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Ambidexterity: The Interplay of Supply Chain Management Competencies and Enterprise Resource Planning Systems on Organizational Performance

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AMBIDEXTERITY: THE INTERPLAY OF SUPPLY CHAIN MANAGEMENT COMPETENCIES AND ENTERPRISE RESOURCE PLANNING SYSTEMS ON ORGANIZATIONAL PERFORMANCE

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ABSTRACT

AMBIDEXTERITY: THE INTERPLAY OF SUPPLY CHAIN MANAGEMENT COMPETENCIES AND ENTERPRISE RESOURCE PLANNING SYSTEMS ON ORGANIZATIONAL PERFORMANCE

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Understanding the business value of information systems (IS) is one of the key issues among practitioners. Specifically, the role of IS in supply chain management (SCM) is one of the main areas that practitioners focus, as the largest portion of production costs are traceable back to supply chain costs. Hence, inter-organizational systems (IOS) gain importance as a result of the increased competition between supply chain networks. Particularly, implementation of enterprise resource planning (ERP), which is a type of IOS, becomes the new trend among organizations.

Although organizations use similar ERP, some gained significant benefits by using them, while others struggled to achieve the same level of success. The performance differences among ERP using organizations illustrate that ERP accrues several indirect benefits to organizational performance via intermediating organizational capabilities. SCM explorative and exploitative competencies are two such capabilities. Although, previous research indicates that ERP needs to be supported by mature SCM processes to maximize the benefits of ERP, there is still a lack of knowledge of how ERP is used to improve SCM competencies and increase performance.

Thus, the goal of this study is to evaluate the indirect benefits that accrue to organizations via the mediating effect of SCM competencies on the relationship between effective ERP usage for SCM and organizational performance. Customer relationship management (CRM), customer service management (CSM), supplier relationship management (SRM) are adopted as the three key ERP based SCM processes, and profitability, market value, and productivity are utilized as

the three main aspects of overall organizational performance. PLS-SEM is used to investigate this relationship.

Overall, this dissertation demonstrates that effective ERP usage for SCM improves SCM competencies, which leads to higher organizational performance. Specifically, the results suggest that although effective ERP usage for CRM is related to both SCM explorative and exploitative competence, effective ERP usage for CSM experience better SCM explorative competence, and effective ERP usage achieves better SCM exploitative competence. The results also indicate that, while SCM exploitative competence influences all three aspects of organizational performance, SCM explorative competence affects only the market value and organizations that manage to balance SCM explorative and exploitative competence efforts outperform their competitors.

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LIST OF ABBREVIATIONS

α.……Cronbach's Alpha

ANOVA.……Analysis of Variance

AVE.……..……the Average Variance Extracted

BOM …….……Bill of Materials

χ^2……Chi-square

CB……..……Covariance-based

CFA……...…… Confirmatory Factor Analysis

CRM……..…… Customer Relationship Management

CRP……Capacity Requirement Planning

CSM……...……Customer Service Management

DM…….……Demand Management

EDI…… Electronic Data Interchange

EIS…….……Enterprise Information System

ERP……Enterprise Resource Planning

IOS…….……Inter-organizational System

IS……...…… Information Systems

ISM……Institute of Supply Management

Ir…… Perreault and Leigh's Index of Reliability

IRB…… Institutional Review Board

IT……...…… Information Technology

κ…….……Cohen's Kappa

MFM……..……Manufacturing Flow Management

MPS……...…… Master Production Scheduling

MRP I…… Material Requirements Planning

MRP II……...…… Manufacturing Resource Planning

NAICS……...…… North American Industry Classification System

ODU……..…… Old Dominion University

OF……..…… Order Fulfilment

PD&C…… Product Development and Commercialization

PLS…… Partial Least Square

Q^2……...…… Stone-Geisser's Q^2 value

RBV……...…… Resource-based View

RM…….…… Return Management

SCC……...…… Supply Chain Collaboration

SCM……...…… Supply Chain Management

SEM……...…… Structural Equation Modelling

SRM……...…… Supplier Relationship Management

TMT……...…… Top Management Teams

VIF…….…… Variance Inflation Factor

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CHAPTER 1

1. INTRODUCTION

Advances in technology change the way organizations operate. Information systems (IS) usage – which represents using any kind of telecommunication networks, hardware, and software for supporting activities such as manufacturing, order processing, and external interactions with customers and suppliers — improves organizational performance by increasing communication and collaboration among supply chain partners (Subramani, 2004; Williamson, 2007). Specially, adaptation of the Internet significantly improves communication and collaboration capabilities among these partners (Gunasekaran & Ngai, 2004). Most modern IS applications, which use the Internet to manage supply chain activities, play critical role in improving these capabilities. Such improved communication and collaboration capabilities between supply chain partners increases the competitive advantage of the focal organizations (supply chain network leader) against their competitors (Jessup & Valacich, 2006). As a result, the competition between focal organizations moves toward supply chain networks in most of the industries, as gaining competitive advantage is one of the main requirements for survival in any given industry (Sheridan, 2000; Straub, Rai, & Klein, 2004; Straub & Watson, 2001). Therefore, understanding the effective ways to use IS applications in the supply chain context to improve communication among supply chain partners and create competitive advantage to the focal organizations is important in today's competitive business environment, and this dissertation aims to investigate the indirect relationship between effective IS usage for supply chain management (SCM) and overall organizational performance.

1.1. BACKGROUND OF THE PROBLEM

1.1.1. Information Systems (IS) and Supply Chain Management (SCM)

Despite the expected benefits of IS usage, the extant literature reports mixed findings. Even though initial studies in the IS literature find no significant effect of IS usage on overall organizational performance, recent research establishes the significance of this relationship (e.g., Altinkemer, Ozcelik, & Ozdemir, 2011; Dedrick, Gurbaxani, & Kraemer, 2003). Some of these studies illustrate that any IS application implementation creates a competitive advantage, as an IS application is a valuable, inimitable, and rare resource (Wade & Hulland, 2004). On the other hand, other studies emphasize the value of constant competency development to gain superior organizational performance (Oh, Teo, & Sambamurthy, 2012).

Thus, implementing an IS application to communicate and collaborate with supply chain partners does not directly affect the performance of an organization, but building supply chain management (SCM) competencies via effective usage of that IS to successfully manage supply chain activities improves its organizational performance. SCM is defined as "a set of approaches utilized for efficiently integrating suppliers, manufacturers, warehouses, and stores, so that, the merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements" (Simchi-Levi, Kaminsky, & Simchi-Levi, 2003, p. 1). Despite the expected benefits of IS usage on supply chain competence development, how and when IS improve supply chain processes is less understood in the literature. Therefore, there is an increasing need for a detailed analysis of how IS support supply chain processes for SCM competence development (Auramo et al., 2005).

Organizations realize the value of effective usage of IS in the competitive environment, where they are faced with different types of challenges every day (e.g., Koh, Gunasekaran, &

Rajkumar, 2008; Subramani, 2004). For example, customers' rapidly demand change and global competition continuously shift operation requirements. The customer demand and operational requirement changes cause uncertainty in the business environment. Therefore, organizations focus on effective usage of IS for improving the supplier and buyer relationship to deal with this uncertainty. Yet, implemented IS applications are mostly built on separate computing platforms, where each implemented application runs in a single hardware and software environment, as a result of the best-of-breed strategy that organizations pursue. The best-of-breed strategy attempts to implement the best IS available from a variety of vendors to support a certain business process (Jessup & Valacich, 2006). Organizations that follow this strategy may experience inefficiencies within their business processes due to the communication and integration issues that can occur among these IS applications. Thus, organizations that experience communication and integration issues switch to use enterprise information systems (EIS) — a single IS application from a single vendor — to avoid such problems. An EIS allows organizations to integrate organization-wide information across different divisions under the same computing platform (Jessup & Valacich, 2006). This increases the speed and accuracy of information transfer among all divisions.

The emergence of EIS applications, combined with increased environmental uncertainty, leads organizations to pursue closer and more transparent relationship with their supply chain partners. Organizations have to develop alliances with their key suppliers and customers to avoid environmental uncertainty. Effective usage of EIS applications in SCM improves organizations' business processes by integrating different departments within the organization and connecting supply chain partners to each other. EIS applications can be categorized under two main groups: (1) internally-focused EIS that can be used to integrate different departments of an organization to each other for supporting internal activities of that organization, and (2) externally-focused

EIS, referred to as inter-organizational systems (IOS) (Kumar & Crook, 1999), which are widely selected for supporting external activities by integrating supply chain network partners with each other.

The developmental stages of IOS are classified in four steps: (1) manual systems, like postal or fax machines, (2) electronic data interchange (EDI), (3) enterprise resource planning (ERP) systems (hereafter traditional ERP) and (4) internet-based systems, such as extended ERP (hereafter ERP) (Shore, 2001). The details of these development stages are discussed in § 2.1.1. Prior literature broadly identifies IOS applications as an enabler of supply chain integration via information sharing (Gunasekaran & Ngai, 2004; Kumar & Van Dissel, 1996). IOS, specifically ERP, allow effective information exchanging among supply chain partners and manage the flow of the information within supply chains. Despite the growing attention toward ERP usage, the IOS literature mainly explores the effects of EDI on organizational performance (Auramo et al., 2005; Kumar & Crook, 1999; Premkumar, Ramamurthy, & Crum, 1997; Subramani, 2004), but ERP's impact on supply chain competence development and organizational performance is little known. Thus, this dissertation focuses on the relationship between effective ERP usage for SCM, which can be defined as the level of the effectiveness of SCM processes usage through ERP, and SCM competencies and their effects on overall organizational performance.

A related issue pertains to examining SCM processes that may influence supply chain communication and collaboration between supply chain partners. Organizations that invest in IOS but have immature SCM processes show low performance compared to organizations with mature SCM processes (Oh et al., 2012). In other words, investment in IOS alone is not enough for the successful SCM. If organizations implement an IOS, but do not have the mature SCM processes, which are necessary to support the communication and collaboration between supply

chain partners, the realized benefits of such IOS investment are limited. The maturity of SCM processes can be classified in four groups: (1) disconnected processes — organizations that are organized by functions and have many independent SCM processes, (2) internal integration — organizations that are still organized by functions, additionally they have little cross-functional integration, (3) full internal integration and some external integration — organizations that are organized cross-functionally, and lastly (4) extensive integration among many organizations — organizations that are fully integrated with their suppliers and customers and know their business environment (Heinrich & Simchi-Levi, 2005). While disconnected processes is the least mature group of SCM processes, extensive integration among many organizations is the most mature SCM processes group. Organizations have to ensure that they possess IS applications, which can support the competence development to achieve such mature SCM processes, as IS applications play critical role in the development of SCM competencies. Hence, organizations need to focus on IOS investment and SCM competence development together to increase the realized benefits of the investments in IOS. Therefore, answering the following questions, which aims to identify the most suitable IOS for improving SCM processes, might assist organizations in leveraging the actual benefits of IOS that they invest in (Ross, 2010):

> What are the goals of information technology from the perspective of the business? What technology toolsets need to be implemented across the supply chain if channel partners are to be closely linked to form a virtual supply network? What computerized technology components (hardware, software, peripherals, etc.) are necessary to realize information goals? What are the trends in today's information technologies and how do they impact the supply chain? What are the methodologies and tasks necessary to create a sustainable supply chain information technology environment? (p. 36)

1.1.2. Organizational Ambidexterity and Supply Chain Management (SCM)

Communication and collaboration between supply chain network partners increases the focal organizations' competitiveness by cutting production costs and providing opportunities for constant product innovation to meet changing customer demands (Malhotra, Gosain, & El Sawy, 2007). If organizations manage to exchange vital information within their supply chain networks, they will be more efficient and effective in SCM activities and processes. SCM mainly involves activities such as inventory strategies, critical information sharing, product development, cash to cash cycle time reduction, technology adaptation, and logistics management (Sheridan, 2000). In addition to that, the Supply Chain Institute identifies the eight key SCM processes: (1) demand management, (2) product development and commercialization, (3) order fulfillment, (4) returns management, (5) manufacturing flow management, (6) customer relationship management, (7) customer service management, and (8) supplier relationship management. SCM processes are essential to today's modern organizations in order to enhance the efficiency and effectiveness of their supply chain activities, improve organizational performance, survive, and gain competitive advantage (Ross, 2010). Specifically, effective usage of IS based SCM processes may influence the SCM competencies of organizations. For successful competence development, organizations choose to pursue at least one of the two following strategies: (1) exploration or (2) exploitation (Oh et al., 2012).

Exploration is related to the processes of search, variation, risk taking, flexibility, play, experimentation, discovery, and innovation; whereas exploitation strategy involves actions such as refinement, choice, production, efficiency, selection, implementation, and execution (March, 1991). In other words, exploration is finding new methods to solve problems, while exploitation is refining current methods to solve the same problems (Sanders, 2008). Therefore, organizations

that pursue exploration focus on innovation of new processes, whereas organizations that pursue exploitation strategy focus on increasing the efficiency of existing processes through fine-tuning these processes. This means that if an organization focuses on both exploration and exploitation strategy to increase the efficiency of existing processes as well as innovating new processes to adapt to the changing conditions in business environment, it has to balance its exploration and exploitation activities. However, the existing literature on organizational ambidexterity captures the complementary view of exploration and exploitation (Duncan, 1976), and the difficulty of balancing these two strategies (e.g. Abernathy, 1978; O'Reilly & Tushman, 2008).

Therefore, there is still a debate about the likelihood of successfully implementing the simultaneous pursuit of exploration and exploitation in organizations. Earlier studies emphasizes the tension between these two strategies (Abernathy, 1978). Conventional wisdom suggests that organizations should pursue either exploration or exploitation at a time as these strategies require different structures, processes, and resources (Ancona, Goodman, Lawrence, & Tushman, 2001; Hannan & Freeman, 1977; O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008). However, recent findings contradict the conventional wisdom and suggest that organizations are required to simultaneously pursue exploration strategy and exploitation strategy to achieve success in SCM (Im & Rai, 2008; Kristal, Huang, & Roth, 2010). Further, the ambidexterity strategy argues that organizational ambidexterity results when organizations integrate and balance exploration and exploitation activities to increase organizational performance (Levinthal & March, 1993), and organizations that can simultaneously manage and balance exploration and exploitation activities stay competitive in the global market and tend to survive longer than their competitors (March, 1991; Raisch & Birkinshaw, 2008), as simultaneously exploration and exploitation helps them to be innovative while cutting production costs (He & Wong, 2004). Consistent with these recent

arguments, this dissertation argues that ambidexterity strategy in SCM is a requirement, not an option, in today's competitive business environment.

Drawing from the previous literature, this dissertation defines an ambidextrous supply chain strategy from a focal organization's point of view and comprises the strategic choice of focal organization to simultaneously pursue both exploration and exploitation activities within SCM (Kristal et al., 2010). In other words, organizations that pursue ambidextrous supply chain strategy have to be capable of simultaneously engaging SCM explorative and SCM exploitative activities with their supply chain partners. Thus, pursuing an ambidextrous supply chain strategy is critical for focal organizations as they can benefit from the knowledge that is gained from their supply chain partners through exploration and exploitation activities. This gained knowledge will help focal organizations to increase their internal SCM competencies and capabilities, which in turn, will allow them to become more competitive in today's competitive business environment (Kristal et al., 2010).

