achieved for those organizations with greater technological readiness. The construct of technological readiness is discussed in the following section.

2.8 Technological Readiness

Technological readiness is defined as a person's propensity to embrace and use new technologies for accomplishing goals (Parasuraman, 2000, p. 308). Four dimensions comprise the construct of technological readiness. These dimensions include optimism, innovativeness, discomfort, and insecurity. Optimism relates to a positive view about technology and a belief that technology offers increased control, flexibility, and efficiency. Innovativeness often refers to the tendency to try out new things as would an early adopter of technology. Insecurity involves the distrust of technology and suggests skepticism with technology and its ability to work properly. Finally, discomfort consists of a perception of lack of control over technology and a feeling of being overwhelmed by the technology. Much of the prior research on technological readiness is concerned with the individual adoption and implementation of technology. An example is the research of Lin et al. (2007). The authors extended the technology acceptance model (TAM) to incorporate the construct of technological readiness. TAM is a framework for predicting and explaining individual adoption of IT in a workplace setting (Davis, 1989). Designated the technology readiness and acceptance model (TRAM) Lin, Shih and Sher (2007) developed their model in the context of consumer adoption of e-service systems. The authors found support for technological readiness as an antecedent for perceived ease of use and perceived usefulness, two major constructs included in the technology acceptance model.

Richey et al. (2007) advanced the conversation regarding technological readiness to the firm level of analysis. *For this study, firm technological readiness implies the firm possesses the ability to embrace and use new technological assets.* Firm technological readiness is considered an operant resource, in this case linking technological adoption to the potential benefits such as improved firm performance, which may develop as a result of successful implementation and provide greater explanatory power to predict the potential for the successful implementation of SCMT (Richey et al., 2007; 2008).

Richey et al. (2007) examined technological readiness within a logistics service technology context to predict a number of logistics performance outcomes. Analyzing the logistics service quality of both manufacturers and retailers, their results indicated that manufacturers seek cost efficiency in relation to technology when technological readiness is high whereas retailers are more likely to seek to be more innovative and responsive to customer needs. Richey et al. (2008) examined the impact of technological utilization on retailer performance, moderated by three elements of technological readiness: optimism, innovativeness, and insecurity. Utilization was measured based on the number of technologies a retailer used in conjunction with a primary supplier, expressed as technological intensity. Their results indicated support for technological intensity leading to higher retail operational effectiveness. The authors also found support for the variables of optimism and insecurity moderating the relationship. Innovativeness as a moderator was not supported. Richey et al. (2009) assessed whether a firm's capability for implementing and using technology plays a role in the collaboration versus technology tradeoff. Their findings indicate that a firm with higher levels of technological readiness is less likely to seek inter-firm collaboration, depending upon the learning capabilities of the firm,. The authors conclude that supply chain managers must determine how open they are to collaboration via their ability to learn and readiness for the implementation of new technology. Kros, Richey, Chen and Nadler (2011) examined the drivers of radio frequency identification (RFID) acceptance, noting that satisfaction with technologies, the relationship hostage position, and two dimensions of technological readiness (technological optimism and technological innovativeness) had a positive impact on RFID acceptance and eventually a firm's logistics performance. Finally, Kuo (2013) examined the moderating effect of technological readiness on information systems quality and organizational performance in the context of the constructions industry. The authors found support for all four elements.

The nature of skills available within an organization influences the success of IT in supply chain (Gunasekaran & Ngai, 2004). Research has suggested that optimism, one of the dimensions of technological readiness, is an aptitude which is an important determinant of successful organizational change (Tan & Tiong, 2005). When inevitable changes must be undertaken within an organization, those with a more positive, optimistic outlook towards the change are likely to find solutions to the challenges sure to arise during SCMT implementation (Kros et al., 2011). Additionally, it has been suggested that the ability of a firm to assimilate new technology into their operation is dependent upon the innovativeness of the organization (Hult et al., 2004). Firms with higher levels of innovativeness are more likely to provide the opportunity to adopt, thus implement, new technology, and forgo old habits (Menguc & Auh, 2006; Kros et al., 2011). Based on prior research, the following hypotheses are offered.

H3a: Technological optimism will positively moderate the relationship between change management and SCMT implementation success.

H3b: Technological innovativeness will positively moderate the relationship between change management and SCMT implementation success.

H3c: Technological discomfort will negatively moderate the relationship between change management and SCMT implementation success.

H3d: Technological insecurity will negatively moderate the relationship between change management and SCMT implementation success.

Kearns and Saberwal (2007) noted there is insufficient understanding among the contextual factors of business – IT strategic alignment. The authors explored the contextual factors of knowledge management and centralization of IT decisions related to business – IT strategic alignment. For this research, the contextual factor is technological readiness. Leveraging IS capabilities, such as technological readiness, to increase operational coordination through SCMT can involve complex changes to firm processes. The alignment of business and SCMT facilitates such changes (Setia & Patel, 2013). Prior research into technological readiness by Richey et al (2007; 2009) found that information exchanges between firms in the manufacturer-retailer dyad indicated that firm exchanges were easier to manage when a good technological fit existed between the two. Fit may be improved by acquiring firm capabilities (Richey, 2003). Focusing on technological resources as a firm capability, one would expect that higher levels of technological readiness would improve fit and potentially lead to greater implementation success. Thus the following hypotheses are offered.

H4a: Technological optimism will positively moderate the relationship between fit and SCMT implementation success.

H4b: Technological innovativeness will positively moderate the relationship between fit and SCMT implementation success.

H4c: Technological discomfort will negatively moderate the relationship between fit and SCMT implementation success.

H4d: Technological insecurity will negatively moderate the relationship between fit and SCMT implementation success.

The ability to measure SCMT implementation success based on impact is tied to the firm's ability to measure organizational outcomes (Petter et al., 2012). Hence, given the appropriate fit and requisite change management leading to successful SCMT implementation moderated by technological readiness, improved firm performance should result as an outcome of SCMT implementation success. Firm performance is discussed in the next section.

2.9 SCMT Implementation and Firm Performance

Firms invest in IT on the assumption the technology will influence firm performance (Campo et al., 2010). However research into the direct impact of IT on firm performance has provided inconsistent results (Sanders, 2007), leading some researchers to suggest the existence of a so called "productivity paradox". The productivity paradox, as detailed in Brynjolfsson (1993) is the idea that investment in IT does not guarantee improved performance. Consistent with the idea that technology is important not for itself but for what it enables the firm to do, research by Tippins and Soh (2003) failed to support the link between IT and firm performance. Using profitability as a measure, Hitt and Brynjolfsson (1996) also found no evidence that IT use led to increased performance. Conversely in their 1998 study, Brynjolfsson and Hitt found that performance is improved when investment in IT is integrated with complementary investments (Brynjolfsson & Hitt, 1998). Devaraj and Kohli (2003) detailed the relationship between financial performance and the actual usage of IT, finding that the greater the actual usage the better the financial performance of the firm. Powell and Dent-Micallef (1997) found that firm performance is enhanced by IT only when the technology is used to leverage preexisting, complementary human and business resources. Interestingly, much of the prior research attempting to connect IT to firm performance makes no mention of successful implementation. It would appear to successful implementation is assumed.

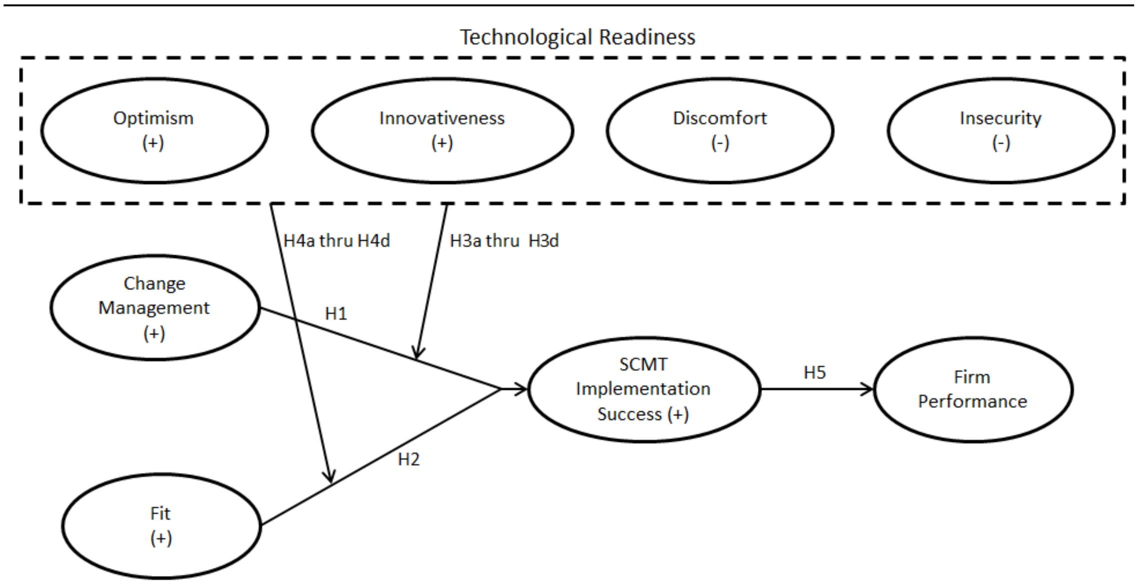
The impact of SCMT on firm performance has become one of the major concerns of both supply chain managers and researchers. It is generally accepted that SCMT plays a significant role in the supply chain because of the contribution it can make to improve the performance of both the individual firm and the supply chain as a whole (Li et al., 2008). Improved performance will likely be enjoyed by those firms who have not merely invested in SCMT but those who have successfully implemented SCMT thus integrating SCMT into their business processes. As IT is the conduit linking the business processes within the firm which adds value to the company (Porter & Millar, 1985), research suggests that firms which are able to align SCMT to business processes will be able to better leverage their SCMT to gain positive financial outcomes (Foss, 1996; Teece, 1998). Technology within the supply chain presents a different perspective. The nature of SCMT suggests a more direct link to different measures of firm performance, such firm profitability (Blankley, 2008). Wu et al. (2006) found that IT can improve firm performance through specific supply chain capabilities, defined by the authors as information exchange, inter-firm coordination, integration of activities, and supply chain responsiveness. Li et al. (2009) detailed that while having no direct effect on supply chain performance, SCMT implementation does positively impact supply chain integration. This is an important finding as a number of prior studies, both empirical and theoretical, have come to the consensus that supply chain integration can lead to improved firm performance (Lee, Padmanabhan & Whang, 1997; Frohlich & Westbrook, 2001).

As noted previously, SCMT represents defined business processes in which process owners use IT to improve the efficiency of their existing processes or use IT to reengineer older processes to improve current capabilities (Maciaszek, 2007). When SCMT is aligned with organizational processes, higher order capabilities will be created (Wiengarten et al. 2013). The capabilities created provide the benefits associated with successfully implemented SCMT. The benefits of SCMT can vary in the context of implementation (Auramo et al., 2005). Thus, the following hypothesis is offered.

H5: SCMT implementation success will have a positive impact on firm performance.

In summary, this dissertation chapter elaborates the theoretical foundation for the research and examines the literature streams which contribute towards the development of the research model. The main objective is to build upon the existing work in various research domains to recognize the relevant gaps and understand how this study contributes towards filling the gaps in the existing literature. Socio-technical system and the Task-Technology-Fit theory are discussed to develop the conceptual model. Constructs relevant to this research are discussed as they relate to each theory. Research hypotheses are proposed. The research model with labeled hypothesis in presented in Figure 12 below.

Figure 12. Research Model with Hypothesis



Chapter three explicates the methodology to be utilized in this research, details the constructs specified in the research model and describes the statistical technique to be used for data analysis

CHAPTER 3

METHODOLOGY

3.0 Introduction

The goal of this research is to determine the factors that influence the successful implementation of SCMT initiatives and develop a comprehensive model for SCMT implementation. This chapter describes the quantitative methodology used in this dissertation. Survey methodology will be used to complete this research. The chapter will first discuss the survey methodology and the appropriateness of the method. The chapter then details the constructs specified in the research model. Finally, the chapter describes the statistical technique to be used for data analysis.

3.1 Research Methodology

It is critical that rigorous academic research be theory based, carried out in a systematic manner and research methods be appropriately implemented in order to obtain both meaningful and valid results (Flynn, Sakakibara, Schroeder, Bates & Flynn, 1990; Malhotra & Grover, 1998). Understanding that all research methods have different strengths and limitations, researchers select a research method in an effort to maximize one of three things: generalizability, precision/control, or realism (McGrath, 1982). Generalizability refers to the inference made to a population based on a sample of that population. Precision/control is concerned with attempting to assess cause-and-effect relationships between variables of interest. Typically research concerned with precision and control is associated with laboratory experiments and simulation. Finally, realism is concerned with realism of context in research. Context realism is typically associated with field studies (McGrath, 1982). Given the necessity, ubiquity and variety of SCMT noted in Table 2, the need to provide a generalizable model of SCMT implementation success applicable to the many types of SCMT is desirable. Thus, the survey methodology was selected. The method and justification for use in this research is discussed in the following sub-sections.

Survey Method

One of the most widely used research methodologies in logistics and supply chain management is the survey research methodology (Melnyk, Page, Wu & Burns, 2012). Given the various advantages provided by using survey research, the dominance of the method is not surprising. As noted by Melnyk et al. (2012), surveys are rather inexpensive to administer; can be useful in describing characteristics and /or traits of large populations; can be administered through a variety of different methods; many questions can be asked about a topic; and high reliability is fairly easy to achieve (Melnyk et al. 2012).

There are two major types of survey research (Kerlinger, 1986). The first is classified as exploratory survey research. The objective is to become more familiar with a research topic. The second and arguably most important type of survey research is explanatory research. Explanatory survey research is designed to find relationships among variables (Malhotra & Grover, 1998). It does so from theory-based expectations on how and why variables should be related. In order to evaluate the proposed model of SCMT implementation, a quantitative explanatory survey method will be applied.

The survey method was selected as appropriate for this research to ensure generalizability. The generalizability of the implementation model is vital. Given the nature of SCMT in both its necessity and ubiquity, along with the variety of SCMT utilized within the modern supply chain, the development of an implementation model applicable to a wide variety of SCMT is desirable. If conducted properly, surveys can make assertions about a population based on information obtained from a sample of that population (Wagner & Kemmerling, 2010) allowing the researcher to maximize generalizability. Ladik and Stewart (2008) note: “Research that offers highly generalizable insights that are meaningful and useful to broad constituencies are most likely to contain a strong contribution” (Ladik & Stewart, 2008, p.162). Malhotra and Grover (1998) provided an assessment to ensure rigor in survey research. Each of the items detailed in the assessment are discussed following the Table 7.

Table 7. Assessing Survey Research

Assessing Survey Research	
General	
1. Is the unit of analysis clearly defined for the study?	A formal statement defining the unit of analysis is needed for a positive assessment on this attribute. Justification of why that unit of analysis was selected is desirable, though not considered critical.
2. Does the instrumentation consistently reflect that unit of analysis?	The items in the questionnaire would need to be at the same level of aggregation as the unit of analysis.
3. Is the respondent(s) chosen appropriate for the research question?	The person most knowledgeable at the selected unit of analysis must be the preferred respondent.
4. Is there any form of triangulation used to cross validate results?	Triangulation will be judged to have been considered if more than one respondent belonging to the same unit of analysis filled out the survey questionnaire.
Measurement Error	
5. Are multi-item variables	Multiple items or questions would have to be used as

used?	opposed to a single item question to define a construct of interest. A positive assessment can be made if both multi-item and single item variables were used in the study.
6. Is content validity assessed?	Content validity would need to be assessed through prior literature, or opinion of experts who are familiar with the given construct.
7. Is field-based pretesting of measures performed?	A positive assessment can be made only if the study formally stated the inclusion of this step in cleaning up the survey instrument and establishing its relevance.
8. Is reliability assessed?	Cronbach's Alpha analysis or test–retest analysis would be needed for a positive assessment.
9. Is construct validity assessed?	Construct validity (discriminant convergent) analysis in the form of exploratory factor analysis, item-construct correlation, etc., would be needed for a positive assessment.
10. Is pilot data used for purifying measures or are existing validated measures adapted?	A positive assessment can be made if constructs and their associated items were evaluated on the basis of pretesting before the collection of actual data. Alternatively, constructs which were well defined and tested in prior studies could also be used.
11. Are confirmatory methods used?	Confirmatory factor analysis (e.g., using LISREL) results would need to be reported to establish construct validity.
Sampling Error	
12. Is the sample frame defined and justified?	A discussion of sample frame is needed for a positive assessment.
13. Is random sampling used from the sample frame?	Sampling procedures (random or stratified random) would need to be discussed for a positive assessment.
14. Is the response rate over 20%?	A formal reporting of response rate over 20% was needed for a positive assessment.
15. Is non-response bias estimated?	A formal reporting of non-response bias testing is needed for a positive assessment.
Internal Validity Error	
16. Are attempts made to establish internal validity of the findings?	At the very minimum, a discussion of results with the objective of establishing cause and effect in relationships, elimination of alternative explanations, etc., is needed for a positive assessment. Statistical analysis for establishing internal validity (like structural equation modeling) is considered as desirable, but not critical.
Statistical Conclusion Error	
17. Is there sufficient statistical power to reduce statistical conclusion error?	At least a sample size of 100 and an item to sample size ratio of more than 5 is needed for a positive assessment.

**Malhotra and Grover (1998)*

Sample

To understand and test the proposed implementation model, including the SCMT implementation success construct as measured by IS-Impact, it is necessary to solicit input from key user groups at appropriate level within the firm. Target respondents will be managers having been or currently involved in SCMT implementation efforts regardless industry of sector. Data will be collected utilizing a cross-sectional survey from a random sample consisting of those managers involved in the implementation of SCMT initiatives from a number of different sources. Key informants will be solicited through professional organizations including The Association for Operations Management (APICS). APICS is one of the leading professional associations for supply chain and operations management and is likely to have the key informants necessary to inform the research. APICS has also received attention by scholars in information systems (Bharadwaj, Bharadwaj & Bendoly, 2007). In addition, private firms, government organizations and logistics service providers identified by the researcher will also be sought to participate.