Furthermore, prior literature defines exploitative competence as "the ability to maintain efficiency and make improvements to current operations", and it defines explorative competence as "the ability to offer presently unavailable services through new ways of combining existing resources to offer presently unavailable services" (Oh et al., 2012, p. 370). Consistent with these definitions, this research expresses that SCM explorative competence consists of finding new methods or different ways to use existing processes to offer presently unavailable supply chain activities. On the other hand, SCM exploitative competence consists of refining current methods to use existing processes to maintain efficiency and improve the current supply chain activities. Hence, SCM explorative competence activities include innovation and discovery of new methods to improve SCM processes, while SCM exploitative competence activities consist of facilitating

routine SCM processes such as invoicing and material transactions, new accounts establishment, order receiving, order tracking, and existing account maintenance (Li, 2012).

1.2. STATEMENT OF THE PROBLEM

Overall, prior literature on SCM emphasize the value of effective IS usage (Auramo et al., 2005; Gunasekaran & Ngai, 2004; Li, 2012) and the ambidextrous strategy (Im & Rai, 2008; Kristal et al., 2010; Oh et al., 2012) for effective control of supply chains. However, the existing literature does not address the role of effective IS usage in ambidextrous supply chain strategy to improve organizational performance. Especially the role of ERP, which is the backbone of many organizations today, is little known. Hence, the purpose of this study is twofold. First, it aims to explore the role of effective usage of ERP for SCM on SCM explorative competence and SCM exploitative competence development. Second, it examines the influences of these competencies on overall organizational performance.

Organizations continuously implement IOS applications (Subramani, 2004). Prior studies illustrate that the effective usage of IOS benefits both suppliers and customers as well as focal organizations by leading closer relationship between supply chain partners (Li, 2012; Sanders, 2008; Subramani, 2004), as this closer relationship causes lower transaction and production costs (Sanders, 2008). Nevertheless, there is still a skepticism regarding the performance benefits of effective IS usage (Dedrick et al., 2003; Ross, 2010). Based on dynamic capabilities theory, it is possible to argue that benefits of an implemented IOS decrease over time, as any IS application can be imitable by other organizations (Altinkemer et al., 2011). Particularly, IS literature still debates about the business value of ERP, because of the high failure rates of the ERP projects (Beheshti, 2006; Hitt, Wu, & Zhou, 2002). One of the main reasons of the high failure rates of

the ERP projects is the nature of the ERP applications. ERP implementation success depends on technical and non-technical factors (Beheshti, 2006; Hitt et al., 2002; Trinh, Molla, & Peszynski, 2012), and requires alignment between ERP based processes and existing business processes. In addition, ERP implementation is relatively more complex than other large scaled IS application implementations due to the changes associated with ERP, such as new capability adaptation and process redesign. These kinds of changes create uncertainty about the main source of the realized benefits, and it is hard to conclude whether ERP implementation or the process redesign causes such benefits (Hitt et al., 2002).

SCM processes are one of the four existing core business processes that require redesign during an ERP implementation. The redesign on SCM processes will result in transformation of existing capabilities. Transforming the set of capabilities that organizations possess, based on the changes in the business environment, is as important as maintaining that application (Trinh et al., 2012). Adaptation of these new capabilities that caused by ERP, like any other IOS, play a vital role in achieving competitive advantage for three different reasons (Bakos, 1991; Ross, 2010; Themistocleous, Irani, & Love, 2004). First, ERP automate processes between customers and suppliers. Automation reduce human-based errors in communication and task completion time (Mohamed, 2002). The more automated the supply chain processes are, the faster and the more efficient they will be. As a result, this dissertation postulates that effective ERP usage for SCM improves the exploitative competence of the organizations. Second, ERP reduces inventory cost by increasing communication and collaboration between supply chain partners (Malhotra et al., 2007). Increased communication and collaboration between supply chain partners is expected to improve the exploitative competence of the organization, which leads to more efficient inventory management. And third, effective ERP usage for SCM increases collaboration by effectively

improving information exchange between the supply chain network partners (Koh et al., 2008; Weston Jr, 2003). Effective information exchange helps organizations to be more transparent. In addition, it helps to identify the problems in the business processes. Thus, this study suggests that the explorative competence increases because of the effective information exchange. As a result, investigating effects of effective ERP usage for SCM on SCM explorative competence and SCM exploitative competence is necessary for both practitioners and researchers to develop a better understanding of the topic of interest. Furthermore, organizations need to understand how SCM processes increase both explorative competence and exploitative competence to gain maximum performance. Therefore, the first research question of this dissertation is defined as: "How does the effective usage of ERP for SCM affect SCM explorative competence and SCM exploitative competence of organizations?"

Further, organizations develop different capabilities depending on the strategies that they pursue. While exploration strategy adds innovation capabilities, exploitation strategy enhances efficiency capabilities. Thus, effective usage of ERP for SCM will help organizations to develop and adapt new SCM capabilities, depending on which strategy that they pursue. Nevertheless, whether the adaptation of these new SCM capabilities affects organizational performance or not is unclear. Although, previous literature attempts to identify main reasons for the performance difference between organizations that use similar IS applications (e.g., Kristal et al., 2010; Li, 2012; Sanders, 2008), and defines one reason as the differences in organizational capabilities, they do not mainly focus on the role of SCM competencies on organizational performance. The developed capabilities change over time due to the significant changes in business environment. Therefore, dynamic capabilities theory suggests that organizations should dynamically transform their capabilities to achieve competitive advantage in a rapidly changing and hypercompetitive

business environment (Eisenhardt & Martin, 2000), and develop appropriate competencies for improved organizational performance. This transformation requires the simultaneous pursuit of exploration and exploitation activities (Ancona et al., 2001). SCM explorative and exploitative competencies play a key role in maintaining and improving the dynamic capabilities of supply chain activities. Therefore, the role of each SCM competencies on organizational performance should be evaluated. Although, a number of earlier studies use dynamic capabilities theory to investigate the ambidexterity in supply chains through explorative competence and exploitative competence development (e.g., Hsu, Lien, & Chen, 2013; Kristal et al., 2010; Oh et al., 2012), they do not address the direct effects of explorative competence and exploitative competence and the role of interaction between these competencies on organizational performance. As a result, the second gap in the literature, and second research opportunity, lies at this point. In order to investigate the direct effects of SCM competencies on organizational performance as well as the role of interaction between SCM explorative competence and SCM exploitative competence on organizational performance, two separate research questions are postulated. The second research question of this dissertation, which examines the direct effects of SCM competencies on overall organizational performance, is postulated as: “How do SCM explorative competence and SCM exploitative competence of organizations directly affect overall organizational performance?”

The third research question of this study explores the interaction between the two SCM competencies. Specifically, it examines the moderating role of SCM explorative competence on the relationship between SCM exploitative competence and overall organizational performance, as it is expected that the new capabilities adapted due to effective usage of ERP for SCM mainly affects SCM exploitative competence (Sanders, 2008). Consequently, the third and final research question of this research is defined as: “How does SCM explorative competence of organizations

moderate the relationship between SCM exploitative competence of organizations and overall organizational performance?"

Overall, this dissertation differs from previous studies by its comprehensive approach to studying the effects of effective ERP usage and ambidextrous supply chain strategy on overall organizational performance. It has two main contributions to the IS discipline: (1) it identifies key SCM processes used in ERP to improve SCM competencies, and helps managers to realize the benefits of effective ERP usage for SCM. In other words, examination of the role of effective ERP usage for SCM enhances the value of IOS by answering how the effective usage of IOS for SCM affects SCM explorative and exploitative competence of organizations. (2) Investigating the influence of increased SCM explorative competence and SCM exploitative competence and the role of moderation between these two competencies on organizational performance illustrates the importance of ambidextrous strategy choice for SCM.

Understanding effective ERP usage for SCM can be beneficial for both practitioners and researchers for four reasons. First, although the relationship between ERP and SCM is heavily investigated in the previous literature (e.g., Koh et al., 2008; Themistocleous et al., 2004), the influence of effective ERP for SCM on SCM explorative and exploitative competence are little known. The extant literature, which address this phenomenon, is limited by only investigating the influence of effective ERP usage for exploration and exploitation on different supply chain activities such as operational coordination, collaborative planning, collaborative forecasting and replenishment, and strategic coordination (e.g., Li, 2012; Sanders, 2008). Hence, understanding the impact of effective ERP usage for SCM on SCM competencies helps practitioners to make better decisions regarding adaptation of these applications. In addition, this gap in the literature gives researchers new research area to explore. Second, this dissertation investigates the indirect

relationship between effective ERP usage and overall organizational performance. In line with previous literature, it uses SCM competencies as a mediating mechanism to enable this indirect relationship (Oh et al., 2012). Thus, results of this research may guide practitioners regarding how to align ERP processes and relevant competencies to improve organizational performance. Third, this dissertation aims to identify the relationship between SCM competencies and overall organizational performance. Although, prior literature show that SCM explorative competence improves innovation (Abernathy & Clark, 1985), and SCM exploitative competence leads to higher efficiency in organizations (Straub & Watson, 2001), the influences of these competencies on overall organizational performance is less studied. Therefore, understanding the role of SCM competencies on organizational performance may emphasize the value of these competencies for organizational success. Finally, understanding the role of ambidextrous supply chain strategy may help both practitioners to realize the importance of balancing explorative and exploitative activities. Even though previous literature explores the importance of ambidextrous supply chain strategy (e.g., Kristal et al., 2010), they do not address how such strategy effects organizational performance. Hence, there is a need for a detailed investigation of this relationship. Further, this gap in the literature provides researches an opportunity to extend organizational ambidexterity literature. In conclusion, this dissertation proposes and empirically tests a comprehensive model of how effective ERP usage affects SCM explorative and exploitative competencies, and how these SCM competencies improve overall organizational performance.

1.3. SIGNIFICANCE OF THE PROBLEM

The significance of the problem of interest in this dissertation can be explained in three reasons. First, this study explores the role of effective ERP usage for SCM to build ambidextrous

supply chains for increasing overall organizational performance via developing relevant SCM competencies. Organizations adopt ERP to achieve higher overall organizational performance by increasing their efficiency through exploitation. However, the real-world experiences indicate that not every organization realizes increased efficiency after ERP implementation (Beheshti, 2006). The main reason for such inefficiency is the lack of developing necessary competencies (De Burca, Fynes, & Marshall, 2005). Further, ERP could lead to higher overall organizational performance by innovating through developing explorative competence. As a result, this study argues that managers need to realize the value of SCM competence development by effective ERP usage for SCM and influences of these simultaneously developed competencies on overall organizational performance, and invest necessary resources and time for ERP implementation to achieve overall organizational performance objectives. Therefore, the focus of this dissertation is to identify the effects of effective ERP usage for SCM on SCM competencies development. Its results support managers to realize the basis of effective ERP usage for SCM to improve overall organizational performance via simultaneously development of unique SCM competencies.

Second, there is a convergence of opinion that ambidextrous supply chains lead to higher process efficiency and competitive advantage and that, in turn, the positive value directly effects overall organizational performance (Kristal et al., 2010). The old school of thought suggests that organizations should choose to pursue either explorative strategy or exploitative strategy due to resource constraints (March, 1991). Yet, recent studies suggest that managers should allocate organizational resources to balance explorative and exploitative activities as the ambidextrous strategy outperforms both strategies separately (He & Wong, 2004; O'Reilly & Tushman, 2013). Nevertheless, achieving ambidexterity by simultaneous exploration and exploitation activities in SCM require managerial dedication and more resources, and hence, managers approach this idea

with caution (Lubatkin, Simsek, Ling, & Veiga, 2006). Therefore, understanding the effects of simultaneously pursuing exploration strategy and exploitation strategy on overall organizational performance is critical for managers. Findings of this study contribute to managers to understand how ambidextrous supply chains increase overall organizational performance. Therefore, this study is of potential value to managers as it shows the value of organizational ambidexterity in SCM processes.

Third, the problem at hand in this dissertation is significant for scholars. Three research questions, which are answered by this research, create an opportunity for a new research area in the IS field. By creating, and empirically testing a comprehensive model to identify the effects of effective ERP usage for SCM on SCM explorative and exploitative competence of organizations brings a new perspective to IOS research. Prior research remains inconclusive and fragmented, hence understanding the relationship among effective ERP usage for SCM, SCM competencies and overall organizational performance would benefit future research and can be applicable to the supply chain managers.

1.4. PURPOSE OF THIS RESEARCH

The purpose of this dissertation is to investigate the extent to which effective ERP usage for SCM improves SCM competencies and the influence of these SCM competencies on overall organizational performance. Specifically, this dissertation explores how effective ERP usage for SCM effects SCM explorative exploitative competence development. Further, this dissertation explores if the effectiveness of ERP usage for SCM in improving organizational performance is mediated by SCM explorative competence and exploitative competence, and offers a thorough discussion of the practical and theoretical implications of the findings.

Hence, the objective of this study is to extend existing research in two ways. First, this dissertation seeks to uncover the role of effective ERP usage for SCM on SCM competencies development by adding different types of SCM processes as antecedents of such competencies. Second, it examines the effect of ambidextrous supply chain strategy on overall organizational performance via investigating the direct and moderating effects of SCM explorative competence and SCM exploitative competence on financial, market value and productivity performance of organizations. Specifically, the dissertation synthesizes IOS and organizational ambidexterity literature with dynamic capabilities perspectives to develop a solid theoretical foundation for the business value of ERP. The main assumption under the theoretical model of this research is that every organization pursues a different SCM strategy to increase its organizational performance. Additionally, dynamic capabilities theory concludes that IOS applications are valuable resources for organizations, leading to competitive advantage (Rajaguru & Matanda, 2013). The key factor here is to use ERP in the best possible way that fits the organization's strategy. An implemented ERP that aligns with the overall organizational strategy increases the explorative and exploitative competencies of the organization. Furthermore, changing organizational capabilities in light of environmental contingencies can lead to increases in performance.

To reach its purpose, this dissertation applies dynamic capabilities theory, organizational ambidexterity, and relevant IOS and SCM literatures as the theoretical foundation for developing and empirically examining 15 hypotheses. This study aims to address the full mediating effect of two variables (SCM explorative competence and SCM exploitative competence) to understand the effects of effective ERP usage for SCM on overall organizational performance. A mediating effect refers to a third variable intervening between independent and dependent variables (Hair, Black, Babin, Anderson, & Tatham, 2006). Therefore, the effects of the independent variable are

transferred to the dependent variable via the mediator variable (Hair, Hult, Ringle, & Sarstedt, 2014). If there is a both significant direct and indirect relationship (over the mediator) between the independent and dependent variable, it is called partial mediating effect; if there is only an indirect relationship between the independent and dependent variable, it is called full mediating effect (Hair et al., 2006).

Further, to test the proposed framework, a questionnaire is developed by drawing from the literature review results. Next, members of the institution of supply management (ISM) are surveyed via their LinkedIn group. Based on the participants' responses, the proposed hypotheses are tested using partial least square-structural equation modeling (PLS-SEM) method. Analysis results clearly illustrate the causality among constructs.

1.5. ORGANIZATION OF THIS DISSERTATION

The dissertation is organized into five main chapters. Chapter one introduces the structure of the dissertation, including the two main research questions. Furthermore, it clearly states the problem of interest, the purpose of the study and the organization of the other chapters.

In the second chapter, the literature review is presented in order to serve as the basis of the theoretical framework. The literature review explains IOS applications and organizational ambidexterity literature, and identifies dynamic capabilities theory. Furthermore, the relevant literature is summarized with six tables: (1) IOS definitions, (2) IOS typologies, (3) major studies about IOS usage in ambidextrous supply chains, (4) key supply chain processes, (5) key dynamic capabilities studies, and (6) major studies about ambidextrous supply chain strategies.

Chapter three explains the research design and methodology used in the dissertation to test the proposed hypotheses. First, the research design and sampling requirements are discussed.

Second, the instrument development and validation processes are explained. Additionally, the constructs to measure the framework are discussed in detail. Third, the data collection procedure and sample characteristics are outlined. In the final section, the PLS-SEM technique, which is used to test the hypotheses, is explained.