Response Rate

Although survey research is still the most widely used research method in logistics and supply chain management, low response rates and non-response bias are continuing areas for concern (Larson, 2005). For survey research to be effective, high response rates are considered important. In their assessment identifying ideal survey research attributes, Malhotra and Grover (1998) recommend a minimum response rate of 20% for empirical studies. Unfortunately, response rates such as those suggested by

Malhotra and Grover (1998) are increasingly difficult to obtain. Melnyk et al. (2012) examined the state survey research in supply chain management. Various factors were examined to account for the drop in response rates including number of questions, the source of the survey population, and the method of survey delivery (Melnyk et al., 2012). Collecting data from five representative journals that publish supply chain research during a 19-year period from 1990 to 2008, the authors found response rates have been declining significantly since 2001. The authors noted the lowest survey response rates accepted in five journals publishing SCM research including Decision Sciences (3%), Journal of Business Logistics (4.3%), Journal of Operations Management (4.3%), Journal of Purchasing and Supply Management (4%) and Production and Operations Management (8.9%). In an earlier study, Larson (2005) completed a content analysis of mail survey practices and results published in the Journal of Business Logistics and The International Journal of Physical Distribution & Logistics Management from 1989 to 2003. He noted the lowest accepted response rates in for articles published in each journal as 4.3% and 2.5% respectively. Efforts to ensure the highest possible response rate for this research are discussed in Section 3.3, Data Collection and Analysis.

Non-Response Bias

Crucial for researchers is to maximize response rate in order to minimize non-response bias. Non-response bias occurs when a significant number of people in the survey sample do not respond to the questionnaire and have different characteristics from those who do respond. Non-response bias will be assessed based on the suggestions by Armstrong and Overton (1977). One of the most widely used techniques; comparisons of early and late respondents over a number of parameters will be evaluated. The basic rationale for this comparison is that non-respondents tend to closely resemble the later-respondents. If no statistical differences are discovered between the early and late respondents, it is presumed that the study has not been impacted by non-response bias (Wagner & Kemmerling, 2010). As detailed by Wagner and Kemmerling (2010): “In sum, if carefully selected and implemented, response inducement techniques can increase response rates and reduce non-response bias in logistics research” (Wagner & Kemmerling, 2010, pg. 359)

Common Method Bias

Common methods bias is a concern wherein a single organizational informant provides answers to both independent and dependent variables using the same data collection approach and is one of the main sources of measurement error in survey research (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). It is said to occur when data for each variable is collected using the same method or provided by the same single source. Essentially, it has been argued that self-reported variables, such as those reported in survey research, are routinely upwardly biased (Conway & Lance, 2010). Podsakoff et al. (2003) note that in general, two primary methods exist for the control of common methods bias. The authors indicate that methods bias can be controlled through either the design of the study’s procedures or through statistical controls. In their research regarding reviewers expectations regarding common methods bias in organizational research, Conway and Lance (2010) state reasonable expectations for reviewers regarding methods bias should include solid reasoning for the appropriateness of self-reports, evidence of construct validity, lack of overlap in items for different constructs and evidence of a proactive design to mitigate method effects. The authors do not recommend the use of post hoc statistical control strategies, stating that all have significant drawbacks. Common methods bias will be addressed for this research using the guidelines provided by Conway and Lance (2010).

3.2 Constructs and Measures

The constructs for this research were operationalized using both multi-item formative and reflective measures from previous studies. Formative indicators have the following attributes: they form a latent construct with each indicator explaining a unique portion of variance in the latent construct, they are not interchangeable and they do not necessarily covary (Petter, Straub & Rai, 2007). By contrast, reflective indicators are caused by a latent construct, are considered interchangeable and necessarily covary (Petter et al., 2007). SCMT implementation success (IS-impact) and firm performance are formative constructs, whereas others included in the model are measured as reflective. Existing scales serve to measure the constructs to the research context, with slight adaption to the scale for firm performance.

The existing constructs were selected for this research based on the research questions and a thorough review of the literature. Each construct reflects the conceptualization of the phenomenon in a manner that is consistent with the perspective of the researcher and deemed appropriate in an examination of the identified factors affecting successful SCMT implementation, the impact of technological readiness on the successful implementation of SCMT initiatives and the development of an SCMT implementation model. In addition, each has been used in prior logistics and supply chain management research and / or information systems research. Table 8 in Appendix B details the constructs being studied, types of the constructs and origin of the items for each scale. The following subsections detail the psychometric properties of each of constructs from prior research.

Change Management

Greer and Ford (2009) explored the differences between supply chain management change and non-supply chain management change to determine if there were differences in the change processes when organizations implement SCM change versus non-SCM change. The authors based the development of their change management construct on the three-phase model of Lewin (1947). They distilled a common set of behaviorally-based factors for study from four widely cited process change models, including the model of Kotter (1995) discussed earlier, in order to operationalize the second-order change management construct. The first-order constructs include problems analysis, action planning, skill development, behavior management, and management control. In their analysis, the authors found each of the five first-order constructs included in the construct of change management exhibited construct validity. Discriminant validity was assessed using average variance extracted (AVE) according to Fornell and Larcker (1981). In addition, the authors note the reliability of each measure based on the accepted 0.70 benchmark (Greer & Ford, 2009).

Change management is one of the most widely cited critical success factors for systems implementation in the literature and appropriate for an SCMT implementation model. Having been developed and used in a logistics and supply chain context, the construct as operationalized by Greer and Ford (2009) is suitable for this research. The construct is based on the model of Lewin (1947). Lewin's model of change recognizes the need to discard old behavior, structures, processes and culture before successfully adopting new approaches (Bamford & Forrester, 2003). This is well suited to the SCMT implementation model given the intent to analyze success at multiple levels within the firm measured using IS-Impact.

Fit (Alignment)

The measure for the construct of fit was adopted from the work of Kearns and Sabherwal (2007). For this research, fit uses the definition of Nadler and Tushman (1980). As previously noted, the lack of strategic fit often frustrates the potential beneficial effects of SCMT by both individual companies and supply chain partners (Kearns & Lederer, 2003; Seggie et al., 2006). Operationalized as a four item scale called business-IT strategic alignment, the measure relates to the alignment between business and IT strategies. Reliability, convergent validity and discriminant validity were each exhibited based on the appropriate statistical tests.

The concept of fit as operationalized by Kearns and Sabherwal (2007) is well suited to this research as it incorporates elements congruent with the proposed model of SCMT implementation as developed in this dissertation. First, the construct corresponds with the definition of fi by Nadler and Tushman (1980) adopted for this dissertation. Additionally, one important element within the construct discusses the prioritization of IT investments by the expected impact on business performance. This aligns with the SCMT implementation success construct as measured by IS-Impact as an antecedent to firm performance.

Technological Readiness

The construct of technological readiness is the main variable of interest. Originally developed at the individual level by Parasuraman (2000), Richey et al. (2007; 2009) later advanced the conversation regarding technological readiness to the firm level of analysis. The authors developed a model of competitive advantage through the linkages of firm Technological Readiness and Logistics Service Quality. Exploratory factor analysis was performed to examine scale validity. Confirmatory factor analysis was conducted to establish discriminant validity. Scale reliability was confirmed based on the method of Fornell and Larcker (1981) with each scale exhibiting a reliability coefficient greater than the benchmark of 0.70 suggested by Nunnally (1978). Construct validity was evaluated by testing whether all of the items in each scale loaded on a common factor when within-scale analysis was conducted. In this procedure, all eigenvalues exceeded the minimum value of 1.0 supporting the unidimensionality of each construct.

SCMT Implementation Success (IS-Impact)

SCMT implementation success will be measured using the construct of IS-Impact as developed by Gable et al. (2008). This formative construct seeks to answer two important questions for evaluating success: “Has the IS benefitted the organization or had a positive impact?” and “Is the IS worth keeping or does it need changing?” To avoid misspecification, the authors took great care to established content validity of the formative construct of IS-Impact. Assessment of content validity is considered mandatory practice for researchers using formative constructs (Petter et al., 2007). Common methods for establishing content validity include a thorough literature review, a review by expert panels and Q-sorting (Boudreau, Gefen & Straub, 2001). Following the guidelines detailed by McKenzie et al. (1999) for establishing content validity of formative constructs, Gable et al. (2008) completed a thorough literature review, established an expert panel of six academics each of whom possess the relevant expertise to evaluate and critique the scale items developed from the literature review, and pilot tested the instrument to ensure content validity. A pool of 37 measures was obtained. Further validation of the measure was then established by testing for multi-collinearity. The authors note: “Excessive collinearity among measures makes it difficult to separate the distinct influence (and hence the validity) of the individual measure of the formative construct” (Gable et al., 2008, p. 391). Through the extensive validation process, the authors noted that construct validation suggested the exclusion of 10 of the initial 37 indicators, resulting in a more parsimonious 27 item scale which demonstrates both face and content validity.

SCMT implementation success as measured by IS-Impact is appropriate for this research for a number of reasons. First, Thong (2001) noted that SCMT implementation success only has meaning to the extent that the technology can impact the organization. Second, the IS-Impact measure addresses system users in a holistic way, using dimensions that look both backward (the impact of the system to date) and forward (the impacts anticipated). Third, the construct is generalizable across different stakeholders, systems and system contexts. Fourth, Gable et al. (2007) noted that, in addition to providing operationalization of a main dependent variable, IS-Impact can serve as an important independent variable, such as an antecedent to organizational performance. Finally, Sedera and Gable (2010) used the more parsimonious 27 item IS-Impact scale in their research regarding Knowledge Management Competence and Enterprise System Success. The authors documented a significant, positive relationship detailing the greater the organization's Knowledge Management Competence, the greater will be the level of Enterprise System Success (as measured by IS-Impact).

Firm Performance

Firm performance will be measured using an adapted scale developed by Rai et al. (2006). As with the construct of IS-impact, the authors took great care to establish content validity of the formative construct. Rai et al. (2006) completed a literature review and all scale items independently evaluated by each researcher in their study until there was unanimous agreement on content validity. An expert panel of two well-established information systems scholars with expertise in the domain then evaluated the scale. Once suggestions from the expert panel were incorporated, two pilot studies were then conducted; one to include nine faculty members actively researching in information systems, followed by a test including ten supply chain and logistics managers. Feedback was incorporated from each test to arrive at the final measure.

The scale developed and validated by Rai et al. (2006) is well suited for the context of this research. It is a comprehensive measure of performance relative to the firm's competition. The construct encompasses dimensions important to performance related to supply chain process integration; something in which prior studies have indicated can lead to improved firm performance (Hitt et al., 2002; Vickery et al., 2003; Li et al., 2008). In their study, data were collected from both manufacturers and retailers. In an effort to improve the firm performance construct, it will be adapted to include an indicator for the strength of supplier relationship. The formative indicators include measures for operational excellence, revenue growth and strength of customer relationships relative to the firm and its competition. Each of indicators in the firm performance construct selected match well to the indicators for the implementation success (IS-Impact) construct.

As detailed in the previous sub-sections, each construct displays good psychometric properties in prior research. Although the scales selected were shown to be both reliable and valid in other research efforts, it is not assumed they will be reliable and valid for this research. Tests for reliability and validity will be conducted based on the procedures detailed by Garver and Mentzer (1999). Convergent validity and unidimenionality will be test using principal component analysis. Reliability will be assessed via Cronbach's coefficient alpha. Based on the guidelines of Nunnally (1978) a score of 0.70 will be considered acceptable evidence of internal consistency and reliability. Discriminant validity will be assessed based on the average variance extracted (AVE). Support for discriminant validity is provided when the AVE estimates are greater than the squared correlation estimates (Hair, Black, Babin & Anderson, 2010).

3.3 Data Collection and Analysis

Data collection for this research will be conducted via a mixed-mode survey. Mixed-mode surveys are used when it is difficult to achieve the desired results using a single mode (Dillman, Smyth & Christian, 2014). As the implementation of information systems typically involves effort at different organizational levels within the firm, a mixed-mode survey will be used in order to decrease coverage error and ensure the sample covers the desired population of interest. For firms in which the researcher has electronic contact information for the appropriate key informants within a particular firm, data collection will be conducted through a web-based survey. Web-based surveys have increased in popularity in recent years due to their added convenience, potential increased response rate, potential for faster response and lower cost (Cobanoglu, Warde & Moreo, 2001). Data will be collected through self-administered questionnaires via email with a link provided to the survey. Implementation of the web-survey for this research will be conducted using the "Tailored Design Method", three-email contact strategy procedures advocated by Dillman et al. (2014). An initial invitation to participate will be sent, followed by a second email which will serve as a thank you for those who have participated and a reminder to those who have not. A third and final email reminder will as the time to complete the survey draws to a close.

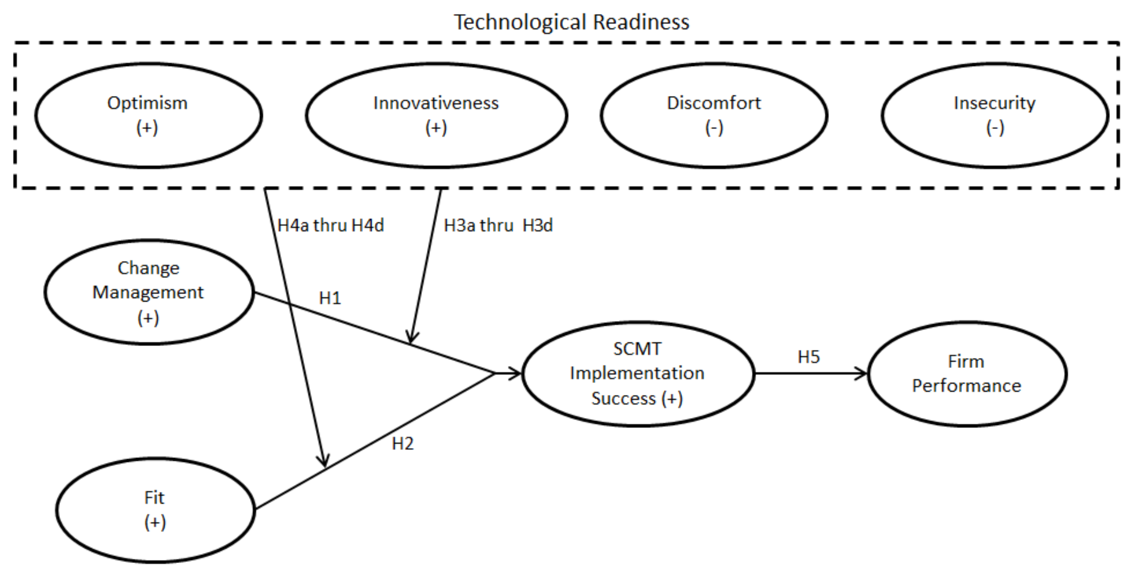
In an effort to ensure the highest possible response rate, mail surveys will be used where appropriate and for potential follow up to the email survey. Mail surveys are often used where email addresses are not available or respondents fail to respond via email (Fowler, 2009). To ensure validity, this research will use the “Tailored Design Method” procedures advocated by Dillman et al. (2014). A pre-notification letter will be sent prior to the questionnaire. A cover letter and pre-paid postage envelope will be included with questionnaire mailing five days following the pre-notification. Approximately one week after mailing the questionnaire, a thank you postcard will be sent. A final reminder, including replacement questionnaire will be sent approximately 2 to 3 weeks following the initial mailing. To enhance the response rate, a summary of the study’s findings will be offered. An additional incentive will be offered as a part of the mail survey. Each respondent will be included in a drawing to win one of six $50 gift cards. Although not as effective as prepaid token financial incentives, there is evidence that response rates can be improved using a prize drawing as an incentive (Dillman et al., 2014).

A pilot test of the survey (see Appendix A for the survey instrument) will be conducted using a convenience sample of 20 to 25 respondents currently involved in the implementation of an ERP system, a specific type of SCMT, for the government sector to ensure the instrument and procedures for survey administration are sound. Given the nature of the proposed study, this is an appropriate subsample. A pilot study is considered important in empirical survey research to ensure the quality of the survey and provide an idea of how the study procedures will work in practice for the larger study (Dillman et al., 2014). Dillman et al., 2014 note pilot studies are particularly important for web surveys and implementation involves individuals from different areas within an organization. Feedback regarding the survey will be solicited from the pilot study respondents. A summary of the hypotheses to be tested is provided in Table 9.

Table 8: Summary of Hypothesis

Summary of Hypothesis	
H1	Change management will have a positive impact on SCMT implementation success
H2	Fit (alignment) will have a positive impact on SCMT implementation success.
H3a	Technological optimism will positively moderate the relationship between change management and SCMT implementation success.
H3b	Technological innovativeness will positively moderate the relationship between change management and SCMT implementation success.
H3c	Technological discomfort will negatively moderate the relationship between change management and SCMT implementation success.
H3d	Technological insecurity will negatively moderate the relationship between change management and SCMT implementation success.
H4a	Technological optimism will positively moderate the relationship between fit and SCMT implementation success.
H4b	Technological innovativeness will positively moderate the relationship between fit and SCMT implementation success.
H4c	Technological discomfort will negatively moderate the relationship between fit and SCMT implementation success.
H4d	Technological insecurity will negatively moderate the relationship between fit and SCMT implementation success.
H5	SCMT implementation success will have a positive impact on firm performance.