Chapter four contains the results of the study. Sample selection, measurement validation, structural model testing and a detailed interpretation and discussion of the research are provided in this chapter.

Chapter five concludes with a discussion of the overall research findings, managerial and theoretical implications of these findings, limitation and future research venues, and conclusion. After chapter 5, the references, appendices, and curriculum vita are provided.

CHAPTER 2

2. LITERATURE REVIEW

This chapter discusses the relevant literature on IOS, SCM, organizational ambidexterity, and dynamic capabilities theory. First, IOS applications and ERP as an IOS are defined and the role of the IOS in SCM is discussed. Furthermore, dynamic capabilities theory is defined and the dynamic SCM competencies are explained. Finally, the organizational ambidexterity concept is outlined, and literature on the ambidextrous supply chain concept is discussed.

2.1. INTER-ORGANIZATIONAL INFORMATION SYSTEMS (IOS)

Recent advancements in the IS applications enable organizations to achieve efficient and effective communication with their supply chain partners. Without active information exchange and communication, organizations fall behind in the competition as a result of the slow reaction to the changes in the market and customer needs (Gunasekaran & Ngai, 2004). IOS applications support coordination, cooperation, and collaboration within supply chain network (Kumar & Van Dissel, 1996). These applications manage information sharing between two or more independent organizations (Barrett & Konsynski, 1982). Such information sharing allows members of supply chain network to develop and coordinate their supply chain activities together (Simchi-Levi et al., 2003). Consequently, IOS become popular due to the single application solution that they offer on a single platform. This single platform allows electronic transformation of information, which improves productivity, and reduces documentation error and the time and cost required for coordination between supply chain network partners (Barrett & Konsynski, 1982).

The IOS literature mainly focuses on the role of the IOS on governance (Bakos, 1991; Choudhury, 1997), competitive advantage (Cash & Konsynski, 1985; Johnston & Vitale, 1988),

and organizational performance (Sanders, 2008; Subramani, 2004). Results of these studies state that there are numerous goals motivating the use of IOS, such as the need to meet requirements, the desire to gain competitive advantage, and the demand to increase efficiency, innovation, and stability (Premkumar et al., 1997; Subramani, 2004). In addition, organizations use IOS in two different ways. First, IOS applications can be leveraged as a direct platform for exploration and exploitation (e.g., Li, 2012; Sanders, 2008; Subramani, 2004). Researchers, who treated IOS as a direct platform, connected IOS usage for exploration and exploitation to organizational or supply chain network benefits, like strategic and organizational coordination or collaborative planning and forecasting (Li, 2012; Sanders, 2008; Subramani, 2004). The findings of these studies show that IOS applications are appropriated for exploration, (such as business process innovation and new market discovery, specialized domain knowledge development, and strategic coordination establishment), and exploitation, (such as achieving exchange efficiency, forming operational coordination, and facilitating business routines). Second, IOS can be used as a platform, which creates or increases exploration and exploitation capabilities (e.g., Oh et al., 2012). Prior studies illustrate that IOS support supply chain capabilities (Rajaguru & Matanda, 2013). Therefore, IOS can be used as an enabler for explorative and exploitative capability development, which leads to improved overall organizational performance. For example, a multichannel retail organization could use an IOS to integrate its channel activities to better communicate with its suppliers and customers. This integration enhances its both explorative and exploitative competencies. In turn, these enhancements improve its overall organizational performance (Oh et al., 2012).

Despite the potential benefit of IOS as enabler for explorative and exploitative capability development, there is a lack of empirical research on this approach. Therefore, this study uses IOS as an indirect platform to investigate how organizations can benefit from these applications.

Such research that examines the effects of IOS usage on SCM competence development is a part of the business value of IS research. Business value is a term that consists of all forms of value that indicates the health and well-being of organizations. Business value of IS literature examines the organizational performance impacts of IS, where organizational performance is measured as productivity, profitability, and/or market value (Melville, Kraemer, & Gurbaxani, 2004). This research stream has two approaches.

The first approach addresses the productivity paradox (e.g., Sanders, 2008). The existing literature on IS productivity paradox states that higher level of investment in IS does not always lead to improved organizational performance (Dedrick et al., 2003; Hitt & Brynjolfsson, 1996). Findings of these studies demonstrate mixed results. These inconsistencies in the results have led researcher to investigate the reasons behind such mixed findings, which resulted in the dawn of the second approach. The second approach identifies the mechanisms to improve the business value of IS (e.g., Oh et al., 2012). A few previous research identify competence development as a mediator between effective IS usage and overall organizational performance as the mechanism to improve the business value of IS (Li, 2012; Subramani, 2004). Furthermore, to understand the business value of IS in SCM, previous studies investigate the mediating role of explorative and exploitative competencies on the relationship between IS usage and organizational performance (Oh et al., 2012).

Despite the increased attention of scholars to the second type of research stream of the business value of IS, there is still a lack of understanding regarding the impact of ERP usage on organizational performance. Therefore, this dissertation follows the second stream to investigate the role of effective ERP usage in ambidextrous supply chains to improve overall organizational performance. To achieve this goal, first IOS should be defined.

2.1.1. Development of IOS

IOS can be broadly defined as system of exchanging information between two or more organizations. However, the IS literature has a number of different definitions for IOS. Table 1 lists the key definitions of IOS from previous IS literature.

Authors	Definition
Barrett and Konsynski (1982, p. 94)	Inter-organizational information sharing system is a general term referring to systems that involve resources shared between two or more organizations.
Cash and Konsynski (1985, p. 134)	Automated information systems shared by two or more companies.
Bakos (1991, p. 32)	IOS is an information system that links one or more firms to their customers or their suppliers and facilitates the exchange of products and services.
Kumar and Van Dissel (1996, p. 279)	Inter-organizational systems are information and communication technology-based systems that transcend legal enterprise boundaries.
Kumar and Crook (1999, p. 22)	Inter-organizational information systems (IOS) are information technology (IT)-based systems that link multiple organizations.
Boonstra and De Vries (2005, p. 3)	IOS that enable companies to share information and conduct business electronically across organizational boundaries as ICT-based systems
Nicolaou, Sedatole, and Lankton (2011, p. 1020)	The technology-enabled systems that facilitate data creation, storage, transformation, and transmission between transacting partners

Table 1. IOS Definitions

Although the existing literature offers various definitions for IOS, all of these definitions underline the main purpose of IOS applications as to link focal organizations with their supply chain partners to increase the collaboration and trust between them (Kumar & Van Dissel, 1996; Nicolaou et al., 2011). Thus, IOS applications go beyond organizational boundaries and improve interactions between organizations in the supply chain network. Furthermore, one of the main roles of IOS applications in SCM is to exchange information between supply chain partners (Im & Rai, 2008). Based on the previous literature, information exchange in SCM can be grouped into three categories: (1) exchanging supply and demand information (2) exchanging competitive

intelligence, and (3) exchanging transaction-based information (Auramo et al., 2005). The type of exchanged information and how it is exchanged through an IOS application depends on the complexity of that application. The more advanced the IOS application is, the better information exchange it will provide between supply chain partners. Yet, as the complexity of IOS increase, the difficulty of implementing that application increases as well (Boonstra & De Vries, 2005).

Advances in IOS development can be categorized in four main stages (Shore, 2001). In the first stage, organizations use simple applications such as fax machines to exchange necessary information between supply chain partners. The role of IS applications and the implementation process is relatively small in this stage. The second stage automates the information exchange process between supply chain partners by using applications that are more advanced (e.g., EDI). In this stage, documents move to the electronic environment and the implementation process is a rather complicated process. However, they still run on different computing platforms. The third stage presents applications that are more integrated. The implementation process of these IOS applications are more complicated than the applications in the first two stages, as they require integration of different departments and units in an organization. Enterprise-wide applications, like traditional ERP, integrate databases and coordinate information flow within organizations. Fourth stage integrates all separate applications of the organizations in the supply chain partners. Integration of this kind of IOS applications allows two-way information flows between supply chain partners (Williamson, 2007). The two-way information flow increases the transparency between supply chain organizations. As a result, IOS usage increases the communication and collaboration between supply chain partners (De Burca et al., 2005). Specifically, the Internet, which makes the integration of different networks possible, plays a critical role in this stage. Hence, these applications provide better information exchange between supply chain partners.

Although, information exchange between supply chain partners is the main goal of IOS, a large body of literature explores IOS from different perspectives. While some studies examine the antecedents of IOS (e.g. Shi, Kunnathur, & Ragu-Nathan, 2010), other studies focus on the outcomes of IOS (e.g. Subramani, 2004). As a result, several different typologies are offered in the literature to categorize IOS applications. The following section summarizes these typologies.

2.1.2. IOS Typologies

There are numerous types of IOS applications that organizations implement to manage their processes. In an effort to categorize these IOS applications, the existing literature proposes different typologies based on the goals, architecture, and configurations of these applications. Table 2 shows a sample of IOS typologies.

Authors	IOS Types
Barrett and Konsynski (1982)	Remote Input / Output Node, Application Processing Node, Integrating Network Node, Multi Participant Exchange Node, Network Control Node
Cash and Konsynski (1985)	Information Entry and Receipt, Software Development and Maintenance, Network and Processing Management
Johnston and Vitale (1988)	Boundary Transactions, Sales Characteristics, Retrieve and Analyze Data
Kumar and Van Dissel (1996)	Pooled Interdependency, Sequential Interdependency, Reciprocal Interdependency
Choudhury (1997)	Electronic Dyads, Multilateral IOISs, Electronic Monopolies
Shah, Goldstein, and Ward (2002)	Operational IOS, Tactical IOS, Strategic IOS
O'Donnell and Glassberg (2005)	Extranets, Business-to-Business Virtual Markets, Electronic Data Interchange (EDI)

Table 2. Sample IOS Typologies

Initial typologies attempt to categorize IOS applications based on the participation level (Barrett & Konsynski, 1982; Cash & Konsynski, 1985) and the business purpose of the system,

the relationship between the focal organization and its partners, and the information function in the system (Johnston & Vitale, 1988). Instead, recent studies use structure of interdependence (Kumar & Van Dissel, 1996; O'Donnell & Glassberg, 2005), electronic integration (Choudhury, 1997), and level of supply chain relationships (Shah et al., 2002) which focuses the exchange of different information levels (Operational level IOS: exchanges transaction-based information, Tactical level IOS: exchanges supply and demand information, Strategic level IOS: exchanges competitive intelligence). Therefore, any given IOS can be categorized in many different ways based on these predefined typologies, but which one is more suitable to categorize a specific IOS application is not clear.

It is hard to discuss that any of these typologies offers better classification than others do. The choice of the IOS typology should be made based on solid criterion of the conducted study. For example ERP, which is the chosen IOS application for this dissertation, can be categorized by using any of these typologies. From participation standpoint, ERP requires the highest level of participation (integrating network node or network and processing management) as it integrates all data flow and communication processes of supply chain partners. From business processes standpoint, it is a ‘retrieve and analyze’ application, as it analyzes data, and executes boundary transactions. From an independence structure standpoint, ERP is an interdependent (reciprocal Interdependency or business-to-business virtual markets) application, as every organization in a supply chain network is as responsible as the focal organization for the ERP to work efficiently and effectively. Further, from electronic integration standpoint, ERP is an ‘electronic monopoly’ application, as all partners in a supply chain network are linked to optimize the processes and increase efficiency. Finally, from level of supply chain relationships standpoint, ERP is a tactical IOS, as it exchange supply and demand information between supply chain partners.

This dissertation focuses on level of supply chain relationships, as the aim of this study is to understand the role of the effective ERP usage for SCM on SCM competence development. Thus, it is important to understand the direct relationship between effective ERP usage and SCM competence development. Specifically, the SCM explorative and exploitative competencies that affect the supply chain relationship within a supply chain network must be explored. To identify the value of these competencies the role of IOS on SCM should be clearly evaluated.

2.1.3. IOS in Supply Chain Management (SCM)

Cooperation between partners in a supply chain network and organizational integration are the key factors of success in SCM. Information exchange is the core of this cooperation and integration. The existing literature emphasizes the value of IS for effective SCM (Gunasekaran & Ngai, 2004). Thus, IOS applications rise as a key tool to support SCM through SCM competence development. Yet, for an IOS implementation to be successful, IOS usage is a critical condition. Previous literature on IS success clearly indicates the role of the IS usage (DeLone & McLean, 1992; Shi et al., 2010). Therefore, the effectiveness of IOS usage should have a clear impact on SCM competence development.

Despite the fact that there is an extensive literature on the association between effective IS usage and SCM competencies (Kristal et al., 2010; Rajaguru & Matanda, 2013; Wu, Yeniyurt, Kim, & Cavusgil, 2006), research on the effective IOS usage is a fairly new topic. Hence, the effects of IOS on the SCM competencies remain an understudied area. An extensive search of the database *Business Source Complete* using the keywords “supply chain, inter-organizational systems, and performance” reveals a total of 21 peer-reviewed articles. After a detailed review of these articles, six of them are found to be relevant to this study. Table 3 summarizes the research focus and key finding of these studies.

Authors	Research Focus	Key Findings
Lee, Clark, and Tam (1999)	EDI, and performance outcomes	Examines the benefits of adopting EDI application on organizational performance. Using the data from 31 retail supply chains, the study finds that EDI adopters can achieve dramatic performance improvements if EDI is used for process reengineering.
Siau (2003)	IOS usage, and competitive advantage	Examines a number of successful IOS implementation and usage cases to identify the key success factors. Based on the four main case studies, results indicate that the most important success factor is the ability to manage changes in the structure and work processes.
Saeed, Malhotra, and Grover (2005)	IOS functionality, and performance outcomes	Examines the linkages between the nature of the IOS, buyer–supplier relationships, and manufacturing performance using the data from 39 organizations. Results show external integration increases efficiency whereas IOS breath and initiation enhance sourcing leverage.
Hartono, Li, Na, and Simpson (2010)	Information quality, and performance outcomes	Examines the role of the quality of shared information in IOS use. Based on the collected data, results show that the quality of shared information positively impacts supply chain performance
Wu and Chang (2012)	E-supply chain management, and performance outcomes	Examines the relationships between a stage-based structure and the Balance scorecard using the data are collected from 127 firms, results show that there are significant differences between external diffusion and the two earlier stages on the four BSC perspectives.
Lee, Kim, and Kim (2014)	Supply chain visibility, and performance outcomes	Examines the antecedents and the outcomes of IOS visibility using data from 124 manufacturers. Results indicate that IOS visibility positively effects supply chain performance.

Table 3. Major IOS studies in Supply Chain Management

Partners in a supply chain network develop long-term relationships for working together to avoid uncertainties that they face and build new capabilities through information exchange (Malhotra et al., 2007). Extant literature illustrates that, although IOS usage is critical for SCM performance (Lee et al., 1999; Wu & Chang, 2012) and competitive advantage (Siau, 2003), IOS functionality (Saeed et al., 2005) and visibility (Lee et al., 2014) also significantly influence the success level of SCM. IOS functionality is captured as external integration, IOS initiation, and IOS breadth. External integration is defined as the extent of electronic links between numerous functional units or departments in two supply chain partners. IOS initiation is evaluated as the number of electronic linkages initiated by the focal organization, divided by the total number of

electronic linkages that the focal organization has established. IOS breadth measures the extent to which the IOS can interface with multiple suppliers. Furthermore, the IOS visibility indicates the extent to which the information of partner organization regarding supply chain cooperation is visible to the focal organization through IOS.

In addition, information sharing and the level of the quality of shared information are one of the main determinants of overall organizational performance (Hartono et al., 2010). Each of the four IOS types (manual applications, EDI, traditional ERP, and internet-based applications) exchanges different level of information between organizations. While manual applications and EDI exchange transactional information, traditional ERP and internet-based applications such as ERP exchange both transactional and tactical information like supply and demand levels (Shore, 2001). Despite the fact that there is an overwhelming attention to EDI applications and the role of transactional information exchange in the existing IOS literature (e.g., Kumar & Crook, 1999; Premkumar et al., 1997; Subramani, 2004), there is a lack of studies that focus on investigating how and why tactical information exchange increases overall organizational performance. Thus, this research focuses on ERP and tactical information exchange rather than EDI or transactional information exchange. The effective use of ERP for tactical information exchange can strengthen SCM. In order to understand the role of ERP in SCM, first the evolution of the ERP needs to be explained.

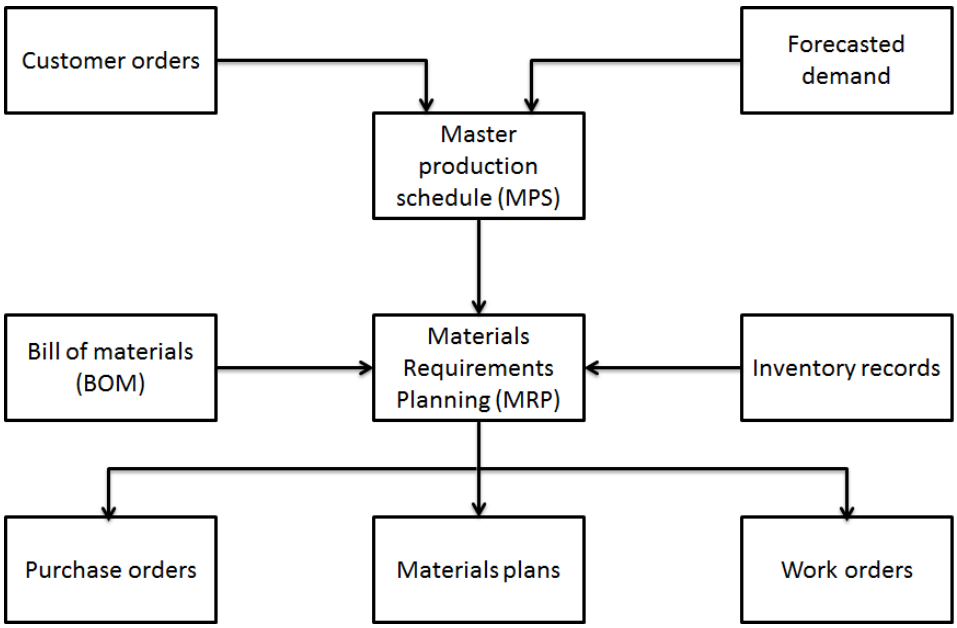
2.1.4. Enterprise Resource Planning (ERP) Systems

ERP applications became popular after the 1990s. Nevertheless, they are not the only EIS applications, which were used overwhelmingly by organizations to exchange information among departments and/or organizations. Organizations implemented various EIS applications before the dawn of the ERP, and ERP evolved as a successor to these earlier EIS applications. Hence,

understanding these legacy applications is essential to understand ERP. The first implemented EIS was inventory control systems, which was developed in the 1950s to organize information flow (Møller, 2005). This application was essentially programmed to manage the inventory of an organization by using barcode scanners. Barcode scanners allowed items that were scanned to be added to the inventory or to be deleted from the inventory.

Following that, in the 1960s, a new concept called material requirements planning (MRP I), was developed (Wagner & Monk, 2009). MRP I application was a production and inventory control application. It focused on "Just in Time (JIT)" inventory. Therefore, the main purpose of MRP I was to ensure that the required materials for production were available when needed and there would be no or little inventory at other times (Shim & Siegel, 1999). In order to achive JIT inventory, MRP I was programmed to conslidate necessary data for production from the bill of materials (BOM) application, inventory records, and the master production schedule (MPS) to generate purchase orders, work orders, and material plans for production (Slack, Chambers, & Johnston, 2001).

BOM is a list of required subassemblies, component parts, and row materials to produce the end item (Shim & Siegel, 1999). It breaks down the required materials for production into lower level until it reaches row materials or purchased parts (Stevenson, 2015). In addition, MPS forecasts the future demand, and it states the timing and quantity of a specific end item needed to be produced (Shim & Siegel, 1999). Therefore, MPS helps planning the required parts and raw materials to meet future demand from all sources (Stevenson, 2015). The outcome of the MRP I — purchase orders, material plans, and work orders — helps managers to decide what parts or materials to purchase, and when and how much to order these parts and materials. The structure of an MRP I application is illustrates in Figure 1.



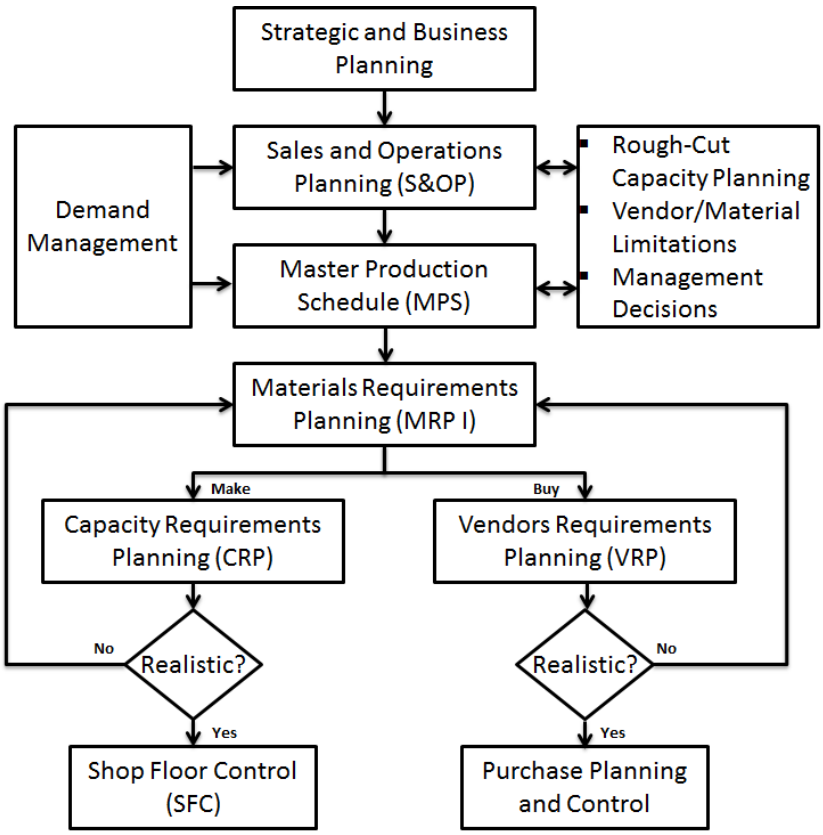
source: Adapted from: Slack et al. (2001)

Figure 1. MRP I Framework

However, one of the main drawbacks of the MRP I was that the manufacturing capacities were not taken into consideration when required materials for production were planned (Kurbel, 2013). Thus, it was uncertain whether the customer demands would be fulfilled. In order to solve this limitation of MRP I, a new concept, manufacturing resource planning (Closed Loop MRP or MRP II), was developed in early 1980s. MRP II was an application for the effective planning of all resources of organizations (Sheikh, 2003), which joined manufacturing, finance, marketing, and engineering subsystems into one big integrated application (Wight, 1984). It emphasized the synchronization between materials and production requirements to optimize the manufacturing process.

An MRP II application has six levels: (1) business planning, (2) production (sales and operations) planning, (3) master production scheduling (MPS), (4) MRP I, (5) capacity (vendor) requirement planning, and (6) ordering system (Gopalakrishnan, 1993; Sheikh, 2003). The first

step – business planning – addresses what materials organization have, what is planned to sold, and what need to be produced (Wight, 1984). Drawing from the business plan, production plan is established, and MPS is determined based on the long-term sales and operation forecast. MPS is the starting point for MRP I, which calculates the quantities of materials and parts required to be produced to meet the demand (Kurbel, 2013). In addition to MRP I, MRP II plans the capacities needed to produce the required products in capacity requirement planning (CRP). This capacity plan is broken down in more detail in shop-floor control (Gopalakrishnan, 1993). Following that, purchase orders are placed and completed through the ordering system. Figure 2 defines MRP II framework.



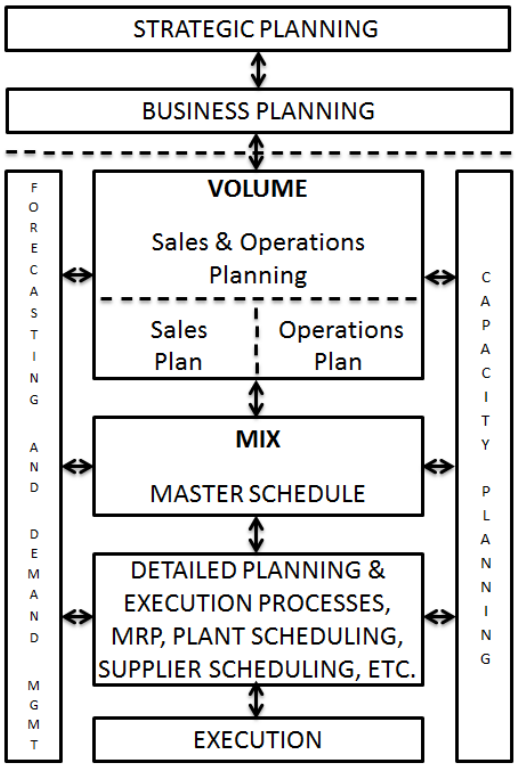
source: Adapted from: Sheikh (2003)

Figure 2. MRP II Framework

Yet, MRP II had its own shortcomings in managing production plans, and inventories, it also had drawbacks like limited focus to manufacturing activities and poor budgetary controls, and it did not include accounting and human resource functions. Hence, the eagerness to address these shortcomings and drawbacks lead software vendors to develop a comprehensive EIS for organizations.

Consequently, in the early 1990s, a more complex EIS application, enterprise resource planning (traditional ERP), was developed to overcome all shortcomings of prior applications. Wallace and Kremzar (2002, p. 10) defined traditional ERP as: "[Traditional] ERP predicts and balances demand and supply. It is an enterprise-wide set of forecasting, planning and scheduling tool, which: (1) links customers and suppliers of an organization into a complete supply chain, and (2) employs proven processes for decision making, and also (3) coordinates sales, marketing, operations, logistics, purchasing, finance, product development and human resources."

Traditional ERP is evolved from MRP II. The process of the traditional ERP starts with strategic and business planning. Even though, these two plans are not integral parts of the ERP process, they are the main drivers of the resource planning (Wallace & Kremzar, 2002). Sales and operations planning operationalize the business plan, and forecast the expected sales volume. Following that, master scheduling determines list of products that should be built to address the demand. Then, MRP I predicts what materials are required to execute the master schedule, and CRP uses the MRP I predictions to determine how much capacity is needed and when. Further, traditional ERP does plant scheduling to develop the start and completion times of each job in the master scheduling. The final execution phase combines all planning stages and addresses all possible problems related with these stages. Figure 3 illustrates a graphical view of traditional ERP.



source: Adapted from: Wallace and Kremzar (2002)

Figure 3. A graphical view of traditional ERP

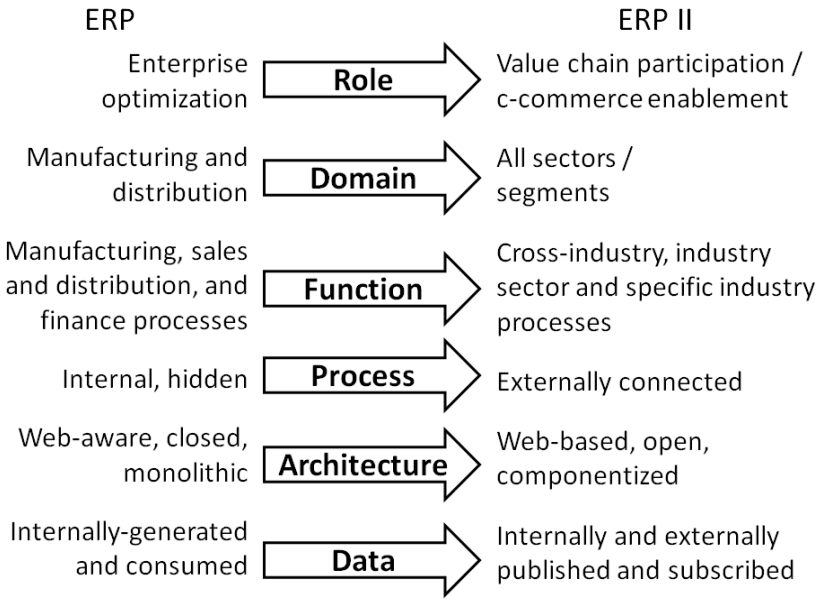
Traditional ERP not only affects the operational side of the business, but also influences financial planning and simulation, (Wallace & Kremzar, 2002). The main future of the traditional ERP is its ability to encompass all business functions in organization (Stevenson, 2015). It has the ability to convert the unit plans into dollars. This ability makes accessing information easier by creating a single database (Jessup & Valacich, 2006). Hence, incorporating financial planning and operational planning produces only one outcome. Furthermore, the simulation capability of traditional ERP helps to answer "what if" question, which leads to developing alternatives and contingency plans.

Despite the extended capabilities and expected benefits, failures in the traditional ERP projects forced businesses to search for better software that would add a competitive advantage

to the organizations. In 2000, Gartner Group, which was also the inventor of traditional ERP, introduced ERP (extended ERP or ERP II) with a paper called “ERP Is Dead - Long Live ERP II” (Bond et al., 2000).

ERP extends traditional ERP into an IOS application by adding CRM and SCM functions to integrate supply chain partners. Gartner Group defines ERP applications as a business strategy and a set of industry domain specific applications that builds customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational, and financial processes (Bond et al., 2000). An ERP application extends business processes, opens application architectures, provides vertical specific functionality, and supports global enterprise-processing requirements (Koh et al., 2008). Therefore, ERP applications support organizations so that they gain competitive advantage by improving their timely and accurate information sharing abilities (Beheshti, 2006).

ERP focuses on the supply chain network as a whole instead of only focusing on the focal organization. This approach allows internal business systems of focal organizations to connect with their suppliers and customers’ systems. As a result, information exchange and transaction between supply chain partners become almost real time and automatized. Thus, the essence of the ERP is multiple electronically linked organizations (Weston Jr, 2003). ERP links external operations of suppliers and customers in addition to traditional ERP. ERP include six elements that touch on business, application and technology strategy (Møller, 2005): (1) role of ERP, (2) its business domain, (3) functions addressed within the business domain, (4) processes required by those functions, (5) system architectures that can support these processes, and (6) the way in which data are handled within the system architectures. Differences between Traditional ERP and ERP in terms of these elements are summarized in Figure 4.