Figure 13. Research Model with Hypothesis



To analyze the data collected and examine the hypotheses set forth, Partial Least Squares (PLS) was selected as the appropriate analytical technique. Though not methodologically tied to survey research, because PLS is closely associated with the analysis of latent constructs, it has been frequently used in survey research (Lee, Petter, Fayard & Robinson, 2011). PLS is a second-generation structural equation modeling (SEM) technique which focuses on maximizing the variance of the dependent variables explained by the independent variables. PLS has gained acceptance as an analytical technique in a number of business domains including information systems, marketing, accounting, and operations management (Hair, Hult, Ringle & Sarstedt, 2014; Peng & Lai, 2012; Ringle, Sarstedt & Straub, 2012; Lee et al., 2011). PLS permits the researcher to combine and concurrently assess both the measurement, typically accomplished through factor analysis, and structural models, traditionally accomplished through path analysis (Lee et al., 2011). The measurement model examines how well the latent constructs are depicted by the mapped set of indicator variables. The structural model estimates the strengths of hypothesized relationships among the latent constructs detailed. The PLS software tool *SmartPLS* will be used.

PLS is suitable for assessing models where explaining relationships among a set of constructs is desired (Chin, 1998; Peng & Lai, 2012; Hair et al., 2014). Furthermore, PLS permits modeling of both formative as well as reflective constructs. Formative constructs have indicators that form or cause the creation or change in the construct. In contrast, reflective constructs are those where the indicators reflect the same underlying concept (Chin, 1998). Formatively measured constructs are particularly useful for explanatory constructs (Hair et al., 2014). In this research, the constructs of IS-Impact and firm performance are each modeled as formative.

PLS is also appropriate where small sample sizes may be a concern. Hair et al. (2010) note that PLS is useful in generating estimates when sample observations are as low as 30 or less. Minimum sample size requirements for using PLS are guided by the often cited 10 times rule of thumb. It states the minimum sample size required to for PLS must be 10 times the largest number of formative indicators used to measure a single construct (Hair et al., 2014). For this research, both SCMT implementation success (measure by IS-Impact) and firm performance are formative, second order constructs. IS-Impact consists of four, first order formative constructs. Those are individual impact, organizational impact, information quality, and system quality. System quality contains nine formative indicators. Using the 10 times rule of thumb for PLS, the minimum required sample size is 90.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.0 Introduction

The purpose of this chapter is to describe the empirical analysis of the research model and present the findings from the study. Information is provided regarding respondent characteristics, non-response bias, common method bias, and hypotheses testing. The items used for measurement of the constructs were adapted from previously validated scales. Construct validity was established through an assessment of unidimensionality, convergent validity, discriminant validity and reliability. After confirming that the constructs met the guidelines established through prior research, the research model was tested using SmartPLS 2. The chapter concludes with a review of the degree of support for each of the hypotheses tested and discussing the implication of the results.

4.1 Pilot Test

A pilot test was conducted following the development of the survey instrument to ensure the instrument and procedures for electronic survey administration were sound. Subjects were provided an email containing a link to the electronic version of the survey instrument. Two additional questions not present in the final survey instrument were included within the pilot survey. These questions related to the readability and comprehension of the survey and potential motivation for improved response. The pilot survey was sent to 6 academicians and 5 logistics professionals. Eleven responses were received. No difficulty was reported by any of the respondents.

4.2 Survey

The results of the pilot study indicated that the questionnaire was appropriate and required no revisions were necessary prior to data collection. The target population was managers currently or having been involved in SCMT implementation efforts. Respondents were asked to consider the most recent technology project implemented within their firm.

Key informants were solicited through professional organizations including The Association for Operations Management (APICS), along with private firms, government organizations and logistics service providers identified by the researcher. Many of the survey contacts were obtained from the attendees list of the 3rd Annual Global Supply Chain and Logistics Summit in Birmingham, AL hosted by the Birmingham Business Alliance (BBA) and held on August 19, 2014. The conference organizer provided the attendees list. Data collection occurred over a two-month period beginning in March 2015.

A total of 1963 surveys were sent via email through Qualtrics. Of those, 277 (14.1%) emails returned as undeliverable. A total of 472 emails were opened (24%). Of the emails opened, 232 (49%) were started. 85 (26%) electronic surveys were completed. 147 (63%) left the survey incomplete. A total of 128 (6.5%) indicated they were not interested in participating. In addition, paper copies of the survey instrument were distributed at the meetings of local chapters of two professional organizations containing logistics and supply chain professionals; The Huntsville, AL chapter for the National

Association for Contract Management (NACM) and the Tennessee Valley chapter of APICS. The researcher was afforded time at the beginning of each meeting to explain the purpose of the survey. Forty-five members attended the NACM meeting, and 7 (15%) surveys were completed. Fifteen members attended the APICS meeting, and 8 (53%) members completed the survey. Self-addressed, stamped envelopes were provided at both events for those who could not complete the survey during the chapter meeting. A combined 4 members took a copy of the survey along with a self-addressed, stamped envelope. None were returned. In total, 2,023 surveys were sent. 100 were completed. Of those, 6 responses were not used due to missing data greater than 15% (Hair et al. 2014). Thus, 94 usable responses were provided (4.64%).

4.3 Respondent Profile

Descriptive analysis was undertaken to examine the characteristics of the sample and data produced through the survey responses. The research participants were logistics and supply chain professionals in the United States at the managerial level covering a broad range of industry sectors. Table 9 indicates the demographic data of the survey respondents. 23.5% of the respondents were from the Textiles, Manufacturing, and Building Materials industry. 17% were from the Government/Military sector. Also included were Appliances, Retail and Consumer Goods (8.5%), Chemicals, Pharmaceuticals, and Electronics (7.4%), and the Service industry (9.6%). Other accounted for 34% of the respondents.

Table 9. Demographic Analysis of the Data Sample

	Frequency	Percent (%)	Cumulative
Type of Industry			
Textiles, Building Materials, Manufacturing	22	23.5%	22
Appliances, Retail, Consumer Goods	8	8.5%	30
Chemicals, Pharmaceuticals, Electronics	7	7.4%	37
Service	9	9.6%	46
Government/Military	16	17.0%	62
Other	32	34.0%	94
Size of Organization			
1-50 employees	20	21.3%	20
51-100	9	9.6%	29
101-250	10	10.6%	39
251-500	9	9.6%	48
501-1000	13	13.8%	61
1000+	33	35.1%	94
Position in the Firm			
Director	26	28.9%	26
Manager	39	43.4%	65
Supervisor	1	1%	66
User	2	2.2%	68
System Provider	0	0%	68
Other	22	24.5%	90
Years of Experience (Industry)			
0 to 5 years	2	2.2%	2
5-9 years	7	7.6%	9
10-20 years	30	32.6%	39
More than 20 years	53	57.6%	92
Years of Experience (Firm)			
0 to 5 years	18	20.0%	18
5-9 years	19	21.1%	37
10-20 years	33	36.7%	70
More than 20 years	20	22.2%	90

As outlined in Table 9, the respondents were experienced industry professionals. The average number of years in industry was 29.6 years. The average number of years with their current firm was 13.7 years. The sample appears to represent the appropriate industry professional in the logistics and supply chain field sought for this research.

Table 10 details the type of SCMT used within each firm, as self-reported by the survey respondents. Many of the respondents indicated their firm used more than one type of SCMT. For the purpose of this study, survey respondents were asked to consider the most recent technology project implemented within the firm, when providing their response to the survey questions.

Table 10. SCMT used within the Firm

SCMT	**Number**
Customer Relationship Management	39
Order Management	28
Transportation Management	27
Electronic Data Interchange	27
Enterprise Resource Planning	25
Warehouse Management	24
Point of Sale	15
Radio Frequency Identification	12
Other	11

Non-Response Bias

Non-response bias occurs when a significant number of respondents in the survey sample do not reply to the survey, and may have different characteristics from those who do reply. Non-response bias was assessed based on the suggestions by Armstrong and Overton (1977). Comparison of early and late respondents over each of the observable variables was evaluated. The justification for this comparison is that non-respondents tend to resemble the later-respondents. If no statistical differences are found between the early respondent and late respondents, it is determined the study has not been affected by non-response bias (Wagner & Kemmerling, 2010).

A two-sample mean difference test between early and late respondents was conducted. The test compared the means on each measurement item between early respondents and late respondents, based on the observable variables measured. No statistically significant difference between the first and second wave of respondents was noted with the exception of five of the seventy-two observable variables (see Appendix C). As the variable constituted a small fraction of the total observed variables, (6.9% of 72 observed variables) it could be determined that non-response bias was not a concern.

Common Method Bias

As one of the main sources of measurement error in survey research, common methods bias is a concern wherein a single organizational informant provides answers to both independent and dependent variables using the same data collection approach. Conway and Lance (2010) state reasonable expectations for reviewers regarding methods bias should include solid reasoning for the appropriateness of self-reports, lack of overlap in items for different constructs, evidence of construct validity and evidence of a proactive design to mitigate method effects. The authors do not recommend the use of post hoc statistical control strategies, stating that all have significant drawbacks. In addition to the guidelines of Conway and Lance (2010), Podsakoff et al. (2003) also recommend the use of different types of measures across constructs as a further step to safeguard against common method bias.

The appropriateness of self-reported measures for this research is justified. Managerial level logistics and supply chain professionals involved in the implementation of SCMT would have the appropriate knowledge to participate in the survey. Evidence of construct validity is provided as a part of the data analysis section. Finally, this research follows the recommendation of Podsakoff et al. (2003) by including both formative and reflective measures in the research model.

4.4 Data Analysis

Measurement scales for this research were adopted from previously validated scales within the literature. The measures for fit, implementation success, technological readiness, and firm performance were assessed using a seven-point Likert scale. The measure for change management was assessed using a five-point Likert scale. Factor analysis using principal components analysis (PCA) was conducted to assess unidimensionality. Subsequently, partial least squares structural equation modeling (PLS-SEM) was used to further analyze the data and test the hypotheses. PLS-SEM, also known as components based SEM, was chosen for data analysis because it offers advantages in estimating complex models while being less sensitive to violation of assumptions of normality and issues related to multi-collinearity. PLS-SEM allows the estimation of research models when sample size is relatively small and the constructs are either reflective or formative (Chin, 1998).

Principal Components Analysis

Factor analysis is used to explore or investigate relationships between variables to confirm underlying dimensions. For this research, principal component analysis (PCA) was used to assess dimensionality of the first order constructs. Varimax rotation was performed where multiple factors were included. All of the items related to the various characteristics of each construct were subjected to factor analysis. The criteria for review of each PCA included a review of which items loaded more strongly on a particular factor. Highly cross-loaded items with cross loadings > 0.50 were then removed, one at a time for each subsequent analysis. Factor loadings >0.40 were retained. Specifics for each construct are provided.

Change Management

Change management is a reflective, second-order construct as operationalized by Greer and Ford (2009) containing five latent first order factors with 16 total indicators. These factors were problem analysis, action planning, skill development, behavior management, and management control. Using each of the three phases of Lewin's (1947) model as anchor points, Greer and Ford (2009) operationalized each of the five factors in their model, linking each factor to one of the three stages in Lewin's (1947) three-phase change model. Problem analysis and action planning were linked to the unfreezing stage.

Skill development was linked to the movement stage. Behavior management and management control were linked to the refreezing stage.

Initial PCA of the change management construct revealed a three factor solution and noted significant cross-loading. Many of scale items did not load on the five distinct factors previously operationalized by Greer and Ford (2009). As a result, cross-loaded scale items were removed one at a time and PCA again conducted. Continued analysis did not improve the results. It was observed that many of the manifest variables for each of the original five factors operationalized by Greer and Ford (2009) were loading on factors consistent with the three phases of Lewin's (1947) three-phase change model. The majority of the items within the problem analysis and action planning scales loaded on one factor. The items for the skill development scale loaded on a second factor. Finally, the items for behavior management and management control scales loaded on the third factor. Thus, it was determined that a three factor solution which mirrored the model of Lewin (1947) would be justified for this research. Two scale items from the three factor solution exhibited cross-loading and were removed. The results are noted in Table 11.

Table 11. Change Management Rotated Component Matrix

	Component		
	1	2	3
analysis_2		.793	
analysis_3		.714	
plan_1		.810	
plan_2		.824	
skilldev_1			.849
skilldev_2			.781
behavmgt_3	.730		
behavmgt_4	.789		
behavmgt_5	.719		
mgtcontrol_1	.831		
mgtcontrol_2	.826		
mgtcontrol_3	.826		

**Cross loadings <0.4 were suppressed*

Fit (Business-IT Strategic Alignment)

Fit is a reflective construct measured using the four item business – IT strategic alignment scale operationalized by Kearns and Sabherwal (2007). All scale items loaded strongly on one factor.

Table 12. Fit Component Matrix

	Component
	1
fit_1	.893
fit_2	.894
fit_3	.894
fit_4	.826

Implementation Success (IS-Impact)

Implementation success (IS-Impact) is a formative-formative, higher order construct, as operationalized by Gable et al. (2008) containing four latent constructs with 27 total items. These factors are individual impact, organizational impact, information quality and system quality. The initial PCA indicated a three factor solution. Highly cross loaded items were then removed, one at a time, for subsequent iterations of the analysis. In the final analysis, a total of four factors containing 19 items were retained.

Table 13. Implementation Success Rotated Component Matrix

	Component			
	1	2	3	4
indimp_1			.859	
indimp_2			.831	
indimp_3			.684	
orgimp_1		.749		
orgimp_2		.633		
orgimp_3		.694		
orgimp_4		.762		
orgimp_5		.794		
infoqual_2				.578
infoqual_3				.702
infoqual_4				.702
infoqual_5				.682
sysqual_1	.713			
sysqual_2	.662			
sysqual_5	.799			
sysqual_6	.750			
sysqual_7	.797			
sysqual_8	.757			
sysqual_9	.741			

**Cross loadings <0.4 were suppressed*

Technological Readiness

The reflective measure of technological readiness, as operationalized by Richey et al. (2007), contained four latent constructs with 17 total manifest variables. These factors are optimism, innovativeness, discomfort, and insecurity. PCA initially revealed a five factor solution. Cross loaded items were removed, one at a time with subsequent iterations of the analysis. A total of four factors containing 13 items were retained.

Table 14. Technological Readiness Rotated Component Matrix

	Component			
	1	2	3	4
opti_1		.843		
opti_2		.876		
opti_5		.729		
inno_1			.685	
inno_2			.890	
inno_3			.870	
disc_1				.813
disc_2				.746
insc_2	.867			
insc_3	.849			
insc_4	.595			
insc_5	.845			
insc_6	.728			

**Cross loadings <0.4 were suppressed*

Firm Performance

Firm performance as operationalized by Rai et al. (2006) is a formative-formative construct consisting of three latent constructs with 7 manifest variables. These factors are operations excellence, revenue growth, and customer relationship. The scale was adapted to include a fourth, single item factor called supplier relationship. The initial PCA revealed all items loading to a single factor. Further consideration of the sample suggested the items for revenue growth may not be appropriate. Analysis of the demographic data indicated a combined 51% of the survey respondents noted their industry as government/military or other. As government organizations are not-for-profit (NFP) entities, revenue growth would not likely be considered an appropriate measure of firm performance. PCA was again conducted with the scale items for revenue growth removed. Subsequent analysis did not improve the results.

In their initial development of a scale to measure the aggregate performance of the firm, Rai et al. (2006) established the operations excellence construct to measure the responsiveness and productivity of the focal firm. The three-item construct included items designed to measure delivery time, the timeliness of after sales service along with improvements in firm productivity, such as decreased labor costs, decreased operating costs, and improvements in the assets of the firm. Given the nature of the measure of operational performance as operationalized by Rai et al. (2006), and the inconsistent factor loadings from the original measure, the single factor of operations excellence was used to measure the performance of the firm.

Table 15. Firm Performance Component Matrix

	Component
	1
oe_1	.880
oe_2	.800
oe_3	.785

Partial Least Squares-Structural Equation Modeling (PLS-SEM)

As noted Chapter 3, PLS-SEM has been used frequently in survey research and is closely associated with the analysis of latent constructs (Lee et al. 2011) gaining acceptance as an analytical technique in a number of business domains including information systems, marketing, accounting, and operations management (Hair et al., 2014; Lee et al., 2011; Peng & Lai, 2012; Ringle et al., 2012). PLS-SEM is a second-generation technique that focuses on maximizing the variance of the dependent variables explained by the independent variables. PLS-SEM enables the researcher to combine and concurrently assess both the measurement, typically accomplished through factor analysis, and structural models, traditionally accomplished through path analysis (Lee et al., 2011). The measurement model examines how well the latent constructs are depicted by the mapped set of indicator variables. The structural model estimates the strengths of hypothesized relationships among the latent constructs detailed. PLS-SEM was conducted to determine the measurement model and examine the structural model, and to explore the moderating effect of technological readiness on the associations of both fit and change management on the successful implementation of SCMT based on the comparison of path coefficients between subgroups through subgroup analysis.

Minimum sample size requirements for using PLS-SEM are guided by the often cited 10 times rule of thumb (Barclay, Higgins & Thompson, 1995; Hair et al., 2014). It states the minimum sample size required to for PLS-SEM must be 10 times the largest number of formative indicators used to measure a single construct. The largest number of formative indicators for any factor was 9. Using the rule of thumb cited, the sample size of 94 is adequate.

A systematic, two-stage evaluation of PLS-SEM results is recommended by Hair et al. (2014) and was conducted in this research. The stages are as follows:

1. Evaluation of measurement model

Reflective Measurement Models	Formative Measurement Models
a. Internal consistency (composite reliability) b. Indicator reliability c. Convergent validity (average variance extracted) d. Discriminant validity	a. Convergent validity b. Collinearity among indicators c. Significance and relevance of out weights

2. Evaluation of structural model

    a. Coefficients of determination (R^2)

    b. Predictive relevance (Q^2)

c. Size and significant path coefficients

d. f^2 effect sizes

e. q^2 effect sizes

Evaluation of the Measurement Model

Initial evaluation of the measurement model for this research included the assessment of reliability and validity for both reflective and formative constructs. For the reflective constructs of change management, fit, and technological readiness, internal consistency is evaluated based on Cronbach's α. A Cronbach's α of 0.70 is considered acceptable for established measures (Nunnally, 1978). Based on the accepted criteria set forth by Fornell and Larcker (1981), reliability is established based on factor loadings of the latent construct indicators must be greater than 0.70.