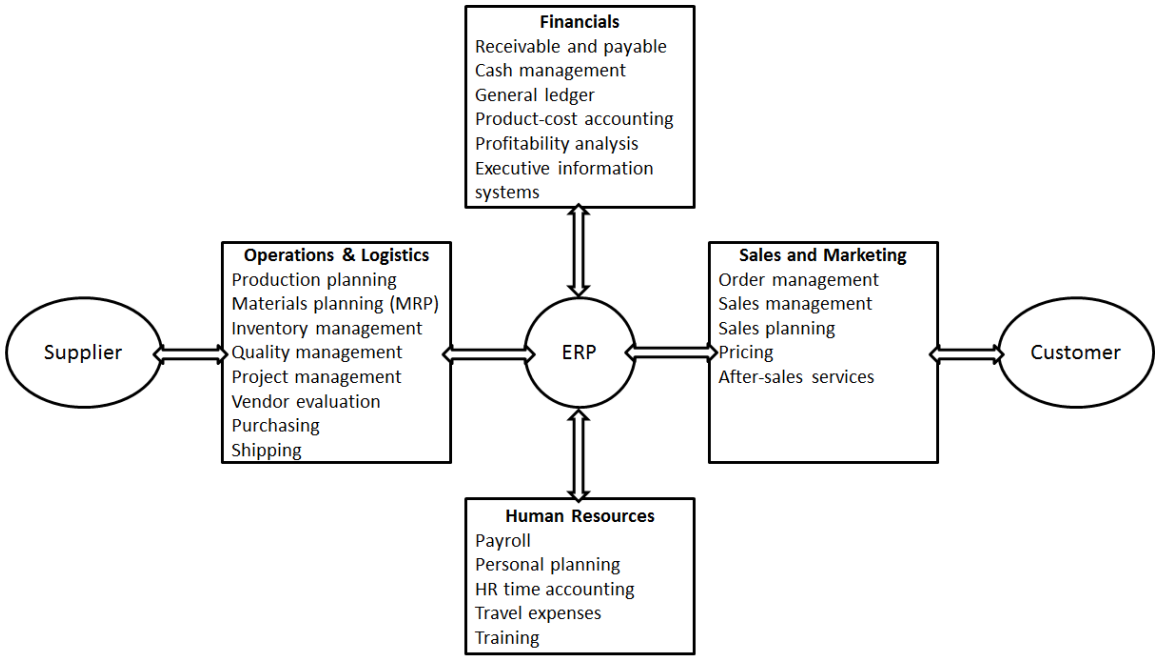
source: Adapted from: Bond et al. (2000)

Figure 4. ERP Definition Framework

Although traditional ERP initially targets optimizing processes within organizations for manufacturing industry, ERP extends the role and domain of the traditional ERP by targeting supply chain networks rather than single organization in every industry. In line with the role and domain extension, the functions, processes, and architecture of ERP are evolved to address the information exchange between organizations through the Internet. Finally, the ERP database is expended to store both internal and external data.

Additionally, as Figure 5 illustrates, the core of the ERP has four main functional areas of operation: (1) financials (accounting and finance), (2) sales and marketing, (3) human resources, and (4) SCM (operations and logistics) (Chen, 2001; Kurbel, 2013). These four main functional areas are the vital departments of organizations. Financials function deals with money flow, sales and marketing function is responsible from selling products, SCM function guarantees that the products sold are ready on time, and human resources function manages the employee turnover

to maintain required personnel. The communication between these four departments is important for competitive advantage. Particularly, SCM area gains importance as ERP considers the supply chain network as a whole. In a competitive environment, speed is crucial. Losing seconds might cost millions of dollars. Thus, many organizations use different IOS applications than each other to manage their supply chains. Some of the small organizations do not use any IOS application at all. This means that the created data must be entered into each of the existing IS applications in the organization separately and manually. This increases the amount of paperwork and effort in addition to causing time to be wasted. ERP integrates the entire organization and all partners in the supply chain network so the necessary data is entered into the application only once and will be distributed to the all members of the supply chain instantly and automatically (Addison, 2004; Wallace & Kremzar, 2002; Williamson, 2007).



source: Adapted from: Chen (2001)

Figure 5. ERP Framework

ERP has become a platform for electronic business, business to business and business to customer applications (Beheshti, 2006). Organizations reduce their inventory costs, and are able to better manage their supply chains and customer relations. This collaborative integration within the supply chain partners also increases the information transparency, accelerates the decision making process and decreases the response time (Mohamed, 2002). Supply chain partners share their external and internal knowledge to improve their SCM processes and increase profitability. Using one system with a huge database, rather than the legacy systems, reduces the search cost and integration cost, and improves the communication between supply chain partners (De Burca et al., 2005). Further, ERP applications combine traditional ERP with the Internet. Widespread access to the Internet makes ERP a more affordable applications than EDI is (Addison, 2004). Suppliers, customers, and even employees of the focal organization might access organizational data from anywhere, at any time, via the Internet. This makes the data more accessible.

Process improvement is another benefit of ERP (Beheshti, 2006). ERP become a tool for effectively managing business processes (Wagner & Monk, 2009). Implementing ERP provides organizations an opportunity to analyze their business processes and improve or eliminate their most costly and poor quality areas in the supply chain flow. The process improvement is critical for all organizations in a supply chain network, as products or services are produced by the entire supply chain network, not just by the focal organization itself. Therefore, if the processes can be improved and produced product or service can be sold for more than all the supply chain partners have spent, the entire supply chain network becomes profitable.

Like each ERP functional area, SCM has its own business processes. Although different software applications like Oracle, PeopleSoft, or SAP might name these processes differently, the main functionalities are the all same. The Global Supply Chain Forum identifies the eight key

SCM processes that need to be managed by partners of supply chain network to reach success in supply chain integration (Wisner & Stanley, 2007). Table 4 defines these eight key processes and their associated activities.

Process	Description	Associated Activities
Customer Relationship Management (CRM)	Creating and maintaining customer relationships	Identify and categorize key customers; tailor products and services to meet the needs of customer groups.
Customer Service Management (CSM)	Interacting with customers to maintain satisfaction	Manage product & service agreements with customers; design and implement customer response procedures.
Demand Management (DM)	Balancing customer demand with supply capabilities	Forecast demand; plan or adjust capacity to meet demand; develop contingency plans for imbalances.
Order Fulfillment (OF)	Satisfying customer orders by delivering on time	Design logistics network to deliver products on time.
Manufacturing Flow Management (MFM)	Making products to satisfy target markets	Design manufacturing and service processes to create products customers want; determine process flexibility.
Supplier Relationship Management (SRM)	Creating and maintaining supplier relationships	Identify key suppliers; establish formal relationships with key suppliers; further develop key suppliers.
Product Development and Commercialization (PD&C)	Develop new products frequently and get them to market effectively	Develop sources for new ideas; develop cross-functional product teams, including customers and suppliers.
Returns Management (RM)	Manage product returns and disposal effectively	Understand legal issues; develop guidelines for returns and disposal; develop returns network.

source: Adapted from: Wisner and Stanley (2007)

Table 4. The Eight Key Supply Chain Processes

ERP comprises all of these key processes in its structure and increases the efficiency of supply chain integration. Organizations improve their SCM processes through effective use of ERP. However, the literature does not investigate how these eight key SCM processes influence the SCM competencies of organizations. Specifically, there is a lack of data demonstrating the relationship between suppliers and customers affected by ERP implementation. The benefits of

ERP to manufacturing and operational side of the business are well documented (Beheshti, 2006; Hitt et al., 2002; Koh et al., 2008), however its benefits on SCM is still less known. Especially, the effects of effective ERP usage for SCM on SCM competencies development are little known. Understanding the benefits of ERP on SCM helps organizations to profit from these benefits. If managers have better understanding of what ERP brings to supply chain integration, they can better assess their SCM strategies. Thus, this research aims to investigate this relationship to shed lights on the benefits of ERP in SCM. Even if, all of these eight key supply chain processes are important for successful supply chain integration, not all of them directly affect the relationship between supply chain partners. For example, both demand management and order fulfillment processes aim to forecast demands and deliver products on time to satisfy customers. Similarly, manufacturing flow management and product development and commercialization processes aim to develop new products to satisfy target markets and customers. Moreover, return management process manages product returns. All these processes are valuable for SCM, but they are internal processes. Therefore, these processes are out of the scope of IOS, and thus, are not the focus of this dissertation

On the other hand, CRM promises a successful relationship with customers and aims to increase profitability. If organizations can understand demands of their customers , they design their strategies and allocate resources to maximize profit (Wisner & Stanley, 2007). CRM not only focuses on existing customers, but also aims to acquire new ones. In today's competitive business environment, customer loyalty is the key element to organizational success. It generates revenue. However, if organizations cannot provide required customer support, they will not be able to develop customer loyalty and survive in this business environment. Therefore, the main contribution of CRM is to create the customer-centric structure for organizations (Ross, 2010).

CRM begins whenever a product is delivered to a customer. Therefore, the initial objective of CRM is to deliver a product in right conditions, on time and at right place (Wisner & Stanley, 2007). Additional CRM steps include providing information regarding the product, providing maintenance and related products (Wisner & Stanley, 2007). Consequently, CRM can be divided to three major functions: (1) marketing, (2) sales, and (3) service (Ross, 2010). Service function can be provided before sale, during sale, or after sale (Wisner & Stanley, 2007). These services are organized around the CSM process (Ross, 2010). CSM is an effort to answer questions of the customers. Help desks, call centers, and customer interactions centers are all part of CSM. If any of the CSM related services fail, it generates unsatisfied customers. Unsatisfied customers cause extra cost as actions such as discount, refund, or promotion will require for satisfying customers. If this case cannot be managed successfully, and customers remain unsatisfied, it may also cause customer losses.

In the past, these functions used to be handled separately. Thus, the loosely connection between them caused inefficiencies and communication problems. Nevertheless, introduction of internet-based CRM technologies assisted organizations to connect these functions and better understand their customer base (Ross, 2010). Specially, ERP provided opportunity to effectively communicate with customers through the introduction of the CRM module, which led to better CRM and CSM.

Similarly, SRM ensures that focal organizations create and maintain a successful supplier relationship. Successful relationship with key supplier contributes to product innovation, quality improvement, and cost reduction (Wisner & Stanley, 2007). Therefore, in today's competitive environment well established and long-term relationships between buyers and their suppliers is no longer an option but a strategic requirement to maintain competitive advantage (Ross, 2010).

If organizations manage to establish such relations with their key suppliers, they guarantee to receive better service such as receiving products on time, and reduce the cost of supply chain. Besides, the transparent relationship that built between suppliers and buyers will yield suppliers to be more cooperative. Hence, the supplier relationship is as important, if not more important, than the customer relationship for focal organizations.

Advances in technology ensure organizations to manage the relationship with their key suppliers. With internet-based SRM technologies, managing the suppliers relationship become much easier, as these technologies allow a faster communication line between organizations and their key suppliers (Ross, 2010). Specifically, evolution of ERP gives the ability of transferring real time information between focal organizations and their key suppliers. This ability leads to better SRM.

Additionally, the main difference of ERP from traditional ERP is the addition of SCM front and end processes (CRM, CSM, and SRM) (Bond et al., 2000). Therefore, this study uses SCM front and end processes that affect the relationship between supply chain partners as they are the processes that improve the communication and collaboration between the members of a supply chain.

2.2. DYNAMIC CAPABILITIES THEORY

One of the main purpose of the business value of IS literature is to recognize how and why effective IS usage improves overall organizational performance and helps organizations to survive. Previous literature offers both static and dynamic theories to explain how organizations survive (Hsu et al., 2013; O'Reilly & Tushman, 2008), and how IS usage effects organizational competitiveness (Mavengere, 2013). The resource-based view (RBV) theory emphasizes the role

of unique resources and capabilities as the source of organizations' competitive advantage (e.g., Oh et al., 2012). However, the static nature of the RBV fails to explain how organizations change and adapt their resources to fit changing environments. Hence, the dynamic capabilities theory provides a better and promising framework for exploring the implications of effective IS usage on organizational performance.

Current literature defines dynamic capabilities as "the ability to integrate, reconfigure, and build internal and external competencies to address rapidly-changing environments" (Teece, Pisano, & Shuen, 1997, p. 516). Dynamic capabilities theory synthesizes RBV and evolutionary economics theory and focuses on the dynamic perspective of learning and innovation (Barney, 2001; Eisenhardt & Martin, 2000). Hence, to understand how dynamic capabilities theory has evolved, the early origins of the dynamic capabilities – the RBV and the evolutionary economics theory – need to be described.

2.2.1. Early Origins of the Theory

Organizational resources and capabilities receive great interest in the existing literature. The RBV is one of the most common approaches used to investigate the relationship between effective IS usage and organizational performance (e.g., Oh et al., 2012; Rajaguru & Matanda, 2013). The RBV states the importance of the individual organization, as opposed to the industry structure or the environmental selection (Barney, 1991; Hannan & Freeman, 1977). In addition, by considering organizations as a bundle of resources, and assuming that each organization has its own unique combination of resources, the RBV highlights the resource heterogeneity between organizations in an industry (Barney, 2001). According to the RBV perspective, organizations achieve competitive advantage if possessed resources are (1) valuable, (2) rare, (3) inimitable, and (4) have no strategic substitute (Barney, 1991). Nevertheless, these resources only create a

temporary competitive advantage (Wade & Hulland, 2004), which results overall organizational performance reduction over time.

Similar to the RBV, evolutionary economics theory is another commonly used approach that aims to understand how organizations achieve and sustain competitive advantage. It focuses on factors that generate heterogeneity between organizations (Foss, Knudsen, & Montgomery, 1995). According to this theory, variation, selection, and retention are the three key stages of the evaluation (Levinthal, 1995). Accordingly, the evolutionary economics theory emphasizes that organizations gain competitive advantage through evaluation. However, this gained competitive advantage has a limited life and its effect on overall organizational performance will also fade over time.

Although both theories provide a good framework to illuminate how organizations gain competitive advantage over other organizations, they fail to explain how organizations maintain such competitive advantage in a rapidly changing and uncertain environment to rapidly improve their overall organizational performance (Eisenhardt & Martin, 2000). Prior studies show that timely responsiveness, rapid and flexible product innovation, and the capability to coordinate and redeploy internal and external capabilities are key steps for maintaining competitive advantage for organizations (Cao & Ramesh, 2007; Storer & Hyland, 2011; Teece et al., 1997). Therefore, organizations should rapidly modify their existing capabilities and develop new capabilities to improve their overall organizational performance.

2.2.2. Emergence of the Dynamic Capabilities Perspective

A rapidly changing environment forces organizations to frequently change their bundles of resources. The dynamic capabilities theory aims to explain how organizations modify their existing resources to adapt to the changes in the industry or environment and stay competitive for

improved organizational performance (Zollo & Winter, 2002). Therefore, dynamic capabilities perspective suggests that the organizational and strategic routines, which create, integrate, and recombine resources, are sources of competitive advantage in a rapidly changing and competitive environment (Eisenhardt & Martin, 2000). In other words, dynamic capabilities are the ability to renew ineffective organizational capabilities by learning and creating new capabilities through innovation.

Organizations use their assets , such as technological, financial, reputational, knowledge-based, and managerial, to develop capabilities (Teece et al., 1997; Zollo & Winter, 2002). For that reason, dynamic capabilities theory discusses that the best use of an organization's existing resources involves the continuous adaptation of organizational competencies in order to seize opportunities. Although, organizational performance depends on organizational capabilities, the reconfiguration and realignment of those capabilities are key requirements to keep up with the changing environment.

However, the way in which organizations manage the adaptation to achieve and sustain competitive advantage is unclear. Organizations develop different dynamic capabilities to gain competitive advantage and improve overall organizational performance. Some of these dynamic capabilities focus on integrating or reconfiguring existing internal and external resources, while other dynamic capabilities focus on gaining new resources or creating new routines (Eisenhardt & Martin, 2000). In other words, the dynamic capabilities theory emphasizes that organizations simultaneously explore and exploit organizational competencies in order to be competitive in the global market. Furthermore, previous literature suggests that dynamic capabilities are rooted in simultaneous exploration and exploitation activities (Ancona et al., 2001), and organizational ambidexterity only becomes a dynamic capability when organizations are able to strategically tie

their exploitation and exploration activities together (Raisch & Birkinshaw, 2008). In addition, the IS literature often adopts the dynamic capabilities perspective to investigate the contributions of the implemented IS to organizational performance (Mavengere, 2013; Rajaguru & Matanda, 2013). Therefore, this dissertation uses dynamic capabilities theory to understand how effective ERP usage for SCM helps organizations to explore and exploit in SCM.