Table 16. Reliability and Validity Analysis – Reflective Measures (n=94)

	Cronbach's a, Min >=0.70	**Composite Reliability Min >=0.70**	**Average Variance Extracted (AVE) min >=0.50**
Change Management	0.929	0.939	0.564
Unfreezing (Problem Analysis /Action Plan.)	0.878	0.916	0.733
Movement (Skill Development)	0.770	0.897	0.813
Re-freezing (Behavior Mgmt./ Mgmt. Control)	0.926	0.942	0.730
Fit	0.900	0.930	0.769
Business-IT Alignment	0.900	0.930	0.769
Technological Readiness			
Optimism	0.782	0.872	0.695
Innovativeness	0.787	0.869	0.689

Discomfort	0.496	0.760	0.628
Insecurity	0.853	0.892	0.625

Convergent validity was assessed based on the average variance extracted (AVE). AVE conveys the proportion of the average variance between latent constructs and the indicator variables. Table 16 details the average variance extracted (AVE) for each of the reflective constructs in the model. A recommended minimum AVE of 0.50 is necessary to indicate appropriate convergent validity (Hair et al., 2014). As noted by Chin (1998), a minimum AVE of 0.50 indicates that 50% or more of the variance is explained by the indicators of the latent constructs. Using the recommended baseline, the model results indicate the manifest variables of the measurement model meet the minimum acceptable values for the latent constructs on each of the reflective measures. Composite reliability measures vary between 0 and 1 with higher values indicating a greater reliability. Reliability values below 0.60 indicate inadequate internal consistency (Hair et al., 2014). It is noted that reliabilities greater than 0.95 may not be desirable as they may indicate redundancy regarding the manifest variables (Hair et al., 2014). While it is observed that Cronbach's α and composite reliability were somewhat high (> 0.90), prior research indicate both satisfactory reliability and validity for the constructs of change management and fit, thus each will be retained in the model. As such, initial analysis of all reflective constructs in the study demonstrated acceptable internal consistency reliability.

The degree to which a construct measures what it intends to measure is construct validity. Methods for establishing construct validity include content validity, convergent validity, and discriminant validity. There is no formal statistical analysis for the determination of content validity. Content validity is verified through a detailed review of literature, establishing a linkage to the theory, and through pilot testing of the survey instrument. Convergent validity details the how well manifest scale items load onto a single latent construct by evaluating factor loadings (Hair et al., 2014). Standard loadings greater than 0.70 indicate each manifest variable has more shared variance with the latent construct than with standard error. Table 17 provides details of the outer loadings for each reflective latent constructs within the model.

Table 17. Convergent Validity – Reflective Outer Loadings

Change Management		**Outer Loadings**
	Unfreezing	0.782 – 0.907
	analysis_2	0.856
	analysis_3	0.834
	plan_1	0.878
	plan_2	0.857
	Movement	
	skilldev_1	0.896
	skilldev_2	0.907
	Refreezing	
	mgtcontrol_1	0.895
	mgtcontrol_2	0.847
	mgtcontrol_3	0.846
	behavmgt_3	0.874
	behavmgt_4	0.879
	behavmgt_5	0.782
Fit		
	Business-IT Alignment	0.832 – 0.899
	fit_1	0.884
	fit_2	0.892
	fit_3	0.899
	fit_4	0.832
Technological Readiness		
	Innovativeness	0.816 – 0.854
	inno_1	0.854
	inno_2	0.816
	inno_3	0.820

	Optimism	0.800 – 0.868
	opti_1	0.831
	opti_2	0.868
	opti_5	0.800
	Discomfort	0.574 – 0.962
	disc_1	0.574
	disc_2	0.962
	Insecurity	0.709 – 0.831
	inno_2	0.831
	inno_3	0.831
	inno_4	0.756
	inno_5	0.819
	inno_6	0.709

Discriminant validity details the degree to which each construct is distinct from other constructs. According to Fornell and Larker (1981), discriminant validity can be assessed by examining the square root of the AVE for each construct in comparison to the highest correlations of each variable. The value of each AVE square root should be greater than the cross correlations on each variable. Table 18 details the criteria specified. The square root of the AVE for each construct is greater than the cross correlations on each variable.

Further evidence of discriminant validity is provided by examining the cross loadings of the indicators for each construct within the measurements model. Construct indicators with cross-loaded values greater than the outer loadings of the construct suggest it may not be distinct from other constructs, thus failing to exhibit discriminant validity (Chin, 1998). Appendix D provides detail on the loadings and cross-loadings within the measure model.

Table 18. Fornell –Larcker Discriminant Criterion – Reflective Measures

	Discomfort	Fit	Individual Impact	Information Quality	Innovativeness	Insecurity	Movement	Optimism	Organizational Impact	Refreezing	System Quality	Unfreezing
Discomfort	**0.792**											
Fit	-0.221	**0.877**										
Individual Impact	-0.150	0.655	**0.901**									
Information Quality	-0.202	0.691	0.659	**0.864**								
Innovativeness	0.018	0.308	0.313	0.297	**0.830**							
Insecurity	0.343	-0.093	-0.205	-0.089	0.134	**0.791**						
Movement	-0.071	0.641	0.463	0.615	0.268	0.003	**0.902**					
Optimism	-0.155	0.341	0.415	0.463	0.244	-0.149	0.395	**0.834**				
Organizational Impact	-0.113	0.554	0.657	0.655	0.251	-0.112	0.430	0.533	**0.856**			
Refreezing	-0.166	0.632	0.544	0.641	0.371	-0.155	0.573	0.341	0.622	**0.854**		
Systems Quality	-0.170	0.547	0.487	0.688	0.475	-0.020	0.526	0.511	0.652	0.522	**0.831**	
Unfreezing	-0.071	0.632	0.475	0.527	0.423	-0.078	0.582	0.369	0.471	0.623	0.405	**0.856**

The statistical assessment for reflective measurement scales cannot be transferred precisely to formative measurement models (Hair et al., 2014). The formative constructs of implementation success and firm performance were also evaluated as a part of the measurement model. Gable et al. (2008) developed the measure for implementation success (IS-Impact) as a formative-formative, second order construct. Four first order constructs were specified. Those were individual impact, organizational impact, information quality, and system quality.

As detailed by Hair et al. (2014), initial assessment of the formative constructs in the measurement model includes the assessment of the outer weights of their respective construct. The outer weights of a formative measure can be used to ascertain the indicator's relative contribution to the construct. In assessing the relative contribution, the outer weights are tested to establish if they are significantly different from zero by means of bootstrapping. Using the bootstrapping technique in PLS-SEM, subsamples are randomly drawn, with replacement, from the original data set. Each subsample is then used to estimate the model. This is an iterative process, typically repeated until approximately 5000 subsamples are created. The parameter estimates (outer weights) estimated from the subsamples are then used to derive the standard errors for the estimates. Using these estimates, t values assessing the indicator weight's significance are calculated. Outer model weights resulting in a t value greater than 1.96 indicate a path coefficient is significantly different from zero at the 5% ($\alpha = 0.05$; two-tailed test) level of significance. The results of the initial analysis are detailed in Table 19. Unfortunately, the initial analysis of the formative measurement model for this research using the IS-

Impact construct did not hold up well using the current data set. The initial results indicate less than half (9 of 19) of the indicators in the measurement model for IS-Impact were significant at the minimum level of significance.

Table 19. Reliability and Validity Analysis – Formative Measures (n=94)

Implementation Success (IS-Impact)		**Outer Weights**	**t Value min >=1.96**
	Individual Impact		
	indimp_1	0.200	1.524
	indimp_2	0.178	1.333
	indimp_3	0.707	**5.068**
	Organizational Impact		
	orgimp_1	0.172	1.575
	orgimp_2	0.186	1.405
	orgimp_3	0.252	**2.493**
	orgimp_4	0.588	**3.255**
	orgimp_5	0.027	0.170
	Information Quality		
	infoqual_2	0.235	**3.128**
	infoqual_3	0.239	**2.255**
	infoqual_4	0.362	**2.864**
	infoqual_5	0.316	**2.671**
	System Quality		
	sysqual_1	0.265	**2.212**
	sysqual_2	0.198	1.717
	sysqual_5	0.149	1.925
	sysqual_6	0.144	1.472
	sysqual_7	0.057	0.605
	sysqual_8	0.256	**2.686**
	sysqual_9	0.121	1.010
Firm Performance			
	Organizational Excellence		
	oe_1	-0.046	0.165
	oe_2	0.654	**3.173**
	oe_3	0.579	**2.694**

Although developed and validated as a formative-formative second order construct by Gable et al. (2008), and intended for use as such in this research, use of the IS-Impact scale has been inconsistent within the literature. In their study investigating the relationship between knowledge management and Enterprise System success, Sedera et al. (2010) use the IS-Impact scale as originally developed as a measure for Enterprise Systems success. The authors reported the psychometrics from the original work of Gable et al. (2008). Elias (2011) used the IS-Impact scale as developed by Gable et al. (2008) to investigate the impact of information systems within a different context from the original study. Although four (4) scale items were removed from the measurement model as not significant, the authors validated the scale as initially developed within the context of Malaysian financial systems. Finally, Sedera and Day (2013) employ the IS-Impact scale as a measure for information systems success, demonstrating that systems users of different expertise levels evaluate systems differently. The authors did not report the psychometrics or details regarding the formative measurement model. In contrast, some researchers have used the IS-Impact construct as a reflective measure. For example, in their study regarding the relationships among ERP post-implementation success constructs, Infinedo et al. (2010) used each of four (4) IS-Impact scales as first order reflective measures. Infinedo (2011) uses a subset of the IS-Impact scales as first order reflective measures to asses both ERP quality and ERP impact in his study of internal IT knowledge and expertise as antecedents of ERP system effectiveness. Finally, Infinedo and Olsen (2015) uses a subset of the IS-Impact scales as first order reflective measures to asses ERP success in their study of the impact of organizational decisions' locus, task structure, rules, knowledge, and IT function's value on ERP system success.

The literature regarding the specification and value of formative constructs is somewhat conflicting. Scholars have debated extensively the specification, use, and value of formative measures (MacKenzie, Podsakoff & Jarvis, 2005; Howell, Breivik & Wilcox, 2007; Petter et al., 2007; Kim, Shin & Grover, 2010; Edwards, 2011). Latent constructs with reflective measures are the most common type of measure found in behavioral and organizational research (MacKenzie et al., 2005). Reflective constructs are thought to be underlying the phenomena that are reflected in the scores of the measurement items used to capture them (Edwards and Bagozzi, 2000). Thus the casual direction flows from the underlying latent variable to the manifest variables. In contrast, the formative constructs are thought to represent composites of their indicators or measurement items with the casual flow going from the manifest items to the construct (Edwards and Bagozzi, 2000). In determining whether a construct is formative or reflective, researchers should consider the nature of the relationships between constructs and their measures. First, is to determine whether the indicators are defining characteristics of the construct or are manifestations of it (MacKenzie et al., 2005). Second they should consider whether the construct's indicators are conceptually interchangeable. Reflective measures should necessarily share a common theme. Formative measures should capture a unique concept. Third, is to consider correlation among indicators. Reflective measures would be expected to covary given that indicators share a common cause. In contrast, formative measures may or may not be highly correlated, but the expectation of high correlation is not anticipated. According to MacKenzie et al. (2005), if indicators are expected to be highly correlated, either model may be appropriate. Researchers would need to rely on other criteria to make the determination. Petter et al. (2007) note that although constructs can be specified as either formative or reflective, many constructs are actually mixed in that they have some items and properties consistent with formative constructs while some are consistent with reflective constructs.

In an effort to address the difficulties with the initial measurement model using the IS-Impact construct as initially developed and data set collected for this research, and based on examples within the relevant literature, the IS-Impact measure was decomposed into four, first order reflective constructs. Decomposed models eliminate the formative structure and permit reflective sub-constructs to be directly related to other constructs within the research model (Petter et al., 2007). A post-hoc analysis using four reflective first order measures was then conducted. The results of post-hoc analysis for IS-Impact are detailed in Table 20.

Table 20. Reliability and Validity Analysis – IS-Impact Post Hoc Analysis (n=94)

	Cronbach's a, Min >=0.70	**Composite Reliability Min >=0.70**	**Average Variance Extracted (AVE) min >=0.50**
Implementation Success			
Individual Impact	0.883	0.928	0.811
Organizational Impact	0.906	0.931	0.732
Information Quality	0.887	0.922	0.746
System Quality	0.925	0.940	0.690

Table 21 provides detail of the outer loadings for IS-Impact the post hoc analysis. As previously noted, standard loadings greater than 0.70 indicate each manifest variable has more shared variance with the latent construct than with standard error. All items met the accepted criteria.

Table 21. Convergent Validity – IS-Impact Reflective Post Hoc Analysis

Implementation Success		**Outer Loadings**
	Individual Impact	0.886 – 0.924
	indimp_1	0.886
	indimp_2	0.924
	indimp_3	0.891
	Organizational Impact	0.721 - 0.931
	orgimp_1	0.841
	orgimp_2	0.721
	orgimp_3	0.860
	orgimp_4	0.931
	orgimp_5	0.908
	Information Quality	0.826 - 0.901
	infoqual_2	0.842
	infoqual_3	0.901
	infoqual_4	0.885
	infoqual_5	0.826
	System Quality	0.806 – 0.888
	sysqual_1	0.888
	sysqual_2	0.834
	sysqual_5	0.810
	sysqual_6	0.809
	sysqual_7	0.818
	sysqual_8	0.847
	sysqual_9	0.806

In summary, the assessment of the measurement model detailing indicator reliability, composite reliability, convergent validity and discriminant validity establishes the reliability and validity of the constructs and offers sufficient support for their inclusion in the path model. Based upon successful evaluation of the measurement model the structural model will be assessed. This includes the examination of the predictive capabilities and the relationships between the constructs by assessing the structural model for collinearity issues, significance and relevance of path coefficients, level of R^2 values, effect sizes f^2 and predictive relevance Q^2 and the q squared effect sizes (Hair et al., 2014).

Evaluation of the Structural Model

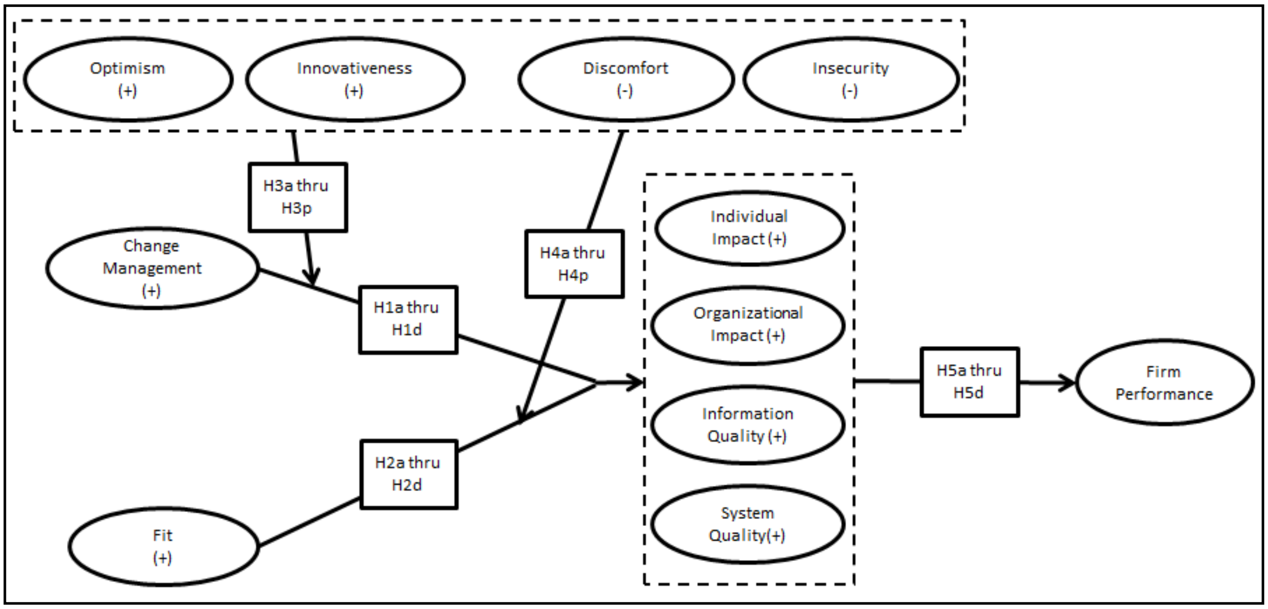
Following examination and confirmation of the reliability and validity of the measures within the model, the next step in the analysis requires examination of the relationships between the constructs by evaluating the structural model. This is accomplished by assessing collinearity, the significance and relevance of the path coefficients, the R^2 values, f^2 effect sizes, the Q^2 values, and the q^2 effect sizes (Hair et al., 2014). Collinearity was to be examined according to Hair et al. (2014). This is necessary for formative measurement models. Reflective indicators can be expected to be correlated. As the formative construct of SCMT implementation success (IS-Impact) was decomposed into four, reflective constructs for model testing, evaluation of collinearity was not required.

PLS-SEM provides estimates that represent the hypothesized relationships among the constructs within the research model. The structural model is evaluated based on the structural model path coefficients calculated by the PLS algorithm. Path coefficients are calculated and assigned standardized values between -1 and +1. Values closer to 0 indicate a weaker relationship. Calculation of the standard error is then completed in order to obtain the t value. Critical values correspond to significance levels. These include 1.65 for a significance level of 10%, 1.96 for a significance level of 5%, and 2.57 for a significance level of 1%.