2.2.3. Dynamic Capability Perspective of SCM Competencies

What constitutes a dynamic capability is still a debate in the literature (Helfat & Peteraf, 2009). Overall, a capability is considered to be dynamic when that capability provides dynamic improvement and strategic insights for organizations to react to the changes in the environment (Eisenhardt & Martin, 2000; Helfat & Peteraf, 2009; Teece et al., 1997; Zollo & Winter, 2002). Similarly, SCM dynamic capabilities are capabilities that create, extend and modify the SCM routines to meet specific supply chain challenges (Storer & Hyland, 2011). Specifically, SCM explorative competence focuses on creating new SCM routines, whereas the main purpose of the SCM exploitative competence is to modify and extend the existing SCM routines (Kristal et al., 2010).

Although connection between dynamic capability development and SCM competencies is extensively studied in the literature (Kristal et al., 2010; Rajaguru & Matanda, 2013; Storer & Hyland, 2011), the role of effective usage of IS applications on this connection is overlooked. An extensive search of the database *Business Source Complete*, using the keywords “supply chain and dynamic capabilities” reveals a total of 63 peer-reviewed articles. 11 of these 63 articles are related to information systems as well. After a detailed review of these 11 articles, six of them were found to be relevant to this study. The research focus and key finding of these studies are summarized in Table 5.

Authors	Research Focus	Key Findings
Banker, Bardhan, Chang, and Lin (2006)	Plant information system, manufacturing capabilities and plant performance	Examines how manufacturing plants improve plant performance by plant information systems enabled advanced manufacturing capabilities using 1077 U.S. firms. Results emphasize the value of organizational capabilities in studying the impact of IS on plant performance.
Fawcett, Wallin, Allred, Fawcett, and Magnan (2011)	SC connectivity, SC collaboration capability, and operational performance	Examines which information systems influences supply chain performance. Based on 702 survey data collected from managers, the study indicates that investment in information systems increases operational performance through supply chain collaboration capability.
Rajaguru and Matanda (2013)	Inter-organizational capability, IOS integration, and supply chain capabilities	Examines the mediating role of IOS integration on the relationships between inter-organizational compatibility and supply chain capabilities. Using data from the 302, Australian retailing sectors the study concludes that IOS integration significantly mediates the relationship.
Liu, Ke, Wei, and Hua (2013)	IS capabilities, absorptive capability, and organizational performance	Examines how IS capabilities affect organizational performance through absorptive capacity using 286 survey responses. Results show that absorptive capacity fully mediates the relationship between IS capabilities and organizational performance.
Mavengere (2013)	Strategic agility, and collective capabilities	Examines how organizations use IS and adapt organizational futures in order to survive in the competitive environment. Based on case study, results reveal that strategic agility has significant role on organizations' survival.
Cheng, Chen, and Huang (2014)	IS infrastructure flexibility, dynamic capabilities, and innovation performance	Examines the factors influencing innovation performance and implementation in inter-organizational relationships. Based on the data from 260 Taiwanese manufacturing organizations, the results argue that dynamic capabilities improve innovation performance.

Table 5. Key Dynamic Capabilities Studies

Both academics and practitioners view SCM capabilities as key to overall performance improvement in organizations (e.g., Banker et al., 2006; Cheng et al., 2014; Fawcett et al., 2011; Wu et al., 2006). Nevertheless, current knowledge on the effects of effective IS usage on SCM capabilities remains unclear. Recent studies discover that effective IS usage positively influences supply chain capabilities (Rajaguru & Matanda, 2013; Wu et al., 2006). Furthermore, the impact of effective IS usage on organizational performance is mediated by manufacturing capabilities like customer and supplier participation programs and JIT manufacturing (Banker et al., 2006),

supply chain collaboration capabilities (Fawcett et al., 2011), and supply chain agility, such as process integration joint planning, shared value, and visibility (Liu et al., 2013). Additionally, effective usage of IS positively influences the strategic agility of organizations to increase their competitive advantage and organizational performance (Mavengere, 2013). Nevertheless, the mediating effect of SCM competencies, which are developed based on these SCM capabilities, on the relationship between effective IS usage and overall organizational performance are not fully addressed in any of these aforementioned studies. Therefore, the mediating effects of SCM explorative competence and SCM exploitative competence on this relationship should be tested in order to understand how ambidextrous supply chain strategy performs and how it affects the overall organizational performance (Chandrasekaran, Linderman, & Schroeder, 2012).

2.3. ORGANIZATIONAL AMBIDEXTERITY

A detailed survey of the organization ambidexterity literature shows that different names, like reconciling exploitation and exploration, balancing search and stability, the simultaneity of induced and autonomous strategy processes, and synchronizing incremental and discontinuous innovation are used in the literature to label organizational ambidexterity (Raisch & Birkinshaw, 2008). No matter how it is labeled in the extant literature, organizational ambidexterity can be defined as the organizations' simultaneous or sequential pursuit of exploration and exploitation activities to address the conflicting customer demands (Kristal et al., 2010; Ramesh, Mohan, & Cao, 2012). Organizational ambidexterity depends on the assumption that overall organizational success is subject to balancing and integrating conflicting activities, structures, and demands like exploring new opportunities and exploiting old certainties (March, 1991; Schulze, Heinemann, & Abedin, 2008). Therefore, the pursuit of organizational ambidexterity strategy leads to higher

organizational performance (Levinthal & March, 1993), and the tension between exploration and exploitation is the key to long-run survival of organizations (March, 1991). Nevertheless, there is still an ambiguity in the existing literature about the applicability of these two activities together. Even if organizational ambidexterity is possible, there remains a question of how to reach the balance between exploration and exploitation.

The ongoing debate about organizational ambidexterity in the organizational theory and strategic management literatures continues to investigate whether exploration and exploitation can be pursued simultaneously (e.g. Abernathy, 1978; Ancona et al., 2001; Hannan & Freeman, 1977; Schulze et al., 2008). Some of these studies indicate that exploration and exploitation are fundamentally incompatible as they compete for scarce sources that organizations possess (e.g., Ancona et al., 2001; Hannan & Freeman, 1977). In contrast, other studies define exploration and exploitation as complementary capabilities rather than competing capabilities (e.g., Schulze et al., 2008). A third group of studies argue that organizations cannot sustain competitive advantage by just increasing the efficiency of processes (e.g. Abernathy, 1978), rather organizations have to innovate while increasing the efficiency of processes to stay competitive. Therefore, numerous fields, including organizational learning, technological innovation, organizational adaptation, organizational design, and strategic management adopt organizational ambidexterity strategy as a theoretical lens to investigate the simultaneous pursuit of conflicting demands. Consistent with this pursuit of conflicting demands, this dissertation examines the conflicts between alignment and adaptability in supply chain activities.

2.3.1. Forms of Organizational Ambidexterity

Prior literature groups organizational ambidexterity strategy under two mechanisms: (1) structural ambidexterity, which refers to creating separate organizational structures to deal with

conflicting demands at different units; and (2) contextual ambidexterity, the behavioral capacity to simultaneously achieve alignment and adaptability in the same unit (Gibson & Birkinshaw, 2004). Although, the main purpose of both mechanisms is to reach organizational ambidexterity, they take different approaches to achieve that purpose.

Structural ambidexterity divides organizations into two separate structures, like divisions, and assumes that exploration and exploitation are totally different activities which need unique and separate organizational resources (Birkinshaw & Gibson, 2004). Therefore, an organization that adopts structural ambidexterity architecture employs explorative and exploitative activities in two separate divisions, where each division is allocated specifically for either exploration or exploitation. Hence, this dual unit structure helps organizations to balance their exploration and exploitation activities to achieve superior organizational performance (Duncan, 1976).

On the other hand, contextual ambidexterity is the ability to balance the exploration and exploitation activities within a single division structure rather than creating separate divisions for exploration and exploitation (O'Reilly & Tushman, 2013). This architecture highlights parallel structure in a division (Stein & Kanter, 1980), and relies on the decision capability of individuals regarding splitting their time between exploration and exploitation activities.

Organizations might pursue structural ambidexterity strategy by using two separate IOS application for exploration and exploitation activities to deal with conflicting demands in supply chain process. On the other hand contextual ambidexterity architecture allows organizations to deal with these conflicting demands within a single IOS application. Nevertheless, following the structural ambidexterity architecture increases the financial cost, requires more resources that small organizations may not possess, and may cause communication and collaboration problems between exploration and exploitation activities (Birkinshaw & Gibson, 2004). In addition, prior

literature suggests that relying on individuals' capability to balance exploration and exploitation is effective given the proper contextual setting (Chandrasekaran et al., 2012). Consequently, the contextual ambidexterity is used in this dissertation.

2.3.2. Ambidextrous Supply Chains

In line with the organizational ambidexterity strategy, any SCM related problems should be addressed with balanced exploration and exploitation activities. Therefore, organizations are forced to adopt the ambidextrous supply chain strategy. The ambidextrous supply chain strategy offers the simultaneous pursuit of exploration and exploitation activities for SCM. Exploration in the supply chains refers to the continuous search for new ideas and new knowledge within the supply chain. In other words, it contains activities to develop new product or process domains to address market changes (Abernathy & Clark, 1985). In contrast, exploitation leverages current supply chain capabilities and improves them to reach lower cost and greater reliability (Barnes, Hinton, & Mieczkowska, 2004). Hence, exploitation in SCM requires constant improvement of the existing capabilities of products and processes (He & Wong, 2004). Further, the cultivation of an organization's dynamic SCM capabilities requires an effective blend of exploitation and exploration actions (Eisenhardt & Martin, 2000).

Even though the concept of an ambidextrous supply chain is gaining importance in both industry and academia, there is still little known regarding its influence on overall organizational performance. An extensive search of the database *Business Source Complete* using the keywords "supply chain, ambidexterity, exploration and exploitation, and performance" reveals a total of 19 peer-reviewed articles. After a detailed review of these articles, eight of them were found to be relevant to this research. Theories adopted to develop theoretical frameworks, main research focuses, and key findings of the studies are shown in Table 6.

Authors	Theories	Research Focus	Key Findings
Subramani (2004)	Organizational learning, transaction cost economics	Investments, benefits, and performance outcomes	Examines the benefits of SCMS on suppliers. Based on the data collected from 131 suppliers of the focal organization, results suggest that IS deployment positively influences the buyer-supplier relationship.
Sanders (2008)	Organizational learning, transaction cost economics	Organizational coordination and performance outcomes	Examines the relationship between patterns of IS usage and coordination activities. Using data from 241 first-tier suppliers, the study finds that, to realize total benefits, suppliers have to use IS for both exploration and exploitation.
Im and Rai (2008)	Semiotic theory	Ambidexterity, and performance outcomes	Examines the effects of exploratory and exploitative knowledge sharing on the performance using 76 pair survey. Results suggest that the long-term performance is affected by exploratory and exploitative KS.
Kristal et al. (2010)	Dynamic capabilities, KBV, law of requisite variety	Capabilities, performance outcomes	Examines the effects of ambidexterity on competitive capabilities of manufacturers. Based on the data provided from 174 manufacturers, results suggest that ambidextrous supply chain improves these capabilities and performance.
Oh et al. (2012)	RBV, organizational learning	Antecedents, ambidexterity, and performance outcomes	Examines the effects of service delivery systems to customers using 125 retailers. The results suggest that IS usage increase the efficiency for current offerings, and innovativeness for future offerings.
Li (2012)	Organizational learning	Planning, forecasting & replenishment, and performance outcomes	Examines the role of EIS on supply chain collaboration (SCC) in China based on 177 organizations. Results indicate the importance mediating role of SCC on the relationship between IS and organizational performance.
Blome, Schoenherr, and Kaesser (2013)	Complementarity theory	Ambidextrous governance, and performance outcomes	Examines the effect of ambidextrous governance on innovation and cost performance. Based on 97 European organizations, the study finds that ambidextrous governance positively affect innovation and cost performance.
(Im & Rai, 2014)	Coordination theory	Antecedents, contextual ambidexterity, and performance outcomes	Examines the mediating role of contextual ambidexterity on the relationship between IOR coordination structure and relationship outcomes based on 76-paired surveys. Results support the mediating effect of contextual ambidexterity.

Table 6. Major Ambidextrous Supply Chain Strategy Studies

Furthermore, only three of the eight articles examine the role of effective IOS usage in ambidextrous supply chains context (Li, 2012; Sanders, 2008; Subramani, 2004). These three

studies focus on effective IS usege for exploration and exploitation; nevertheless, they do not clearly identify whether the IS application used for exploration and exploitation is the same or not. First, Subramani (2004) concantrates on the benefits of suppliers from effective IOS usage. He approaches IOS as a direct platform for exploration and exploitation. The results indicate that suppliers benefit from effective IOS usage. Yet, findings of that study cannot be generalized due to the limited scope of the sample data used in the analysis. Following that, Sanders (2008) adds to Subramani (2004)'s research by using data from the computer industry and tests the realized benefits of supplier from effective IOS usage. She also considers IOS as the direct platform for exploration and exploitation. Finally, Li (2012) investigates a similar relationship in the Chinese enterprise ownership setup. The results show the differences in using EIS for exploration, based on the enterprise ownership setup. Yet, this study also focuses on the use of enterprise systems as a direct platform for exploration and exploitation. Therefore, none of these studies attempts to understand the value of IOS applications as an indirect platform to increase the exploration and exploitation capabilities of organizations. As a result, the effect of IOS, as an indirect platform, on SCM explorative and exploitative competence needs to be identified.

2.3.3. Antecedents of Organizational Ambidexterity

Previous literature studies antecedents of organizational ambidexterity using quantitative and qualitative research, and cross-sectional and longitudinal settings (Cao & Ramesh, 2007). Antecedents of ambidexterity can be grouped in three broad approaches (Chandrasekaran et al., 2012; Raisch & Birkinshaw, 2008): (1) structural antecedents, (2) leadership-based antecedents, and (3) contextual antecedents.

Structural antecedents focus on structural mechanisms to deal with conflicting demands faced by organizations for adaptability and alignment. These mechanisms are grouped as spatial

separation and parallel structure concepts (Chandrasekaran et al., 2012). Spatial separation solves the ambidexterity problem by creating separate units that each unit pursue one of the exploration or exploitation strategies at a time (Duncan, 1976). On the other hand, parallel structure allows organizations to switch between exploration and exploitation strategy, based to the requirements of a task (Stein & Kanter, 1980). Further, sensing, seizing, and reconfiguring are identified as the antecedents of structural ambidexterity (O'Reilly & Tushman, 2008).

The role of leadership is vital in organizational ambidexterity development (Beckman, 2006; Perretti & Negro, 2006). Leadership-based antecedents aim to develop internal processes of top management teams (TMTs) to facilitate ambidexterity (Raisch & Birkinshaw, 2008). The characteristics of TMTs are vital leadership-based antecedents of organizational ambidexterity. These characteristics of TMTs include factors such as team composition (TMT member's prior affiliation, and mix between newcomers and old-timers), leadership traits, decision-making risk, and consensus between TMT members and behavioral integration (Beckman, 2006; Lubatkin et al., 2006; Perretti & Negro, 2006).

Contextual antecedents focus on creating a supportive organizational context that are the systems, processes, and beliefs that shape the behaviors of individuals in an organization (Raisch & Birkinshaw, 2008; Ramesh et al., 2012). Even though there is no consensus on the antecedent of the contextual structure, the organizational context can be categorized under social context and performance management (Gibson & Birkinshaw, 2004). Discipline, stretch, support, and trust are used to measure organizational context. While hard elements (discipline and stretch) represent performance management, soft elements (support and trust) represent social context. Strong presence of both categories of organizational context is crucial for true ambidexterity in an organization (Birkinshaw & Gibson, 2004). Furthermore, initiative, cooperation, relationship

brokering and multitasking of individuals (Birkinshaw & Gibson, 2004), mechanisms that help promoting communication between different organization levels (Chandrasekaran et al., 2012), retail routines (Oh et al., 2012), and inter-organizational relationship structure (Im & Rai, 2014) are identified as the antecedents of the contextual structure as well. This research aims to focus on the inter-organizational relationship structure, by exploring the role of ERP as an antecedent of ambidextrous supply chain strategy.

2.3.3.1. ERP as an antecedent of Ambidextrous Supply Chain Strategy

Despite the fact that previous literature tries to identify the antecedents of organizational ambidexterity, the strategic management literature only measures the behavior of individuals in the organizational context. However, in today's competitive business environment, individuals' behaviors are restricted or enhanced by the IS applications that they use. Especially, use of ERP causes massive behavioral change (Wallace & Kremzar, 2002). The adaptation of ERP reduces transaction cost. Yet, the main benefit of ERP implementation could go beyond the transaction cost reduction (Straub & Watson, 2001). ERP allows focal organizations to communicate with their supply chain partners via the Internet. It enables collaboration and real time information exchange between supply chain partners. This enables focal organizations to develop explorative and exploitative competencies as collaboration and information exchange helps them to identify ways to improve processes and new venues of opportunity that increases the ambidexterity level in SCM. Thus, effective ERP usage may help organizations to pursue ambidextrous supply chain strategy by supporting development of SCM explorative and exploitative competencies.

2.3.3.2. Impact of ERP usage on SCM Competencies Development

Advances in IS applications has transformed supply chains into supply chain networks. Supply chain network partners are interconnected in real time to meet customer demands. IOS

applications are critical for SCM in this new structure (Rajaguru & Matanda, 2013). ERP is an IOS that connects the sales and marketing, financials, human resources, and SCM functions of organizations in supply chain networks. Specifically, the integration of SCM processes supports supply chain networks to function more effectively. All eight key SCM processes are essential for a competitive supply chain network. Nevertheless, the front and end SCM processes (CRM, CSM, and SRM) are the focus of this dissertation as these three processes obtain the information exchange and collaboration between supply chain partners.

The IS literature shows the critical value of IS usage to successfully realize the potential benefits of the implementation of any IS application (DeLone & McLean, 1992; Shi et al., 2010). In addition, dynamic capabilities theory states that, by learning and creating new capabilities, organizations renew their ineffective capabilities (Eisenhardt & Martin, 2000). Furthermore, the existing literature on SCM shows that supplier relationship management (SRM) mainly focuses on improving the efficiency capabilities, whereas customer relationship management (CRM) and customer service management (CSM) mainly aim to improve the innovation capabilities (Carr & Pearson, 1999; Li, Humphreys, Yeung, & Cheng, 2007; Lin, Chen, & Kuan-Shun Chiu, 2010). Nevertheless, these studies do not attempt to investigate the unique influences of these processes through ERP. Therefore, the direct influences of effective ERP usage for CRM, CSM, and SRM processes on SCM explorative competence and SCM exploitative competence are unknown. In line with these arguments, focal organizations should develop SCM explorative competence and SCM exploitative competence as a realized benefit of effective ERP usage. Mainly, CRM, CSM, and SRM processes, which are ERP based front and end SCM processes, should influence these competencies as they connect supply chain partners. Therefore, this dissertation hypothesizes that:

H_{1a}: The greater the use of ERP to manage CRM process in an organization, the greater the SCM explorative competence will be.

H_{1b}: The greater the use of ERP to manage CRM process in an organization, the greater the SCM exploitative competence will be.

H_{2a}: The greater the use of ERP to manage CSM process in an organization, the greater the SCM explorative competence will be.

H_{2b}: The greater the use of ERP to manage CSM process in an organization, the greater the SCM exploitative competence will be.

H_{3a}: The greater the use of ERP to manage SRM process in an organization, the greater the SCM explorative competence will be.

H_{3b}: The greater the use of ERP to manage SRM process in an organization, the greater the SCM exploitative competence will be.

2.3.4. Outcomes of Organizational Ambidexterity

Organizational ambidexterity is one of the most heavily explored concepts in the strategic management literature (Raisch & Birkinshaw, 2008). Despite the attention received in the prior literature, whether organizational ambidexterity leads to better organizational performance is still an understudied area in the existing literature (O'Reilly & Tushman, 2013). Organizations face the risk of being average on both exploration and exploitation while they aim to balance these activities (Schulze et al., 2008). Further, organizations that engage in exploitation might realize higher and more predictable return on investment for each dollar that they spend for IS compared to exploring organizations, since the exploration activities are more costly and more risky then exploitation activities (He & Wong, 2004). In contrast, organizations may fall into a success trap

or failure trap, if they pay more attention on one of these activities over the other (Levinthal & March, 1993; Ramesh et al., 2012).

Moreover, the effects of organizational ambidexterity on overall performance outcomes depend on the form of the organizational ambidexterity architecture (e.g., Im & Rai, 2008). It is possible to operationalize organizational ambidexterity using an addition (Gibson & Birkinshaw, 2004), absolute difference (He & Wong, 2004), or multiplication (Birkinshaw & Gupta, 2013) model, based on the architecture. Besides, it is reasonable to argue that there might be a u-shaped relationship between organizational ambidexterity and organizational performance outcome, if the organizational ambidexterity is assumed to be a continuum instead of two separate constructs (Hsu et al., 2013).

Even though, prior studies reveal that ambidextrous organizations tend to outperform its competitors (e.g., Blome et al., 2013; Hsu et al., 2013; Im & Rai, 2008, 2014), there are a limited number of studies in the literature that adopt an organizational ambidexterity concept to analyze the effects of ambidexterity in SCM in the operations research and SCM field (e.g., Kristal et al., 2010; Oh et al., 2012).

However, organizational performance is an extensive concept. As Raisch and Birkinshaw (2008) indicated, it can be categorized in three types of organizational outcome: (1) accounting (profitability) (Blome et al., 2013; Kristal et al., 2010; Sanders, 2008), (2) growth (productivity) (He & Wong, 2004; Li, 2012), and (3) market (value) (Kristal et al., 2010; Li, 2012; Oh et al., 2012). Prior literature on organizational performance explores the influence of all three aspects of organizational performance in a variety of different contexts. Particularly, the business value of IS literature numerously tests all three aspects in different combinations to understand the role of IS investment on organizational performance (e.g., Dedrick et al., 2003; Hitt & Brynjolfsson,

1996). Therefore, this dissertation considers all three outcomes of organizational performance to investigate performance change in detail.

2.3.4.1. Impact of SCM Competencies on Organizational Performance

Prior literature shows that dynamically changing SCM capabilities positively influence organizational performance (Banker et al., 2006; Cheng et al., 2014; Fawcett et al., 2011; Wu et al., 2006). Yet, these studies focus on different types of SCM capabilities, such as manufacturing capabilities, supply chain collaboration capabilities, and supply chain agility. No study, to our knowledge, specifically explores the impact of SCM explorative and exploitative competencies on overall organizational performance. SCM explorative and exploitative competencies are the two key capabilities that allow focal organizations to improve existing routines and create new routines for SCM. Therefore, the influences of these two competencies on overall organizational performance should be investigated.

Organizations that develop SCM exploitative competence improve the efficiency of their existing services and processes. In addition, SCM exploitative competence allows organizations to reduce their operating costs (Barnes et al., 2004) and effectively utilize their assets (Straub & Watson, 2001). In contrast, focal organizations that concentrate on SCM explorative competence development are more innovative than their competitors are (Lubatkin et al., 2006). Furthermore, SCM explorative competence enhances organizations' ability to respond quickly to changes by discovering new ways to improve SCM processes (Abernathy & Clark, 1985). Thus, creating new SCM routines and improving the existing ones should positively influence organizations' overall performance. However, the influence of SCM explorative and exploitative competencies on overall organizational performance is not clear. Especially, whether they influence all three outcomes (profitability, market value, and productivity) or just one or two of these outcomes are

not known. Hence, drawing from the evidence from the literature and dynamic capabilities, the study hypothesizes that:

H_{4a}: The greater the SCM explorative competence in an organization, the better the profitability of the organization will be.

H_{4b}: The greater the SCM explorative competence in an organization, the better the market value of the organization will be.

H_{4c}: The greater the SCM explorative competence in an organization, the better the productivity of the organization will be.

H_{5a}: The greater the SCM exploitative competence in an organization, the better the profitability of the organization will be.

H_{5b}: The greater the SCM exploitative competence in an organization, the better the market value of the organization will be.

H_{5c}: The greater the SCM exploitative competence in an organization, the better the productivity of the organization will be.

2.3.4.2. Impact of Ambidextrous Supply Chains on Organizational Performance

Development of SCM explorative and SCM exploitative competencies can be critical for overall organizational performance. Organizations that fail to balance these two competencies perform poorly compared to organizations that can balance them (Schulze et al., 2008). Previous research indicates that concentrating too much on exploitation results in a success trap, whereas concentrating too much on exploration results in a failure trap (Levinthal & March, 1993), and dynamic capabilities are rooted in simultaneous exploration and exploitation activities (Ancona

et al., 2001). However, organizations implement ERP to improve efficiency through exploitation. In other words, organizations mainly use ERP for exploitation and not for exploration (Sanders, 2008). Therefore, there is an inevitable influence of the ERP on exploitative competence, but the previous literature does not to address whether ERP implementation creates any opportunity for explorative competence development or not. No study, to our knowledge, explicitly inspects the moderating effect of SCM explorative competence and SCM exploitative competence on overall organizational performance. Such moderation may help to understand the role of ambidextrous supply chain strategy on overall organizational performance, as the interaction variables between SCM explorative competence and SCM exploitative competence can be used as the proximity measure for ambidexterity level of organizations. Hence, based on these arguments, this study postulates the following hypotheses to investigate the interaction effect of SCM explorative and exploitative competencies:

H_{6a}: The higher the ambidexterity levels of SCM competencies in an organization, the better the profitability of the organization.

H_{6b}: The higher the ambidexterity levels of SCM competencies in an organization, the better the market value of the organization.

H_{6c}: The higher the ambidexterity levels of SCM competencies in an organization, the better the productivity of the organization.

Overall, the theoretical framework proposed in this study examines three main questions. First, it explores the extent to which effective ERP usage for SCM improves SCM explorative and SCM exploitative competencies of organizations. Second, it investigates the direct influence

of these competencies on overall organizational performance. Finally, this dissertation explores the influences of ambidextrous supply chain strategy on overall organizational performance by investigating the moderating effect of SCM explorative competence on the relationship between SCM exploitative competence and overall organizational performance. Figure 6 illustrates the proposed theoretical framework.

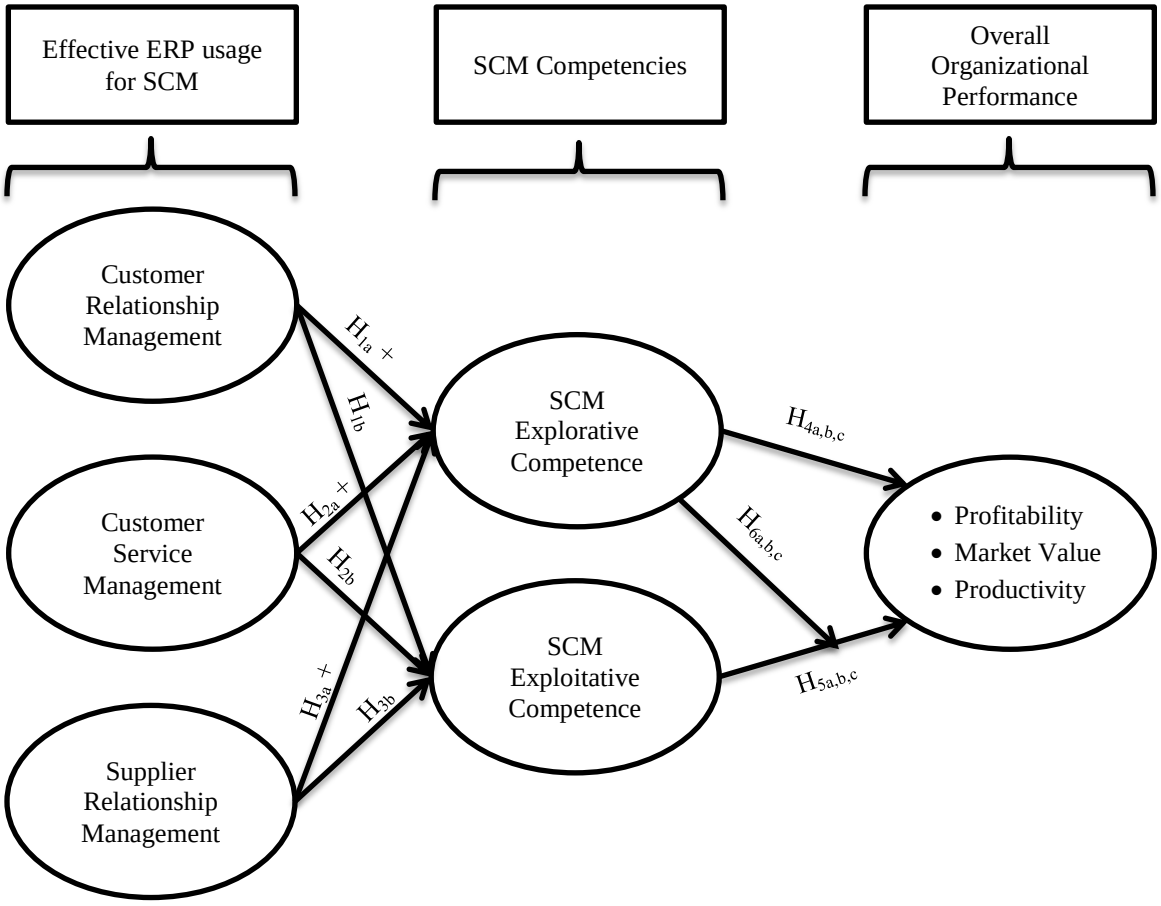


Figure 6. Theoretical Framework

CHAPTER 3

3. RESEARCH DESIGN AND METHODOLOGY

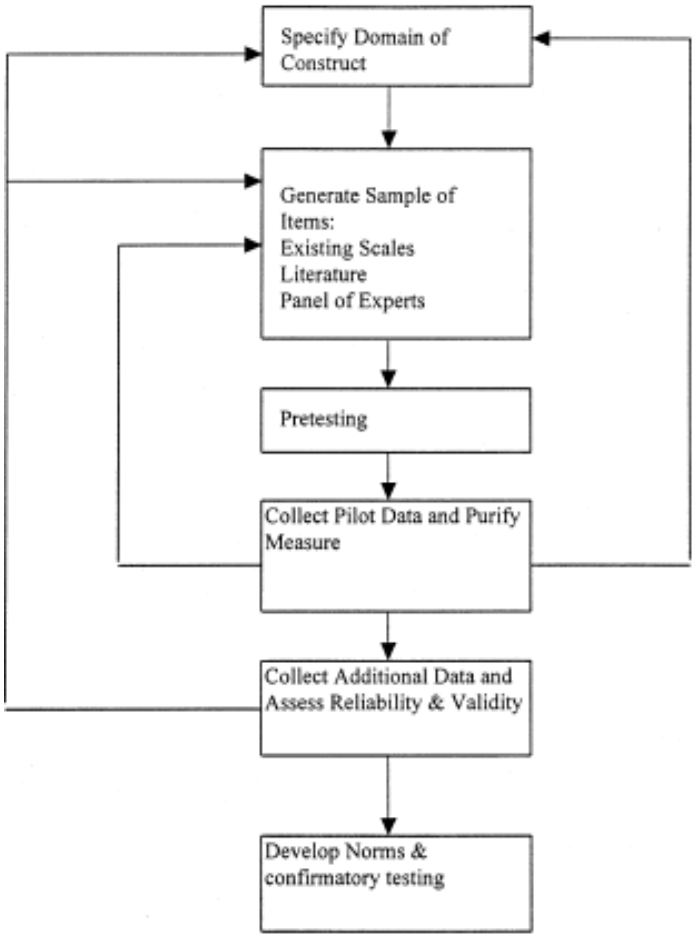
This chapter describes the research design and the methodology that is employed in the dissertation. First, the research design, including the survey research steps and sampling frame selection, is described. After that, instrument development steps like item generation, validity, and reliability test are discussed. Next, the data collection procedure and sample characteristics are explained. Finally, the statistical method that is used to test the hypotheses is defined.