Test of Hypotheses

As previously noted, in an effort to address the difficulties with the initial measurement model using the IS-Impact construct as originally developed and data set collected for this research, the IS-Impact measure was decomposed into four, first order reflective constructs. Decomposed models eliminate the formative structure and permit reflective sub-constructs to be directly related to other constructs within the research model (Petter et al., 2007). As a result of the decomposition of the IS-Impact construct into four, first-order reflective constructs, the hypotheses tested differ slightly from those originally proposed. The revised research model is detailed in Figure 14.

Figure 14. Revised Research Model



Hypotheses 1a through 1d

The first proposed hypothesis for this research stated that *change management will have a positive impact on SCMT implementation success.* As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, four independent direct relationships were tested. The hypothesis and results are reported as follows:

Hypothesis 1a – Change management will have a positive impact on SCMT individual impact. This hypothesis tested the direct relationship between change management and individual impact; that is the extent to which SCMT has influenced the capabilities and effectiveness, on behalf of the organization, of key users (Gabel et al., 2008). The PLS path coefficient was 0.117 with a t-score of 1.451. Therefore, the realized relationship was not statistically significant.

Hypothesis 1b – Change management will have a positive impact on SCMT organizational impact. This hypothesis looked at the relationship between change management and organizational impact: that is the extent to which the SCMT has promoted improvement in organizational results and capabilities (Gabel et al., 2008). The path coefficient of 0.427 and a t-score of 5.269 indicate a statistically significant, positive relationship.

Hypothesis 1c – Change management will have a positive impact on SCMT information quality. This hypothesis examined the relationship between change management and information quality; that is the quality of the SCMT outputs: namely, the quality of the information the system produces. The path coefficient of 0.335 and a t-score of 4.047 indicate a statistically significant, positive relationship.

Hypothesis 1d – Change management will have a positive impact on SCMT system quality. This hypothesis looked at the relationship between change management and system quality: the performance of SCMT from a technical and design perspective (Gabel et al., 2008). The path coefficient of 0.155 and a t-score of 2.071 indicate a statistically significant, positive relationship.

The findings of this research lead to the acceptance of three of the four revised hypotheses related to the direct effect of change management on SCMT implementation outcomes. Only the relationship between change management and individual impact was not significant.

Hypotheses 2a through 2d

The second proposed hypothesis for this research stated that *fit will have a positive impact on SCMT implementation success.* As with the initial first hypothesis, the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs required that four, independent hypotheses were tested. The results are reported as follows:

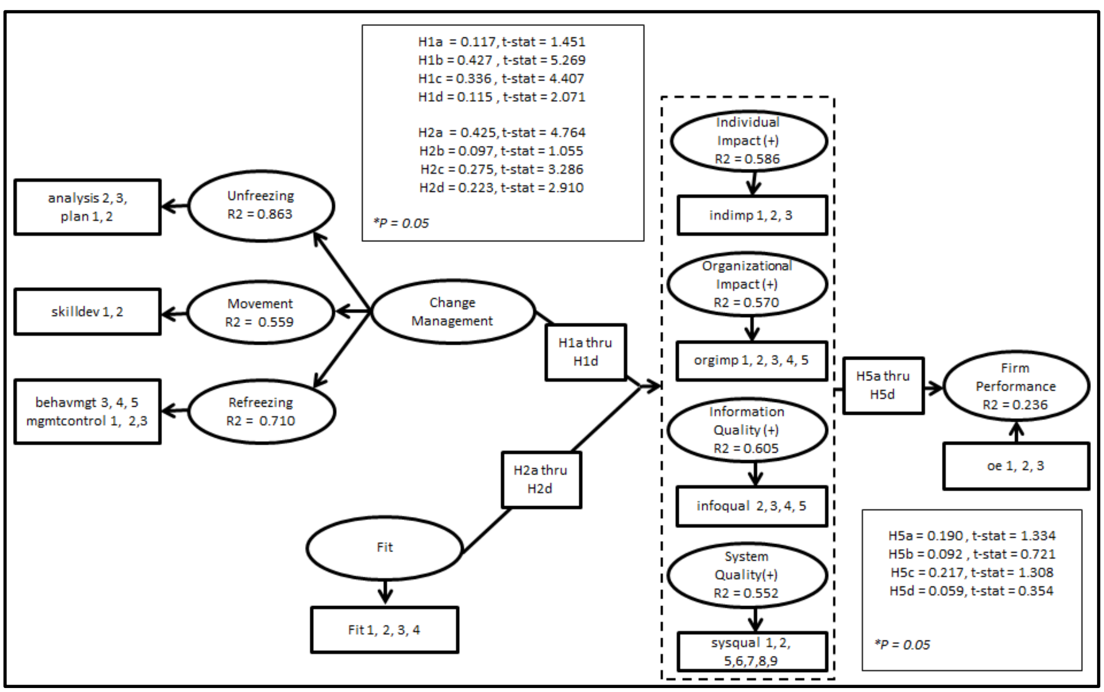
Hypothesis 2a – Fit will have a positive impact on SCMT individual impact. This hypothesis tested the direct relationship between fit and individual impact. The PLS path coefficient was 0.425 with a t-score of 4.764 indicating a statistically significant, positive relationship.

Hypothesis 2b – Fit will have a positive impact on SCMT organizational impact. Hypothesis 2b examined the direct relationship between fit and organizational impact. The PLS path coefficient was 0.097 and the t-score was 1.055. Thus, the relationship was not statistically significant.

Hypothesis 2c – Fit will have a positive impact on SCMT information quality. Hypothesis 2c assessed the direct relationship between fit and information quality. The path coefficient of 0.275 and a t-score of 3.286 indicate a statistically significant, positive relationship.

Hypothesis 2d – Fit will have a positive impact on SCMT system quality. Hypothesis 2d looked at the direct relationship between fit and system quality. The path coefficient of 0.223 and a t-score of 2.910 indicate a statistically significant, positive relationship. As with change management, the findings of this research lead to the acceptance of three of the four revised hypotheses related to the direct effect of fit on SCMT implementation outcomes. However in this instance, the relationship between fit and organizational impact was not significant.

Figure 15. Structural Model Results – Direct Effects



Evaluation of the structural model requires the assessment of the models' predictive accuracy. The most commonly used measure for assessment of predictive accuracy is the coefficient of determination (R^2 value). Calculated as the squared correlation between specific endogenous constructs' actual and predictive values, the R^2 value represents the exogenous latent variables combined effect on the endogenous latent variable (Hair et al., 2014). Higher R^2 values indicate higher predictive accuracy of the model. The R^2 values for individual impact, organizational impact, information quality and system quality were 0.586, 0.570, 0.605, and 0.552 respectively.

Another method of assessing predictive accuracy is to measure the impact of a specific predictor construct on an endogenous construct. This is called the f^2 effect size. The f^2 effect size measures the change in R^2 when a specific exogenous construct is removed from the model. The measure is used to evaluate whether the omitted predictor construct has a substantive impact on the R^2 values of the endogenous constructs. Guidelines for assessing f^2 values are: small is 0.02, medium is 0.15, and large is 0.35 (Hair et al., 2014). For this research, each of the exogenous constructs of change management and fit were removed from the model, one at a time, and the model re-estimated. The R^2 values for each of the endogenous constructs of individual impact, organizational impact, information quality, and system quality was recorded. The change in R^2 values was recorded and the f^2 effect size measures obtained. With the construct of change management removed, the f^2 values were 0.203, 0.581, 0.091, and 0.071 respectively. With the construct of fit removed, the f^2 values were 0.138, 0.207, 0.141 and 0.031.

In assessing the predictive accuracy and predictive relevance of the model, researchers should also consider Stone-Geisser's Q^2 (Geisser, 1974; Stone, 1974). Q^2 values larger than zero for a specific reflective endogenous latent variable indicate the path model's predictive relevance for a particular construct (Hair et al., 2014). This procedure does not apply to formative endogenous constructs. Q^2 values for the endogenous variables of individual impact, organizational impact, information quality, and system quality are provided. The model's indicated Q^2 values of 0.461, 0.424, 0.376, and 0.376 respectively. These values suggest the model has predictive relevance.

Finally, evaluation of the structural model includes assessment of the relative predictive relevance; effect size q^2. Similar to effect size f^2 for assessing the R^2 values, the relative impact of predictive relevance can be compared by means of the measure to the q2 effect size. With the construct of change management removed, the q^2 values were 0.050, -0.090, -0.277, and -0.260 respectively. With the construct of fit removed, the q^2 values were 0.106, 0.127, -0.010 and 0.042. As with f^2 values, guidelines for assessing q^2 effect size values are: small is 0.02, medium is 0.15, and large is 0.35 (Hair et al., 2014).

The Moderating Effect of Technological Readiness

"Moderating effects are evoked by variables whose variation influences the strength or the direction of a relationship between an exogenous and an endogenous variable." (Baron & Kenny, 1986, p. 1174) A moderating effect occurs when a third

variable or construct changes the relationship between two related constructs (Baron & Kenny, 1986; Hair et al., 2014). In fact, moderation occurs when predictor and moderator have a joint effect in accounting for incremental variance in criterion variable beyond that explained by main effects (Cohen & Cohen, 1983). Technological readiness could link technological adoption to the potential benefits that may ensue as a result of successful implementation and may provide greater explanatory power to predict the potential for the successful implementation of SCMT (Richey et al., 2007; 2009). This research investigated the moderating effect of technological readiness as a part of the SCMT implementation model.

Moderation for this research was assessed through interaction. The interaction effect for each moderating variable was tested using the product indicator approach. This approach involves multiplying each indicator of the exogenous latent variable with each indicator of the moderator variable (Hair et al., 2014). The bootstrapping process is then competed to determine the significance of the interaction path linking the interaction term and the endogenous latent construct. As with the evaluation of the structural model, a value of 1.96 correlates to a significance level of 5%. As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, additional hypotheses were tested. The revised hypotheses for technological optimism and innovativeness are as follows:

Hypotheses 3a through 3h

Hypothesis 3a – Technological optimism will positively moderate the relationship between change management and individual impact.

Hypothesis 3b – Technological innovativeness will positively moderate the relationship between change management and individual impact.

Hypothesis 3c – Technological optimism will positively moderate the relationship between change management and organizational impact.

Hypothesis 3d – Technological innovativeness will positively moderate the relationship between change management and organizational impact.

Hypothesis 3e – Technological optimism will positively moderate the relationship between change management and information quality.

Hypothesis 3f – Technological innovativeness will positively moderate the relationship between change management and information quality.

Hypothesis 3g – Technological optimism will positively moderate the relationship between change management and system quality.

Hypothesis 3h – Technological innovativeness will positively moderate the relationship between change management and system quality.

Hypotheses 4a through 4h

Hypothesis 4a – Technological optimism will positively moderate the relationship between fit and individual impact.

Hypothesis 4b – Technological innovativeness will positively moderate the relationship between fit and individual impact.

Hypothesis 4c – Technological optimism will positively moderate the relationship between fit and organizational impact.

Hypothesis 4d – Technological innovativeness will positively moderate the relationship between fit and organizational impact.

Hypothesis 4e – Technological optimism will positively moderate the relationship between fit and information quality.

Hypothesis 4f – Technological innovativeness will positively moderate the relationship between fit and information quality.

Hypothesis 4g – Technological optimism will positively moderate the relationship between fit and system quality.

Hypothesis 4h – technological innovativeness will positively moderate the relationship between fit and system quality.

The results of testing for moderation within the research model are provided in Table 22 and Table 23. First, Table 22 presents the result of the interaction moderation effects hypothesized as positive.

Table 22. Moderation - Interaction (Hypothesized as positive)

	Exogenous (Predictor)	Moderator (+)	Endogenous	Interaction Term	t Value
H3a	Change Management	Optimism	Individual Impact	-0.184	0.897
H3b	Change Management	Innovativeness	Individual Impact	0.190	1.670
H4a	Fit	Optimism	Individual Impact	0.070	0.759
H4b	Fit	Innovativeness	Individual Impact	-0.002	0.024
H3c	Change Management	Optimism	Organizational Impact	-0.236	1.899
H3d	Change Management	Innovativeness	Organizational Impact	0.112	0.032
H4c	Fit	Optimism	Organizational Impact	0.116	1.213
H4d	Fit	Innovativeness	Organizational Impact	0.147	1.185
H3e	Change Management	Optimism	Information Quality	-0.161	0.949
H3f	Change Management	Innovativeness	Information Quality	-0.176	1.136
H4e	Fit	Optimism	Information Quality	0.027	1.213
H4f	Fit	Innovativeness	Information Quality	0.077	1.185
H3g	Change Management	Optimism	System Quality	0.137	1.743
H3h	Change Management	Innovativeness	System Quality	-0.067	0.502
H4g	Fit	Optimism	System Quality	0.106	1.002
H4h	Fit	Innovativeness	System Quality	-0.067	0.680

The revised hypotheses for technological discomfort and insecurity are as follows:

Hypotheses 3i through 3p

Hypothesis 3i –Technological discomfort will negatively moderate the relationship between change management and individual impact.

Hypothesis 3j – Technological insecurity will negatively moderate the relationship between change management and individual impact.

Hypothesis 3k – Technological discomfort will negatively moderate the relationship between change management and organizational impact.

Hypothesis 3l – Technological insecurity will negatively moderate the relationship between change management and organizational impact.

Hypothesis 3m – Technological discomfort will negatively moderate the relationship between change management and information quality.

Hypothesis 3n – Technological insecurity will negatively moderate the relationship between change management and information quality.

Hypothesis 3o – Technological discomfort will negatively moderate the relationship between change management and system quality.

Hypothesis 3p – Technological insecurity will negatively moderate the relationship between change management and system quality.

Hypotheses 4i through 4p

Hypothesis 4i – Technological discomfort will negatively moderate the relationship between fit and individual impact.

Hypothesis 4j – Technological insecurity will negatively moderate the relationship between fit and individual impact.

Hypothesis 4k – Technological discomfort will negatively moderate the relationship between fit and organizational impact.

Hypothesis 4l – Technological insecurity will negatively moderate the relationship between fit and organizational impact.

Hypothesis 4m – Technological discomfort will negatively moderate the relationship between fit and information quality.

Hypothesis 4n – Technological insecurity will negatively moderate the relationship between fit and information quality.

Hypothesis 4o – Technological discomfort will negatively moderate the relationship between fit and system quality.

Hypothesis 4p – Technological insecurity will negatively moderate the relationship between fit and system quality.

Table 23 presents the result of the interaction moderation effects hypothesized as negative.

Table 23. Moderation - Interaction (Hypothesized as negative)

	Exogenous (Predictor)	Moderator (-)	Endogenous	Interaction Term	t Value
H3i	Change Management	Discomfort	Individual Impact	-0.142	1.585
H3j	Change Management	Insecurity	Individual Impact	-0.146	0.722
H4i	Fit	Discomfort	Individual Impact	0.021	0.242
H4j	Fit	Insecurity	Individual Impact	0.123	1.330
H3k	Change Management	Discomfort	Organizational Impact	0.282	1.296
H3l	Change Management	Insecurity	Organizational Impact	-0.055	0.416
H4k	Fit	Discomfort	Organizational Impact	0.033	0.311
H4l	Fit	Insecurity	Organizational Impact	-0.128	0.929
H3m	Change Management	Discomfort	Information Quality	0.173	0.944
H3n	Change Management	Insecurity	Information Quality	-0.036	0.291
H4m	Fit	Discomfort	Information Quality	0.039	0.349
H4n	Fit	Insecurity	Information Quality	0.146	1.075
H3o	Change Management	Discomfort	System Quality	0.221	1.505
H3p	Change Management	Insecurity	System Quality	-0.157	0.876

H4o	Fit	Discomfort	System Quality	0.072	0.617
H4p	Fit	Insecurity	System Quality	-0.051	0.391

Hypotheses 5a through 5d

Hypothesis 5a through 5d examined the direct relationship between implementation success and firm performance. Initially, the proposed hypothesis for this relationship stated that *SCMT implementation success will have a positive impact on firm performance.* As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, four independent direct relationships were tested. As previously noted, given the nature of the measure of operational performance as operationalized by Rai et al. (2006) and the inconsistent factor loadings from the original measure, the single factor of operations excellence was used to measure the performance of the firm. The hypothesis and results are reported as follows:

Hypothesis 5a – SCMT individual impact will have a positive impact on firm performance. This hypothesis tested the direct relationship between SCMT individual impact and firm performance. The PLS path coefficient was 0.190 with a t-score of 1.334. Thus, the relationship was not statistically significant.

Hypothesis 5b – SCMT organizational impact will have a positive impact on firm performance. This hypothesis looked at the relationship between SCMT organizational impact and firm performance. The PLS path coefficient was 0.092 with a t-score of 0.721. No statistically significant relationship was indicated.

Hypothesis 5c – SCMT information quality will have a positive impact on firm performance. This hypothesis assessed the relationship between SCMT information quality and firm performance. The PLS path coefficient was 0.217 with a t-score of 1.308. No statistically significant relationship was indicated.

Hypothesis 5d – SCMT system quality will have a positive impact on firm performance. This hypothesis examined the direct effect between SCMT system quality and firm performance. The PLS path coefficient was 0.059 with a t-score of 0.354. As with we each of the previous hypotheses related to firm performance, no statistically significant relationship was indicated.

In summary, this chapter detailed the respondent characteristics of the sample population used in this research and presented the analysis from the survey data collected.

Table 24. Summary of Hypothesis Results – Direct Effects

Hypothesis		**Results of Testing**
H1a	Change management will have a positive impact on SCMT individual impact.	Not supported
H1b	Change management will have a positive impact on SCMT organizational impact.	Supported
H1c	Change management will have a positive impact on SCMT information quality.	Supported
H1d	Change management will have a positive impact on SCMT system quality.	Supported
H2a	Fit will have a positive impact on SCMT individual impact.	Supported

H2b	Fit will have a positive impact on SCMT organizational impact.	Not supported
H2c	Fit will have a positive impact on SCMT information quality.	Supported
H2d	Fit will have a positive impact on SCMT system quality.	Supported
H5a	SCMT individual impact will have a positive impact on firm performance.	Not supported
H5b	SCMT organizational impact will have a positive impact on firm performance.	Not supported
H5c	SCMT information quality will have a positive impact on firm performance.	Not supported
H5d	SCMT system quality will have a positive impact on firm performance.	Not supported

Table 25. Summary of Hypothesis Results Moderation (Hypothesized as positive)

Hypothesis		**Results of Testing**
H3a	Technological optimism will positively moderate the relationship between change management and individual impact.	Not supported
H3b	Technological innovativeness will positively moderate the relationship between change management and individual impact.	Not supported
H4a	Technological optimism will positively moderate the relationship between fit and individual impact.	Not supported
H4b	Technological innovativeness will positively moderate the relationship between fit and individual impact.	Not supported
H3c	Technological optimism will positively moderate the relationship between change management and organizational impact.	Not supported
H3d	Technological innovativeness will positively moderate the relationship between change management and organizational impact.	Not supported
H4c	Technological optimism will positively moderate the relationship between fit and organizational impact.	Not supported
H4d	Technological innovativeness will positively moderate the relationship between fit and organizational impact.	Not supported
H3e	Technological optimism will positively moderate the relationship between change management and information quality.	Not supported
H3f	Technological innovativeness will positively moderate the relationship between change management and information quality.	Not supported
H4e	Technological optimism will positively moderate the relationship between fit and information quality.	Not supported
H4f	Technological innovativeness will positively moderate the relationship between fit and information quality.	Not supported
H3g	Technological optimism will positively moderate the relationship between change management and system quality.	Not supported
H3h	Technological innovativeness will positively moderate the relationship between change management and system quality.	Not supported
H4g	Technological optimism will positively moderate the relationship between fit and system quality.	Not supported
H4h	Technological innovativeness will positively moderate the relationship between fit and system quality.	Not supported

Table 26. Summary of Hypothesis Results Moderation (Hypothesized as Negative)

Hypothesis		**Results of Testing**
H3i	Technological insecurity will negatively moderate the relationship between change management and individual impact.	Not supported
H3j	Technological discomfort will negatively moderate the relationship between change management and individual impact.	Not supported
H4i	Technological insecurity will negatively moderate the relationship between fit and individual impact.	Not supported
H4j	Technological discomfort will negatively moderate the relationship between fit and individual impact.	Not supported
H3k	Technological insecurity will negatively moderate the relationship between change management and organizational impact.	Not supported
H3l	Technological discomfort will negatively moderate the relationship between change management and organizational impact.	Not supported
H4k	Technological insecurity will negatively moderate the relationship between fit and organizational impact.	Not supported
H4l	Technological discomfort will negatively moderate the relationship between fit and organizational impact.	Not supported
H3m	Technological insecurity will negatively moderate the relationship between change management and information quality.	Not supported
H3n	Technological discomfort will negatively moderate the relationship between change management and information quality.	Not supported
H4m	Technological insecurity will negatively moderate the relationship between fit and information quality.	Not supported
H4n	Technological discomfort will negatively moderate the relationship between fit and information quality.	Not supported
H3o	Technological insecurity will negatively moderate the relationship between change management and system quality.	Not supported
H3p	Technological discomfort will negatively moderate the relationship between change management and system quality.	Not supported
H4o	Technological insecurity will negatively moderate the relationship between fit and system quality.	Not supported
H4p	Technological discomfort will negatively moderate the relationship between fit and system quality.	Not supported

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

The purpose of this chapter is to summarize the study. A review of Chapters 1 through 3 outlining the motivation for the research, the gaps addressed within, the theoretical basis for the study, and research methodology will be detailed. A discussion of the key findings presented in Chapter 4 will follow. Finally, the study limitations and potential future research opportunities are presented.

It's clear that organizations continue to use innovations in IT to share information, collaborate, integrate business processes and improve supply chain relationships (Wladawsky-Berger 2000; Klein 2007). Recognizing that effective information sharing, collaboration and integration are held as strong tenets of current logistics and supply chain thought, advances in IT continue to play an essential role in the emergence and improvement of the modern supply chain (Hult et al., 2004; Fawcett et al., 2009; Fawcett et al., 2011). Consequently, ensuring SCMT initiatives are successfully implemented can play a crucial role in firm success and should be a fundamental part of any effective supply chain strategy (Closs & Savitskie, 2003; Li et al., 2008; Stank et al., 2011).

A considerable stream of research exists that examines the many different facets of SCMT and the implications for selection and investment (Blankley, 2008), adoption

(Bienstock & Royne, 2010), supply chain strategy, operations and how each of those factors potentially impact SCM (Esper & Williams, 2003; Patterson et al., 2004) competitive advantage and firm performance (Sanders, 2005; Rai et al., 2006; Wu et al., 2006; Fawcett et al., 2008; Ranganathan et al., 2011). Certainly, research has aided in clarifying the reasons and methods by which a firm selects and adopts different technologies. However, research on the subsequent implementation of SCMT has largely been ignored (Richey & Autry, 2009). Although firms continue to make significant investments in SCMT and the implementation process, there is extensive evidence that companies continue to experience considerable complications, particularly during the adoption of a new technology (Piszczalski, 1997; Tebbe, 1997; Stocia & Brouse, 2013). A proven path to SCMT implementation has yet to be established (Fawcett et al., 2008). This research sought to investigate the factors affecting the successful implementation of SCMT. A model for SCMT implementation including the constructs of change management, fit, and technological readiness was developed and empirically tested.

Two theoretical paradigms provided the basis for the development of the SCMT implementation model. The first is Socio-Technical Systems Theory (STS). An influential theory from organizational behavior, STS has been widely used to study the implementation of information technology and technology related change in organizations. The second is the Task - Technology - Fit Theory (TTF) (Goodhue, 1995). Having its roots organization contingency theory, TTF explicates that outcomes depend upon the degree of fit or alignment between the information systems and the tasks that must be performed. Both STS and TTF offer insight into the understanding of how the factors of change management, fit, and technological readiness impact SCMT implementation success.

This research was conducted through the use of a mixed mode survey in an attempt to increase response rate and provide for the generalizability of results. A diverse group of logistics professionals from a variety of industries was asked to participate. Key informants from professional organizations including The Association for Operations Management (APICS), along with private firms, government organizations and logistics service providers identified by the researcher were surveyed. Many of the survey contacts were acquired from the attendees list of the 3rd Annual Global Supply Chain and Logistics Summit in Birmingham, AL hosted by the Birmingham Business Alliance (BBA) and held on August 19, 2014. Respondents were asked about the implementation of SCMT within their organization and to consider the most recent technology project implemented within the firm. The survey was developed using previously validated scales from published literature. Data was collected over a two-month period beginning in March 2015. A total of 94 useable responses were received. A two-sample mean difference test between early and late respondents established by Armstrong and Overton (1977) indicated no evidence of non-response bias. Principal components analysis was used to evaluate unidimensionality. PLS-SEM was applied to evaluate the hypothesized relationships. The systematic evaluation of the PLS-SEM results according to Hair et al. (2014) indicated appropriate reliability and validity of the measures. The key findings are discussed.

5.1 Discussion of Findings

Following the evaluation of the measurement model to verify the reliability and the validity of the construct measures, the relationships and predictive capabilities between the constructs was examined. The objective was to develop and empirically test a model for successful SCMT implementation. Three research questions guided this research:

***Research Question 1*:** What factors influence the successful implementation of supply chain management technology initiatives?

***Research Question 2*:** How can managers improve decision making concerning supply chain management technology initiatives?

***Research Question 3*:** What dimensions of performance are related to the successful implementation of logistics and supply chain management technology?

The research questions initially led to development of the research model and eleven proposed hypotheses. Subsequent analysis required the decomposition of the implementation success (IS-Impact) construct from 2nd order, formative-formative higher order construct into four, first-order reflective constructs leading to a revised research model and the revised hypotheses discussed below.

Hypothesis 1a through 1d

It has been noted in the literature that supply chain professionals frequently find they are ill-equipped to manage change. Consequently, they spend valuable time fixing change related items as a result of not doing things right the first time (Stank et al., 2011). Defined for this research as the process, tools, and structures intended to keep a change or transition effort under control, taking individuals, teams, and organizations from a current state to a future one (Filicetti, 2007; Kotter, 2011), change management is considered central to the reengineering of business processes and the successful implementation of information technology (Grover et al., 1995). Effective organizational design, including the SCMT implementation, must couple the design of business processes and work systems. This concept is a foundation of STS theory. An effective change management philosophy is critical when changes to one or the other sub-systems occur.

Initially included using the five factors operationalized by Greer and Ford (2009), PCA revealed a three factor change management solution for this research. The factors used were consistent with the three-phase change model developed by Lewin (1947), upon which the work of Greer and Ford (2009) was based. These factors were: unfreezing, movement, and refreezing. The first four hypotheses examined the direct relationship between the three factors of change management and four factors of implementation success. The factors of implementation success were individual impact, organizational impact, information quality and system quality. The results of this research supported hypotheses three of the four revised hypotheses. The hypothesis of change management being positively related to individual impact was not supported. This research provides overall support that the process of change management can improve implementation success. As empirical evidence in the literature regarding the antecedent of change management leading to positive SCMT implementation outcomes is limited, the results contribute to both the change management and SCM literature.

Hypothesis 2a through 2d

The importance of strategic fit in both IS and SCM has been explored in prior research (Reich & Benbaset, 1996; 2000; Fisher, 1997; Lee, 2002). Defined as the degree to which the needs, demands, goals, objectives and/or structures of one component are consistent with the needs, demands, goals, objectives and/or structures of another component (Nadler & Tushman, 1980), scholars have noted the lack of strategic fit typically frustrates the potential beneficial effects of technology investments (Kearns & Lederer, 2003; Seggie et al., 2006) leading to a potential implementation gap between the goals set by senior management and those at the lower levels of management (Larson & Gray, 2011).Yet, there has been little theory-based empirical research on the factors related to fit (Chan et al., 2006).

The first order construct of fit was hypothesized to have a positive relationship to the factors of implementation success, composed of individual impact, organizational impact, information quality and system quality. As with change management, the results of this research supported three of the four revised hypotheses. However in this instance, the hypothesis of fit having a positive relationship to organizational impact was not supported. This study offers overall empirical support that the construct of fit provides for greater implementation success. The result is consistent with TTF which provides for the congruence between an information system and its organizational environment (Klaus et al., 2003). This study makes a contribution by providing empirical evidence of the positive relationship between the factors of fit and SCMT implementation success.

Hypothesis 3a through 3h

The initial hypotheses stated both technological optimism and technological innovativeness will positively moderate the relationships between change management and SCMT implementation success. As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, the initial hypothesis was revised and additional hypotheses were tested. The results of each revised hypothesis indicated no statistically significant relationship.

Hypothesis 3i through 3p

The initial hypotheses stated both technological discomfort and technological insecurity will negatively moderate the relationships between change management and SCMT implementation success. As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, the initial hypothesis was revised and additional hypotheses were tested. The results of each revised hypothesis indicated no statistically significant relationship.

Hypothesis 4a through 4p

The initial hypotheses stated both technological optimism and technological innovativeness will positively moderate the relationships between fit and SCMT implementation success. As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, additional the initial hypothesis was revised and additional hypotheses were tested. The results of each revised hypothesis indicated no statistically significant relationship.

Hypothesis 4i through 4p

The initial hypotheses stated both technological discomfort and technological insecurity will negatively moderate the relationships between fit and SCMT implementation success. As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, additional the initial hypothesis was revised and additional hypotheses were tested. The results of each revised hypothesis indicated no statistically significant relationship.

Hypothesis 5a through 5d

Hypothesis 5a through 5d examined the direct relationship between implementation success and firm performance. Initially, the proposed hypothesis for this relationship stated that *SCMT implementation success will have a positive impact on firm performance.* As a result of the decomposition of the SCMT Implementation success construct (IS-Impact) into four, first-order reflective constructs, four independent direct hypothesized relationships between individual impact, organizational impact, information quality and system quality were tested. As previously noted, given the nature of the measure of operational performance as operationalized by Rai et al. (2006) and the inconsistent factor loadings from the original measure, the single factor of operations excellence was used to measure the performance of the firm. The results of each revised hypothesis indicated no statistically significant relationship, thus none of the four revised hypotheses were supported.

Theoretical Implications

The purpose of this research was to fill the gap in the literature with the development of a model of SCMT implementation. As a proven path to supply chain information technology implementation within the supply chain has yet to be established (Fawcett et al., 2008), this study explored the factors affecting the successful implementation of supply chain management technology and the potential for the construct of technological readiness as a key indicator. Understanding that it is unlikely a single theoretical explanation can describe all types of technological innovations (Kimberly & Evanisko, 1981; Lai & Guynes, 1997; Thong, 1999; Zhu et al., 2006b), a multi-theoretical perspective blending both STS and TTF was incorporated as the theoretical foundation of the study. A model was proposed and empirically tested.

References to change management within the operations and supply chain literature have been scarce (Atilgan & McCullen, 2011) and there has been very little structured research in SCM related change management (Stank et al., 2011). This is an obvious gap in the logistics and supply chain literature. This dissertation explored the theoretical elements associated with supply chain change and its impact on SCMT implementation success (Stank et al., 2011). As a part of the SCMT implementation model developed, the factor of change management was included as an antecedent to implementation success. STS provides the theoretical basis for the inclusion of change management in the model of successful implementation. The results of this study revealed the factor of change management was positively associated to three of the four factors of SCMT implementation success.

Finally, although prior research has touted the importance of strategic IS fit, the literature contains little theory-based empirical research on the factors related to fit (Chan et al., 2006). Fit has been considered a core concept to explain implementation success (Hong & Kim, 2002). Based on the need for technology to be compatible with firm strategy, structure, processes, and tasks, (Tornatzky & Klein, 1982; Rodrigues et al., 2004), the construct of fit was included in a model for implantation success and the relationship to the factors of implementation success empirically tested. TTF provides the basis for the need for congruence between an information system and its organizational environment (Klaus et al., 2003). The results of this study revealed the factor of fit was positively associated to three of the four factors of SCMT implementation success, extending the knowledge supply chain and information systems literature highlighting the need for strategy congruence with SCMT.

Practical Implications

Understanding the necessity of information technology within the modern supply chain, this study should inform practitioners with regard to technology selection and investment this research sought to identify those factors through the development of a model of SCMT implementation. Numerous high profile examples of implementation failures have been reported in recent years leading to negative consequences and financial loss for the firms involved (Dwivedi et al., 2105). Given that SMCT is an integral part of what encompasses the modern supply chain, along with the processes and practices within, and not a support function, the identification of the factors affecting successful implementation could provide for a reduction in failed projects and lead to significant savings and improved investment decisions.

Transforming the supply chain through technology to drive value requires careful attention to change management. Supply chain managers have conceded they spend time fixing change related issues as a result of not doing things right the first time (Stank et al., 2011). Scholars have noted that effective change management is critical to successful implementation of information technology projects (Grover et al., 1995), however there is less management control involved in supply chain change processes compared to non-supply chain change, leading to lower levels of implementation success (Greer & Ford, 2009). As both scholars and supply chain managers recognize that change management issues could make or break supply chain change efforts, this study provides empirical evidence that the factors comprising a formal change management process positively impact the factors of implementation success. Firms who employ a formal process of change management in SCMT initiatives should experience greater implementation success.

Study Limitations and Future Research

As with all research, limitations inherent to the method employed do exist. This study suffers from the limitations inherent to the survey methodology. As noted by McGrath (1982), survey research suffers from a both a lack of precision and control, along with lacking in realism of context in favor of greater generalizability. Although it must be noted, the generalizability of the findings of this research is potentially limited by the convenience sample employed by the researcher. Many of the respondents (51%) noted their industry and government/military or other. This included government contractors. Further study with a more broad respondent profile could provide greater insight and generalizability of the results.

Another limitation of this study is that of low response rate and small sample size. Small sample size raises concerns about both the statistical power and the generalizability of the results. Although the Tailored Design Method advocated by Dillman (2014) was employed in an effort to increase response rate, the response rate for this study was lower than desired (4.64%). PLS-SEM was utilized as the primary statistical analysis technique because it is considered to be robust in the case of small sample situations. The minimum sample size should be 10 times the maximum number of formative indicators in the path model (Hair et al., 2014). Although the sample size of 94 responses was adequate to complete this study using PLS-SEM, a larger, more diverse, data sample would improve the statistical power and strengthen the results.

While support for the construct of technological readiness as a moderating variable was not supported, it was noted during data analysis that there is the potential for the construct to be an antecedent for successful implementation of SCMT. As an operant resource, technological readiness could link technological adoption to the potential benefits. Technological readiness, as a firm capability, can be considered an operant resource. Future research opportunities could include further study into the possibility that technological readiness may be an appropriate antecedent in a model for successful SCMT implementation.

An interesting extension to this research could also be a qualitative study on the technological readiness of government organizations versus private corporations related to SCMT implementation and performance. Understanding that government organizations are likely not concerned with the same measures as private organizations, what are benefits government organizations seek when implementing SCMT and how technological readiness is related to successful SCMT implementation?

Study Contribution

As noted by Stank et al. (2011) in their synopsis of *The New Supply Chain Agenda* (Slone et al., 2010), avoiding failed SCMT implementations requires supply chain professionals ask some key questions prior to any SCMT initiative to ensure the benefits of new SCMT project can be quantified. First, it is important to ascertain whether or not the SCMT project being undertaken has a clear business case. Second, providing for the appropriate change mechanisms and asking what is necessary to help better implement supply chain change initiatives such as SCMT projects must also be considered. Finally, it is essential to understand whether the organization is ready to accept the proposed change as a result of a new SCMT initiative. Although the modern supply chain is built on a platform of SCMT and firms continue to make significant technology investments, the literature provides extensive evidence that many companies experience considerable complications with technology, particularly during the adoption of a new technology (Piszczalski, 1997; Tebbe, 1997; Stocia & Brouse, 2013). This study developed and empirically tested an SCMT implementation model which included the factors of fit, change management, and technological readiness. As there has been little empirical research discussing the implementation of supply chain technology initiatives within the domains of information systems and supply chain management, this study makes a contribution to both.

Table 27: Research Contribution

Research Questions	**Research Justification**	**Research Objectives**	**Research Contribution**
What factors influence the successful implementation of and supply chain management technology initiatives?	A proven path to logistics and supply chain information technology implementation has yet to be established (Fawcett et al. 2008).	Provide a comprehensive view of and proposes a parsimonious model for supply chain management technology implementation.	This study found the both the factors of fit and change management contribute to SCMT implementation success.
How can managers improve decision making concerning supply chain management technology initiatives?	Technological readiness could link the adoption of technology to the potential benefits that may accrue following implementation (Richey et al. 2007).	Investigate technological readiness as a potential indicator not only of successful implementation, but as a tipping point for the justification of investment in technology initiatives.	This study found preliminary evidence that technological readiness may be an antecedent of implementation success
What dimensions of performance are related to the successful implementation of logistics and supply chain management technology?	Supply chain executives / managers often struggle to quantify the benefits of new technology (Stank et al. 2011).	Examine the impact of successful supply chain technology implementation on diverse dimensions of performance.	Further study is needed.

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APPENDIX A

SURVEY INSTRUMENT

GEORGIA SOUTHERN UNIVERSITY

This is a pilot survey on the factors affecting successful implementation of supply chain management technology (SCMT). You opinion is important and your information will be kept strictly confidential. Your participation is voluntary. If there are any questions or problems with the survey, or if you would like a copy of the results of this research, please contact Scott Cox at scott_r_cox@georgiasouthern.edu. The Institutional Review Board (IRB) number for this study is H14464. The number to contact the IRB at Georgia Southern University is (912) 478-0843. Thank you for your participation.

Please circle the item that describes your organization's use of supply chain management technology (SCMT).

1. Enterprise Resource Planning (ERP)	**Yes**	**No**	**Don't Know**
2. Transportation Management System (TMS)	**Yes**	**No**	**Don't Know**
3. Warehouse Management System (WMS)	**Yes**	**No**	**Don't Know**
4. Order Management Systems (OMS)	**Yes**	**No**	**Don't Know**
5. Electronic Data Interchange (EDI)	**Yes**	**No**	**Don't Know**
6. Customer Relationship Management System (CRM)	**Yes**	**No**	**Don't Know**
7. Point of Sale System (POS)	**Yes**	**No**	**Don't Know**
8. Radio Frequency Identification (RFID)	**Yes**	**No**	**Don't Know**
9. Other, please describe: ____	**Yes**	**No**	**Don't Know**

We are interested in measuring your use of formal change management during SCMT implementation. Please circle the item that most closely approximates your level of agreement.

	Infrequent Use of Activity (low usage intensity)		**Some Use of Activity (moderate usage intensity)**		**Systematic Use of Activity (high usage intensity)**
10. Was fact-based data used to identify the need for change?	**1**	**2**	**3**	**4**	**5**
11. Did organizational leaders evaluate the current condition (financial, competition, labor, etc.) prior to setting goals for the change?	**1**	**2**	**3**	**4**	**5**
12. Was the gap between “where we are” and “where we want to be” determined?	**1**	**2**	**3**	**4**	**5**
13. Was an action plan developed for making the change?	**1**	**2**	**3**	**4**	**5**
14. Was the timeline for successful completion established?	**1**	**2**	**3**	**4**	**5**
15. Did organizational leaders identify important skills and capabilities needed to make the change?	**1**	**2**	**3**	**4**	**5**
16. Did the organization develop necessary skills and capabilities through training, mentoring, outside acquisition?	**1**	**2**	**3**	**4**	**5**
17. Did the organization make sure that the needed skills and capabilities were in place in time to complete the changes?	**1**	**2**	**3**	**4**	**5**
18. Was the need for this changed widely communicated throughout the company?	**1**	**2**	**3**	**4**	**5**
19. Were employees kept informed about the ongoing status of the change process?	**1**	**2**	**3**	**4**	**5**

20. How well were successes of the change effort communicated?	**1**	**2**	**3**	**4**	**5**
21. Were successful change results shared in a timely fashion?	**1**	**2**	**3**	**4**	**5**
22. Were employees rewarded for working to support the change effort?	**1**	**2**	**3**	**4**	**5**
23. Was information about the progress of the change obtained?	**1**	**2**	**3**	**4**	**5**
24. Was information effectively used to enable corrective action when necessary?	**1**	**2**	**3**	**4**	**5**
25. How effective were the actions taken to correct the progress of the change?	**1**	**2**	**3**	**4**	**5**

The following statements refer to the perceived fit of SCMT in your firm. Please circle the item that most closely approximates your level of agreement.

	Strongly Disagree	**Disagree**	**Disagree Somewhat**	**Neither Agree or Disagree**	**Disagree Somewhat**	**Agree**	**Strongly Agree**
26. The SCMT plan aligns with the company mission, goals, objectives, and strategies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27. The SCMT plan contains quantified goals and objectives.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28. The SCMT plan contains detailed action plans / strategies that support company direction.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
29. We prioritize major SCMT investments by the expected impact on business performance.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

What are your perceptions of the benefits of the SCMT implemented? Please circle the item that most closely approximates your level of agreement.

	Strongly Disagree	Disagree	Disagree Somewhat	Neither Agree or Disagree	Disagree Somewhat	Agree	Strongly Agree
30. I have learned much through the presence of SCMT.	1	2	3	4	5	6	7
31. SCMT enhances my awareness and recall of job related information.	1	2	3	4	5	6	7
32. SCMT enhances my effectiveness in the job.	1	2	3	4	5	6	7
33. SCMT increases my productivity.	1	2	3	4	5	6	7
34. SCMT is cost effective.	1	2	3	4	5	6	7
35. SCMT has resulted in reduced staff costs.	1	2	3	4	5	6	7
36. SCMT has resulted in cost reductions (e.g. inventory holding costs, administration expenses, etc.)	1	2	3	4	5	6	7
37. SCMT has resulted in overall productivity improvement.	1	2	3	4	5	6	7
38. SCMT has resulted in improved outcomes or outputs.	1	2	3	4	5	6	7
39. SCMT has resulted in an increased capacity to manage a growing volume of activity (e.g. transactions, population growth, etc.)	1	2	3	4	5	6	7
40. SCMT has resulted in improved business processes.	1	2	3	4	5	6	7

41. SCMT has resulted in better positioning for e-Government/Business.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
42. SCMT provides output that seems to be exactly what is needed	**1**	**2**	**3**	**4**	**5**	**6**	**7**
43. Information needed from SCMT is always available.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
44. Information from SCMT is in a form that is readily usable.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
45. Information from SCMT is easy to understand.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
46. Information from SCMT appears readable, clear and well formatted.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
47. Information from SCMT is concise.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
50. SCMT is easy to use.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
51. SCMT is easy to learn.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
52. SCMT meets (the Unit's) requirements.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
53. SCMT includes necessary features and functions.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
54. SCMT always does what it should.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
55. The SCMT user interface can easily be adapted to one's personal approach.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
56. SCMT requires only the minimum number of fields and screens to achieve a task.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
57. All data within SCMT is fully integrated and consistent.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

58. SCMT can be easily modified, corrected or improved.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

We are interested in your ability to embrace and use new technological assets. Please circle the item that most closely approximates your level of agreement.

	Strongly Disagree	**Disagree**	**Disagree Somewhat**	**Neither Agree or Disagree**	**Disagree Somewhat**	**Agree**	**Strongly Agree**
59. Technology gives my company more control over daily operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
60. Processes and equipment that use the newest technology are more convenient to use.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
61. We prefer to use the most advanced technology.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
62. We use technology that allows you to tailor things to fit your own needs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
63. Technology makes task completion more efficient.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
64. Other firms come to us for advice on new technologies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
65. It seems that our business partners and competitors are learning less about the newest technologies than we are.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
66. In general, we are the first in my industry to acquire new technology.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
67. We can usually figure out high tech products without the help of others.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
68. Sometimes, we feel technology is not developed for use by ordinary people.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

69. When we get technical support from a provider of a high-tech product or service, we sometimes feel that we are being taken advantage	1	2	3	4	5	6	7
70. We do not consider it safe giving out our company account numbers over a computer.	1	2	3	4	5	6	7
71. We do not consider it safe to do any kind of financial business online.	1	2	3	4	5	6	7
72. We worry that information you send over the Internet will be seen by competitors	1	2	3	4	5	6	7
73. We do not feel confident in working with a business partner that can only be reached online.	1	2	3	4	5	6	7
74. If we transmit computer information electronically, we can never be sure it will get to the right place.	1	2	3	4	5	6	7
75. If we transmit company information electronically, a terrorist may use the information against us.	1	2	3	4	5	6	7

Rate the performance of your organization in comparison to your competitors. Please circle the item that most closely approximates your level of agreement.

	Much less than average	**Slightly less than average**	**Same as competitors - average**	**Slightly better than average**	**Much better than average**
76. Product delivery cycle time	1	2	3	4	5
77. Timeliness of after sales service	1	2	3	4	5
78. Productivity Improvements (e.g., assets, operating costs, labor costs)	1	2	3	4	5

78. Increasing sales of existing products	**1**	**2**	**3**	**4**	**5**
79. Finding new revenue streams (e.g. , new products, new markets)	**1**	**2**	**3**	**4**	**5**
80. Strong and continuous bond with customers	**1**	**2**	**3**	**4**	**5**
81. Precise knowledge of customer buying patterns	**1**	**2**	**3**	**4**	**5**
82. Strong and continuous bond with suppliers	**1**	**2**	**3**	**4**	**5**

Characteristics of the respondent

83. Number of years worked in the company ____
84. Number of years of experience in the industry ____
85. Position in the company
___ (1) Director
___ (2) Manager
___ (3) Supervisor
___ (4) User
___ (5) System Provider
___ (6) Other, please specify ________________________

Characteristics of the firm

86. Firm Size
___ (1) 1-50 employees
___ (2) 51-100
___ (3) 101-250
___ (4) 251-500
___ (5) 501-1000
___ (6) 1000

87. Industry Type

___ (1) Textiles
___ (2) Appliances
___ (3) Automotive
___ (4) Aviation
___ (5) Building Materials
___ (6) Chemicals
___ (7) Consumer Goods
___ (8) Electronics
___ (9) Food and Beverage
___ (10) Hardware
___ (11) Machine Tools
___ (12) Manufacturing
___ (13) Government/Military
___ (14) Pharmaceuticals
___ (15) Retail
___ (16) Service
___ (17) Other

88. For this pilot study, please provide your comments identifying any issues you see with the survey.

____
____
____
____
____

89. In your opinion, what can motivate respondents to complete this survey?

___ (1) Receive survey results
___ (2) Prize such as a gift card, an IPad Mini, an IPod, etc.
___ (3) Donation to a national charity
___ (4) Other, please describe ____

90. If you are interested in receiving the results of this study sometime next year (2015), please list your name and email address in the space below.

Thank you for your time and willingness to participate in this survey.

APPPENDIX B

ORIGINAL MEASURES

Second Order Constructs	**First Order Constructs**	**Number of Items**	**Type**	**Adopted / Adapted From**
Change Management	Problem Analysis	3	Reflective	Greer and Ford 2009
	Action Planning	2		
	Skill Development	3		
	Behavior Management	5		
	Management Control	3		
N/A	Fit (Alignment)	4	Reflective	Kearns and Sabherwal 2007
Technological Readiness	Innovativeness	4	Reflective	Richey et al. 2007
	Optimism	5		
	Insecurity	6		
	Discomfort	2		
IS-Impact (Implementation Success)	Individual Impact	4	Formative	Gable et al. 2008
	Organizational Impact	8		
	Information Quality	6		
	System Quality	9		
Firm Performance	Operational Excellence	3	Formative	Rai et al. 2006
	Revenue Growth	2		
	Customer Relationship	2		
	Supplier Relationship	1		

APPPENDIX C

ANALYSIS OF NON-RESPONSE BIAS

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
analysis _1	Equal variances assumed	4.061	.047	-1.529	92	.130	-.340	.223	-.783	.102
	Equal variances not assumed			-1.529	86.186	.130	-.340	.223	-.783	.102
analysis _2	Equal variances assumed	.001	.970	-1.424	92	.158	-.319	.224	-.764	.126
	Equal variances not assumed			-1.424	91.996	.158	-.319	.224	-.764	.126
analysis _3	Equal variances assumed	11.718	.001	-1.657	92	.101	-.340	.205	-.749	.068
	Equal variances not assumed			-1.657	70.765	.102	-.340	.205	-.750	.069
plan_1	Equal variances assumed	.361	.549	-.660	92	.511	-.128	.193	-.512	.257
	Equal variances not assumed			-.660	88.103	.511	-.128	.193	-.512	.257
plan_2	Equal variances assumed	3.895	.051	-1.725	92	.088	-.383	.222	-.824	.058
	Equal variances not assumed			-1.725	83.838	.088	-.383	.222	-.824	.058
skilldev_1	Equal variances assumed	.673	.414	-.295	92	.769	-.064	.216	-.494	.366
	Equal variances not assumed			-.295	91.192	.769	-.064	.216	-.494	.366
skilldev_2	Equal variances assumed	.099	.754	-.958	92	.341	-.234	.244	-.719	.251
	Equal variances not assumed			-.958	90.982	.341	-.234	.244	-.720	.251
skilldev_3	Equal variances assumed	.840	.362	-.540	92	.591	-.128	.236	-.597	.342
	Equal variances not assumed			-.540	89.213	.591	-.128	.236	-.597	.342
behavmgt_1	Equal variances assumed	.001	.972	-.264	92	.793	-.064	.242	-.545	.417
	Equal variances not assumed			-.264	91.884	.793	-.064	.242	-.545	.417

behavmgt_2	Equal variances assumed	.092	.762	.262	92	.794	.064	.244	-.420	.547
	Equal variances not assumed			.262	91.985	.794	.064	.244	-.420	.547
behavmgt_3	Equal variances assumed	.096	.757	.000	92	1.000	.000	.226	-.450	.450
	Equal variances not assumed			.000	91.257	1.000	.000	.226	-.450	.450
behavmgt_4	Equal variances assumed	1.298	.257	.461	92	.646	.106	.231	-.352	.564
	Equal variances not assumed			.461	89.769	.646	.106	.231	-.352	.565
behavmgt_5	Equal variances assumed	.311	.579	-1.447	92	.151	-.404	.279	-.959	.150
	Equal variances not assumed			-1.447	91.989	.151	-.404	.279	-.959	.150
mgtcontrol_1	Equal variances assumed	.063	.803	-.286	92	.775	-.064	.223	-.506	.379
	Equal variances not assumed			-.286	91.792	.775	-.064	.223	-.506	.379
mgtcontrol_2	Equal variances assumed	.266	.608	-.095	92	.925	-.021	.224	-.466	.423
	Equal variances not assumed			-.095	91.962	.925	-.021	.224	-.466	.423
mgtcontrol_3	Equal variances assumed	.004	.952	.760	92	.449	.170	.224	-.275	.615
	Equal variances not assumed			.760	91.990	.449	.170	.224	-.275	.615
fit_1	Equal variances assumed	.077	.782	.000	92	1.000	.000	.258	-.512	.512
	Equal variances not assumed			.000	91.715	1.000	.000	.258	-.512	.512
fit_2	Equal variances assumed	4.991	.028	-1.261	92	.210	-.319	.253	-.822	.183
	Equal variances not assumed			-1.261	79.280	.211	-.319	.253	-.823	.184
fit_3	Equal variances assumed	1.886	.173	.000	92	1.000	.000	.310	-.616	.616
	Equal variances not assumed			.000	89.322	1.000	.000	.310	-.616	.616
fit_4	Equal variances assumed	2.241	.138	.776	92	.439	.234	.301	-.365	.833
	Equal variances not assumed			.776	90.222	.440	.234	.301	-.365	.833
indimp_1	Equal variances assumed	.021	.886	-1.306	92	.195	-.298	.228	-.751	.155
	Equal variances not assumed			-1.306	90.677	.195	-.298	.228	-.751	.155
indimp_2	Equal variances assumed	.617	.434	-.403	92	.688	-.085	.211	-.505	.335

	Equal variances not assumed			-.403	90.554	.688	-.085	.211	-.505	.335
indimp_3	Equal variances assumed	.805	.372	.095	92	.924	.021	.223	-.421	.464
	Equal variances not assumed			.095	91.287	.924	.021	.223	-.421	.464
indimp_4	Equal variances assumed	.352	.554	.594	92	.554	.149	.251	-.349	.647
	Equal variances not assumed			.594	91.925	.554	.149	.251	-.349	.647
orgimp_1	Equal variances assumed	.014	.906	-1.660	92	.100	-.383	.231	-.841	.075
	Equal variances not assumed			-1.660	91.226	.100	-.383	.231	-.841	.075
orgimp_2	Equal variances assumed	.461	.499	-.630	92	.530	-.191	.304	-.795	.412
	Equal variances not assumed			-.630	91.673	.530	-.191	.304	-.795	.412
orgimp_3	Equal variances assumed	.007	.931	.000	92	1.000	.000	.260	-.516	.516
	Equal variances not assumed			.000	91.845	1.000	.000	.260	-.516	.516
orgimp_4	Equal variances assumed	.002	.961	.264	92	.792	.064	.242	-.417	.544
	Equal variances not assumed			.264	91.630	.792	.064	.242	-.417	.544
orgimp_5	Equal variances assumed	.282	.597	.620	92	.537	.149	.240	-.328	.626
	Equal variances not assumed			.620	91.995	.537	.149	.240	-.328	.626
orgimp_6	Equal variances assumed	.319	.573	.591	92	.556	.149	.252	-.352	.650
	Equal variances not assumed			.591	91.903	.556	.149	.252	-.352	.650
orgimp_7	Equal variances assumed	.191	.663	-.361	92	.719	-.085	.236	-.554	.383
	Equal variances not assumed			-.361	91.728	.719	-.085	.236	-.554	.383
orgimp_8	Equal variances assumed	.305	.582	.154	92	.878	.043	.276	-.506	.591
	Equal variances not assumed			.154	90.751	.878	.043	.276	-.506	.591
infoqual_1	Equal variances assumed	1.335	.251	-.184	92	.855	-.043	.232	-.503	.418
	Equal variances not assumed			-.184	86.079	.855	-.043	.232	-.503	.418
infoqual_2	Equal variances assumed	1.362	.246	.652	92	.516	.170	.261	-.348	.688
	Equal variances not assumed			.652	86.227	.516	.170	.261	-.348	.689

infoqual_3	Equal variances assumed	.250	.618	.084	92	.933	.021	.253	-.481	.524
	Equal variances not assumed			.084	90.202	.933	.021	.253	-.481	.524
infoqual_4	Equal variances assumed	.211	.647	.086	92	.932	.021	.247	-.469	.512
	Equal variances not assumed			.086	91.984	.932	.021	.247	-.469	.512
infoqual_5	Equal variances assumed	3.703	.057	.367	92	.715	.085	.232	-.376	.546
	Equal variances not assumed			.367	87.943	.715	.085	.232	-.376	.546
infoqual_6	Equal variances assumed	.007	.932	.000	92	1.000	.000	.241	-.479	.479
	Equal variances not assumed			.000	91.792	1.000	.000	.241	-.479	.479
sysqual_1	Equal variances assumed	.325	.570	-.708	92	.481	-.170	.240	-.648	.307
	Equal variances not assumed			-.708	91.991	.481	-.170	.240	-.648	.307
sysqual_2	Equal variances assumed	.599	.441	-.179	92	.858	-.043	.237	-.514	.429
	Equal variances not assumed			-.179	89.708	.858	-.043	.237	-.514	.429
sysqual_3	Equal variances assumed	1.894	.172	-.535	92	.594	-.128	.239	-.602	.347
	Equal variances not assumed			-.535	86.447	.594	-.128	.239	-.602	.347
sysqual_4	Equal variances assumed	.038	.847	-.267	92	.790	-.064	.239	-.538	.410
	Equal variances not assumed			-.267	91.769	.790	-.064	.239	-.538	.410
sysqual_5	Equal variances assumed	.112	.739	-.471	92	.638	-.128	.271	-.666	.410
	Equal variances not assumed			-.471	91.994	.638	-.128	.271	-.666	.410
sysqual_6	Equal variances assumed	2.350	.129	-.252	92	.802	-.064	.254	-.568	.440
	Equal variances not assumed			-.252	89.721	.802	-.064	.254	-.568	.440
sysqual_7	Equal variances assumed	.007	.931	-.680	92	.498	-.191	.282	-.751	.368
	Equal variances not assumed			-.680	91.971	.498	-.191	.282	-.751	.368
sysqual_8	Equal variances assumed	.016	.901	-.240	92	.811	-.064	.266	-.592	.464
	Equal variances not assumed			-.240	91.991	.811	-.064	.266	-.592	.464
sysqual_9	Equal variances assumed	.056	.813	.160	92	.874	.043	.267	-.487	.572

	Equal variances not assumed			.160	91.390	.874	.043	.267	-.487	.572
opti_1	Equal variances assumed	1.688	.197	-1.085	92	.281	-.255	.235	-.723	.212
	Equal variances not assumed			-1.085	88.648	.281	-.255	.235	-.723	.212
opti_2	Equal variances assumed	1.255	.265	-.370	92	.713	-.085	.230	-.542	.372
	Equal variances not assumed			-.370	87.429	.713	-.085	.230	-.543	.373
opti_3	Equal variances assumed	1.018	.316	-.514	92	.608	-.128	.248	-.621	.365
	Equal variances not assumed			-.514	89.721	.608	-.128	.248	-.621	.366
opti_4	Equal variances assumed	.027	.870	-.081	92	.936	-.021	.264	-.546	.503
	Equal variances not assumed			-.081	91.895	.936	-.021	.264	-.546	.503
opti_5	Equal variances assumed	.288	.593	.000	92	1.000	.000	.183	-.364	.364
	Equal variances not assumed			.000	90.891	1.000	.000	.183	-.364	.364
inno_1	Equal variances assumed	.386	.536	-1.224	92	.224	-.426	.348	-1.116	.265
	Equal variances not assumed			-1.224	90.428	.224	-.426	.348	-1.116	.265
inno_2	Equal variances assumed	.238	.627	-1.166	92	.247	-.298	.256	-.805	.210
	Equal variances not assumed			-1.166	89.254	.247	-.298	.256	-.806	.210
inno_3	Equal variances assumed	.002	.968	-.544	92	.588	-.170	.313	-.792	.451
	Equal variances not assumed			-.544	91.997	.588	-.170	.313	-.792	.451
inno_4	Equal variances assumed	9.498	.003	.290	92	.773	.085	.294	-.498	.669
	Equal variances not assumed			.290	80.594	.773	.085	.294	-.500	.670
disc_1	Equal variances assumed	.097	.756	-1.668	92	.099	-.383	.230	-.839	.073
	Equal variances not assumed			-1.668	91.960	.099	-.383	.230	-.839	.073
disc_2	Equal variances assumed	2.086	.152	-.912	92	.364	-.255	.280	-.811	.300
	Equal variances not assumed			-.912	91.775	.364	-.255	.280	-.811	.301
insc_1	Equal variances assumed	.178	.674	-2.437	92	.017	-.809	.332	-1.467	-.150
	Equal variances not assumed			-2.437	91.993	.017	-.809	.332	-1.467	-.150

insc_2	Equal variances assumed	.095	.759	.180	92	.858	.064	.355	-.642	.770
	Equal variances not assumed			.180	91.867	.858	.064	.355	-.642	.770
insc_3	Equal variances assumed	.206	.651	-.745	92	.458	-.255	.343	-.936	.426
	Equal variances not assumed			-.745	90.810	.458	-.255	.343	-.936	.426
insc_4	Equal variances assumed	2.461	.120	.129	92	.897	.043	.329	-.610	.695
	Equal variances not assumed			.129	90.063	.897	.043	.329	-.610	.696
insc_5	Equal variances assumed	1.647	.203	-.202	92	.841	-.064	.316	-.692	.565
	Equal variances not assumed			-.202	89.780	.841	-.064	.316	-.693	.565
insc_6	Equal variances assumed	.913	.342	-.324	92	.746	-.106	.328	-.758	.545
	Equal variances not assumed			-.324	91.134	.746	-.106	.328	-.758	.545
oe_1	Equal variances assumed	.442	.508	.000	92	1.000	.000	.200	-.397	.397
	Equal variances not assumed			.000	91.219	1.000	.000	.200	-.397	.397
oe_2	Equal variances assumed	.307	.581	-.112	92	.911	-.021	.191	-.400	.357
	Equal variances not assumed			-.112	91.989	.911	-.021	.191	-.400	.357
oe_3	Equal variances assumed	.586	.446	-1.560	92	.122	-.234	.150	-.532	.064
	Equal variances not assumed			-1.560	91.963	.122	-.234	.150	-.532	.064
revgrowth_1	Equal variances assumed	.624	.431	.619	92	.537	.106	.172	-.235	.448
	Equal variances not assumed			.619	91.216	.537	.106	.172	-.235	.448
revgrowth_2	Equal variances assumed	.000	.992	-.466	92	.642	-.085	.183	-.448	.277
	Equal variances not assumed			-.466	91.847	.642	-.085	.183	-.448	.277
custrel_1	Equal variances assumed	.006	.940	-.981	92	.329	-.191	.195	-.579	.196
	Equal variances not assumed			-.981	91.915	.329	-.191	.195	-.579	.196
custrel_2	Equal variances assumed	4.526	.036	-1.231	92	.222	-.255	.207	-.667	.157
	Equal variances not assumed			-1.231	88.164	.222	-.255	.207	-.668	.157
suplrel_1	Equal variances assumed	.872	.353	-.822	92	.413	-.170	.207	-.581	.241

Equal variances not assumed			-.822	90.147	.413	-.170	.207	-.581	.241

**p <0.05 (Sig. Column)*

APPPENDIX D

FACTOR LOADINGS - PLS

	Unfreezing	Movement	Refreezing	Fit	Ind. Impact	Org. Impact	Info. Quality	Sys. Quality	Innovativeness	Optimism	Discomfort	Insecurity	Firm Performance
analysis_2	**0.856**	0.516	0.515	0.543	0.427	0.468	0.456	0.408	0.391	0.350	-0.060	-0.033	0.319
analysis_3	**0.835**	0.514	0.568	0.558	0.409	0.471	0.542	0.394	0.306	0.420	-0.038	-0.139	0.294
plan_1	**0.878**	0.502	0.533	0.525	0.394	0.308	0.427	0.292	0.425	0.253	-0.047	-0.018	0.294
plan_1	**0.855**	0.458	0.518	0.538	0.397	0.366	0.375	0.290	0.327	0.237	-0.100	-0.076	0.323
skilldev_1	0.503	**0.896**	0.499	0.583	0.400	0.370	0.574	0.454	0.259	0.358	-0.009	0.071	0.319
skilldev_2	0.545	**0.908**	0.535	0.574	0.434	0.404	0.537	0.494	0.226	0.355	-0.117	-0.062	0.155
behavmgt_3	0.615	0.586	**0.874**	0.582	0.442	0.586	0.590	0.533	0.287	0.295	-0.145	-0.037	0.345
behavmgt_4	0.564	0.480	**0.879**	0.538	0.473	0.593	0.599	0.478	0.292	0.333	-0.202	-0.076	0.283
behavmgt_5	0.503	0.422	**0.782**	0.419	0.381	0.442	0.443	0.351	0.285	0.219	-0.019	-0.140	0.255
mgmtcontrol_1	0.535	0.522	**0.895**	0.562	0.482	0.557	0.600	0.452	0.378	0.306	-0.169	-0.175	0.257
mgmtcontrol_2	0.482	0.474	**0.847**	0.577	0.526	0.465	0.602	0.418	0.336	0.264	-0.202	-0.222	0.321
mgmtcontrol_3	0.488	0.443	**0.846**	0.555	0.482	0.532	0.485	0.433	0.325	0.325	-0.100	-0.158	0.270
fit_1	0.556	0.559	0.509	**0.885**	0.563	0.445	0.566	0.428	0.253	0.304	-0.107	-0.084	0.409
fit_2	0.589	0.582	0.580	**0.891**	0.568	0.476	0.592	0.495	0.290	0.271	-0.189	-0.120	0.332
fit_3	0.602	0.610	0.643	**0.901**	0.606	0.544	0.671	0.541	0.311	0.284	-0.222	-0.059	0.327
fit_4	0.465	0.492	0.474	**0.830**	0.596	0.470	0.586	0.446	0.221	0.342	-0.250	-0.067	0.377
indimp_1	0.390	0.352	0.446	0.601	**0.887**	0.543	0.530	0.394	0.255	0.321	-0.226	-0.210	0.368
indimp_2	0.410	0.420	0.486	0.590	**0.924**	0.587	0.594	0.401	0.258	0.383	-0.036	-0.203	0.424

indimp_3	0.486	0.481	0.538	0.608	**0.890**	0.648	0.660	0.525	0.334	0.471	-0.147	-0.141	0.319
orgimp_1	0.367	0.374	0.483	0.461	0.527	**0.840**	0.541	0.515	0.202	0.391	0.014	-0.050	0.399
orgimp_2	0.382	0.345	0.446	0.326	0.370	**0.715**	0.466	0.530	0.248	0.332	-0.026	-0.027	0.254
orgimp_3	0.426	0.368	0.554	0.473	0.583	**0.858**	0.561	0.594	0.330	0.478	-0.184	-0.141	0.469
orgimp_4	0.432	0.410	0.583	0.545	0.665	**0.935**	0.640	0.614	0.178	0.552	-0.124	-0.121	0.301
orgimp_5	0.409	0.345	0.580	0.533	0.625	**0.913**	0.581	0.538	0.128	0.500	-0.136	-0.119	0.279
infoqual_2	0.479	0.546	0.582	0.650	0.600	0.552	**0.898**	0.537	0.228	0.435	-0.205	-0.115	0.393
infoqual_3	0.440	0.549	0.571	0.598	0.618	0.615	**0.921**	0.598	0.272	0.352	-0.138	-0.055	0.511
infoqual_4	0.514	0.565	0.562	0.591	0.513	0.603	**0.825**	0.733	0.331	0.505	-0.215	-0.068	0.313
infoqual_5	0.286	0.508	0.462	0.446	0.540	0.612	**0.694**	0.642	0.254	0.322	-0.020	-0.124	0.327
sysqual_1	0.421	0.447	0.531	0.540	0.461	0.606	0.649	**0.884**	0.421	0.441	-0.223	-0.089	0.369
sysqual_2	0.425	0.456	0.457	0.507	0.415	0.592	0.531	**0.832**	0.439	0.479	-0.179	-0.062	0.305
sysqual_5	0.338	0.395	0.472	0.404	0.379	0.515	0.507	**0.809**	0.359	0.382	-0.133	-0.005	0.301
sysqual_6	0.346	0.442	0.414	0.408	0.371	0.525	0.529	**0.806**	0.368	0.382	0.022	0.082	0.277
sysqual_7	0.230	0.399	0.337	0.392	0.338	0.510	0.470	**0.825**	0.320	0.386	-0.050	0.041	0.250
sysqual_8	0.331	0.510	0.386	0.500	0.452	0.535	0.642	**0.852**	0.465	0.463	-0.224	0.001	0.444
sysqual_9	0.221	0.385	0.438	0.387	0.396	0.495	0.521	**0.805**	0.360	0.429	-0.152	-0.072	0.184
inno_1	0.490	0.355	0.441	0.363	0.356	0.297	0.332	0.462	**0.853**	0.358	-0.001	0.044	0.405
inno_2	0.244	0.147	0.218	0.233	0.224	0.162	0.179	0.327	**0.818**	0.113	-0.057	0.112	0.506
inno_3	0.236	0.083	0.184	0.101	0.139	0.111	0.177	0.359	**0.819**	0.039	0.120	0.228	0.314
opti_1	0.279	0.283	0.277	0.212	0.308	0.348	0.329	0.349	0.221	**0.833**	-0.186	-0.129	0.099
opti_2	0.278	0.343	0.243	0.286	0.382	0.477	0.438	0.492	0.124	**0.869**	-0.089	-0.113	0.223
opti_5	0.365	0.354	0.336	0.343	0.337	0.490	0.376	0.419	0.278	**0.797**	-0.127	-0.133	0.363
disc_1	0.103	-0.010	0.004	-0.043	-0.095	0.000	-0.044	-0.048	0.155	-0.137	**0.546**	0.278	0.209
disc_2	-0.109	-0.078	-0.188	-0.236	-0.142	-0.127	-0.216	-0.178	-0.024	-0.135	**0.971**	0.308	0.012
insec_2	-0.038	0.110	-0.092	-0.045	-0.114	-0.123	-0.048	-0.002	0.136	-0.146	0.299	**0.833**	-0.009
insec_3	0.022	0.038	-0.029	-0.047	-0.174	-0.070	-0.083	-0.051	0.111	-0.093	0.242	**0.831**	0.062
insec_4	-0.199	-0.185	-0.215	-0.127	-0.193	-0.103	-0.112	-0.180	0.043	-0.248	0.229	**0.747**	-0.030
insec_5	0.015	0.122	-0.110	-0.055	-0.160	-0.057	-0.070	0.089	0.120	-0.013	0.346	**0.824**	-0.082

insec_6	-0.055	0.018	-0.141	-0.071	-0.148	-0.088	-0.004	0.181	0.159	-0.016	0.266	**0.714**	0.051
oe_1	0.152	0.113	0.205	0.159	0.200	0.308	0.345	0.223	0.322	0.216	0.166	-0.062	**0.663**
oe_2	0.332	0.209	0.293	0.405	0.290	0.316	0.437	0.365	0.436	0.216	-0.054	-0.006	**0.857**
oe_3	0.257	0.223	0.269	0.400	0.400	0.361	0.359	0.257	0.382	0.262	0.183	-0.005	**0.811**

APPPENDIX E

EFFECT SIZE f^2, q 2

EFFECT SIZE f^2

	R^2 Included	**R^2 Excluded**	***f^2***
Individual Impact	0.586	0.502	0.203
Organizational Impact	0.570	0.545	0.058
Information Quality	0.605	0.569	0.091
System Quality	0.552	0.520	0.071
Individual Impact	0.586	0.529	0.138
Organizational Impact	0.570	0.481	0.207
Information Quality	0.605	0.549	0.142
System Quality	0.552	0.538	0.031

EFFECT SIZE q^2

	Q^2 Included	**Q^2 Excluded**	***q 2***
Individual Impact	0.461	0.404	0.106
Organizational Impact	0.424	0.351	0.127
Information Quality	0.376	0.382	-0.010
System Quality	0.376	0.350	0.042
Individual Impact	0.461	0.434	0.050
Organizational Impact	0.424	0.481	-0.099
Information Quality	0.376	0.549	-0.277
System Quality	0.376	0.538	-0.260