3.1. RESEARCH DESIGN

A number of designs have been used to collect data in IS research including interviews, case studies, field experiments, established datasets, etc. (Kim, Cavusgil, & Calantone, 2006; Yaylacicegi & Menon, 2004). These designs can be categorized under qualitative research and quantitative research. Qualitative research is usually used for exploratory research and theory development, whereas quantitative research is used to provide rigorous testing to confirm the exploratory model (Hair et al., 2006). Each design has its own advantages and disadvantages. Suitable research design for a study is determined by the objective of that study, nature of the research question, and the stage of the theory development process. As the main purpose of this study is to explore the causal relationship between effective ERP usage, SCM competencies, and overall organizational performance, quantitative research is more suitable for this research. To explore such causal relationship each construct must be measured by observed indicators. In a large-scale survey, questions serve as an observed indicator for a construct. In addition, survey research allows rigorous testing of the explanatory models as this study proposes. Hence, survey research design is chosen to test the proposed theoretical framework.

3.1.1. Survey Research Steps

This dissertation adopts Malhotra and Grover (1998)'s measurement scale development framework to reduce the measurement error. The framework is shown in Figure 7.



source: Adapted from: Malhotra and Grover (1998)

Figure 7. Measurement Scales Development Framework

In line with this framework, first, construct domains and their associated variables were specified based on the theoretical background. After that, samples of measurement items for each construct and definitions of the constructs were generated based on prior literature. Following

that, the instrument was pretested and the content validity of the constructs was assessed. Next, a pilot study was conducted using the Q-sort methodology to assess the initial convergent validity, discriminant validity, and reliability. The survey instrument was purified based on the results of the pilot study. Finally, a large-scale web survey was launched. A cover letter (See Appendix A), which explains the purpose of the dissertation, was attached to the web survey. Once the data were collected, reliability and validity tests were performed to evaluate the measurement models. Using the validated model, partial least square SEM (PLS-SEM) was employed to investigate the direct and indirect relationships between effective ERP usage, SCM competencies, and overall organizational performance constructs. The details of these steps are outlined in § 3.2 and § 4.2, but before that, the population and sampling framework of this study is discussed in § 3.1.2.

3.1.2. Population and Sample Selection

3.1.2.1. Unit of Analysis

Supply chain networks involve suppliers and customers as the network partners. Hence, investigating dyadic relationships sounds logical in a SCM research context. However, the focal organization is the leader of its supply chain network. When it comes to decision making, such as selecting which IOS to implement and which supply chain partners to include, the leader of the supply chain network is in charge (Levinthal, 1995). Moreover, the organizational-unit level of analysis is recommended in a study of contextual ambidexterity (Birkinshaw & Gibson, 2004).

Thus, in line with the literature (e.g. Lee et al., 2014; Liu et al., 2013), the unit of analysis of this dissertation is the focal organization from various industries in the U.S. The respondents are instructed to answer to the questions from their organization's point of view, while keeping the entire supply chain network in mind. The questions intend to investigate the importance of effective ERP usage for the front and end SCM processes — CRM, CSM, and SRM.

3.1.2.2. Key Informants (Respondents)

Identifying key informants is a critical issue as the proposed model aims to understand the relationship between effective ERP usage, SCM competencies, and overall organizational performance. The 'key informant' approach offers a guideline when selecting single strategic-level manager per organization as informants. Based on this approach, key informants need to be chosen based on their position, experience, and specialized knowledge (Huber & Power, 1985).

Previous studies in this domain identify CEOs (He & Wong, 2004), production managers (Cheng et al., 2014), supply chain managers and operations managers (Kristal et al., 2010) as key informants because they are the most knowledgeable people about the strategic issues of ERP usage and SCM. Hence, targeted key informants should hold one of these aforementioned titles and should have experience and knowledge in both SCM and ERP used in the organization in order to provide accurate responses. Further, focal organizations that have implemented ERP in the past should be targeted.

3.1.2.3. Target Sampling Frame

The targeted sampling frame is drawn from U.S. organizations only. Therefore, the most suitable sampling frame, to increase the generalizability of the results for this dissertation, is the members of Institution of Supply Management (ISM) for two reasons. First, ISM is the first and one of the largest global supply chain management organizations and it is a highly respected and effective SCM organization in the global market. Second, U.S. members of the institution cover a wide range of industries across the entire country. The LinkedIn group of the ISM had more than 70,000 members at the time of data collection. To collect data, upper level managers, who hold titles such as CEO, production manager, supply chain manager or operations manager in their organization, are reached via LinkedIn group of the ISM.

This study adopts the survey research approach as a data collection tool, because of its capability to reach a large number of respondents (Dillman, Smyth, & Christian, 2014). A web survey and LinkedIn are used to increase the effectiveness of the survey approach and to reach as many respondents as possible. A list of qualified informants with the appropriate title is obtained by using the "advanced people search" tool.

The LinkedIn search revealed 1466 eligible members of ISM. 34 of these 1466 members could not be reached because of their privacy restrictions. Consequently, a participation request message including the web survey link was sent to the 1432 eligible ISM members via LinkedIn, and they were asked to complete the survey. Following that, a reminder message was sent two weeks later than the initial message.

Seven of these 1432 potential respondents declined to participate to the research because the formal policy of their organizations forbids them. Another 14 respondents indicated that they were not qualified to participate because their organization did not use SCM module of ERP. Of the remaining 1411 eligible respondents, 238 of them agreed to participate; however, only 176 of them completed the survey (12% response rate). Out of the 176, 63 responses were removed due to missing data that resulted in 113 usable responses (8% effective response rate). The informant feedbacks indicated that missing data occurred mainly because the informants did not know the answers and/or they were not comfortable answering such sensitive questions.

3.1.2.4. Nonresponse Bias

The first concern in survey research is that data collected from respondents might cause nonresponse bias. This is an outcome of the lack of participation of respondents in the survey. Respondents that choose not to participate can change the characteristics of the sample frame and cause a non-representative sample (Dillman et al., 2014), which limits the generalizability of the

results. Thus, it is critical to test the nonresponse bias before proceeding with data analysis. It is tested using one of two common methods: (1) the independent t-test and (2) chi-square test.

In line with the prior literature, nonresponse bias was assessed by comparing the business characteristics, such as number of employees, revenue, and industry of early and late respondents (Armstrong & Overton, 1977). Early informants were defined as the informants who completed the survey in the first two weeks. As a result, 56.64% of the informants were classified as early informants. Nonresponse bias was tested individually for all possible comparisons between the means of the two groups (early vs. late respondents). The chi-square test was conducted because of the nominal structure of the variables. Results of the chi-square test indicated no evidence of significant differences between early respondents and late respondents (see Appendix F). Hence, the nonresponse bias was not a serious concern in this study.

3.1.2.5. Sample Size and Power Analysis

Identifying the sample size is a crucial to determine whether it provides enough statistical power for testing the proposed model. Prior literature suggests that sample size can be driven by a power analysis (Cohen, 1988) or 10 times rule of thumb (Hair et al., 2014). The 10 times rule of thumb indicates that the minimum sample size needs to be equal to the larger of: (1) 10 times the largest number of formative indicators used to measure a single construct, or (2) 10 times the largest number of structural paths directed at a particular construct in the structural model. On the other hand, power analysis measures the probability of rejecting a false null hypothesis. It is a function of the effect size, sample size, and alpha level (Cohen, 1988).

When calculating the required minimum sample size, the recommended effect size for power analysis is 0.02, 0.15 and 0.35 respectively for small, medium and large size effects (Hair et al., 2014). Furthermore, it is customary to consider alpha at a level of 5% or 1%. Finally, the

minimum suggested power is 80%. Moreover, the maximum numbers of predictors for a latent construct needs to be determined to assess minimum sample size.

In order to identify the minimum sample size needed, G*Power 3.1.9.2, which is software for statistical power analysis, is used. The F test for linear multiple regression to estimate fixed model considering R^2 deviation from zero is chosen, as the PLS models are estimated through a series of multiple regressions (Chin, 1998b). The maximum number of predictors (measures) for a latent construct is six. Therefore, for medium effect size (0.15) at an alpha level of 5% with six predictors, the minimum sample size is predicted to be 98 to reach at least 80% statistical power. Further, based on the 10 times rule of thumb, the minimum sample size is 60, since the largest number of structural paths directed at a particular construct is six. Thus, the minimum number of observations required to reach powerful statistical results is determined as 98.

In order to determine the power of the statistical analysis, a post hoc analysis was run in G*Power 3.1.9.2 software. Medium effect size of 0.15 at alpha level of 5% with six predictors was specified. When the sample size was 113, the power of the test was 87%. This indicated that the sample size of this dissertation was large enough to test the hypotheses using the developed measurement model because the statistical power of the study was larger than 80%, which is the minimum required statistical power in a study.

3.2. DEVELOPMENT AND VALIDATION OF MEASUREMENT SCALE

3.2.1. Step 1: Construct Domain Specification

This dissertation consists of four main constructs: (1) effective ERP usage for SCM, (2) SCM explorative competence, (3) SCM exploitative competence, and (4) overall organizational performance. These constructs are extracted from the relevant literature (Kristal et al., 2010; Oh

et al., 2012; Sanders, 2008; Subramani, 2004), as described in previous chapters. Additionally, SCM ambidexterity is captured by multiplying the SCM competency scores.

It is important to identify appropriate measurement scale for a construct in an empirical study to ensure the validity and reliability of all constructs. Validity (discriminant, convergent, and content) indicates whether the developed items measures the intended construct, whereas reliability indicates the stability of the instrument and the consistency of all measures (Nunnally, 1978). Content validity is critical for developing good measures. Content validity means that the instrument covers the major content domain of each construct (Li, 2012). It is usually achieved by conducting a comprehensive literature review and consulting experts. Additionally, construct validity indicates the agreement between measurement items that measure the same construct (Nunnally, 1978). Two related concepts, convergent validity and discriminant validity, are used to evaluate construct validity. Although both construct validity and reliability can be examined with the Q-sort method, there are additional methods to verify validity and reliability.

Hence, as a second step, measurement items are generated through an extensive literature review (§ 3.2.2). Next, the developed questionnaire is pretested to assess the content validity (§ 3.2.3). Finally, a pilot study is conducted using the Q-sort method to evaluate the reliability and the validity of all measures (§ 3.2.4).

3.2.2. Step 2: Item Generation

All constructs are compiled from the pre-developed scales through an in-depth review of the relevant literature. When pre-developed scales require significant deviation, modifications are made and new measures are developed based on suggestions from prior literature (Malhotra & Grover, 1998; Moore & Benbasat, 1991). All constructs are measured on a 7-point Likert scale to indicate the extent to which respondents agree or disagree with each statement.

The final survey includes five parts. The first part has two screening questions to confirm that respondents hold preferred titles and their organizations have implemented ERP for SCM. The second part collects organizational-level demographic characteristics such as total revenue, the line of business (industry), and number of employees. The third part requires participants to evaluate their organization's performance compared to their major competitors' performance. The fourth part involves a series of questions about effective ERP usage for SCM. The fifth part provides an option for respondents to indicate any additional comments and to request a copy of the results and summary by entering an e-mail address (see Appendix B).

3.2.2.1. Effective ERP usage for SCM Measures

Effective ERP usage for SCM construct is defined as "using ERP effectively to improve the efficiency and innovation in front and end processes of SCM." Front and end processes of SCM consist of CRM, CSM, and SRM. However, no study in the literature has developed a scale to measure effective ERP usage for SCM. Subramani (2004) and Sanders (2008) measure the effective IS usage for exploration and exploitation. However, these studies do not investigate the communication for SCM front and end processes via ERP usage. Additionally, Ifinedo (2007) and Karimi, Somers, and Bhattacherjee (2009) measure ERP success in general. However, these studies do not specifically measure the success of communication between supply chain partners as well. Thus, a customized scale is developed to measure effective ERP usage for SCM based on the similar scales developed by Subramani (2004), Ifinedo (2007), Sanders (2008) and Karimi et al. (2009). Each of the three SCM front and end processes are measured with the same 6-item Likert scale, anchored at 'Not at all' (1), 'to a great extent' (7), and 'somewhat same' (4). Q6a of the survey measures effective ERP usage for CRM, Q6b of the survey measures effective ERP usage for CSM, and Q6c of the survey measures effective ERP usage for SRM.

3.2.2.2. SCM Competencies Measures

SCM competencies are split into two competencies: (1) SCM explorative competence and (2) SCM exploitative competence. SCM explorative competence is defined as 'finding new methods or different ways to use existing SCM processes to offer presently unavailable supply chain activities,' whereas SCM exploitative competence is defined as' improving current ways to use existing SCM processes to maintain efficiency and to improve supply chain activities.' Thus, SCM competencies are conceptualized and operationalized as two separate constructs. Oh et al. (2012) measure explorative competence and exploitative competence to explore the effects of IS-enabled retail channel integration capability on organizational performance. This study adopts these competence measures from Oh et al. (2012), to develop the measurement items for SCM explorative competence and SCM exploitative competence. As a result, the SCM competencies are measured with eight-item Likert scale, anchored at 'Not at all' (1), 'to a great extent' (7), and 'somewhat same' (4). Of the eight measures of Q7 of the survey, first four items measures SCM exploitative competence, and last four items measures SCM explorative competence.

3.2.2.3. Ambidextrous Supply Chain Measure

Organizational ambidexterity is measured in various ways in the existing literature. While some papers measure it as an addition (A+B) model (Gibson & Birkinshaw, 2004), other studies use the absolute difference (A-B) as a balance measure (He & Wong, 2004). Additionally, a third approach is proposed to use the multiplication score (A*B) as an indicator of the organizational ambidexterity level (Birkinshaw & Gupta, 2013). Even though they are all logical approaches, the balance measure is the most problematic because an organization that performs poorly on both exploration and exploitation would appear as an ambidextrous organization on the balance measure. In contrast, when the addition model is used, the differences would be too close, and it

would be hard to distinguish which organization is actually better than other organizations. Thus, this study uses interaction of SCM explorative competence and SCM exploitative competence to measure ambidexterity of supply chains. The ambidexterity score for each organization is created by multiplying SCM explorative competence level and SCM exploitative competence level of that organization. The ambidexterity score is used to explore the influence of ambidexterity on profitability (Explore*Exploit Profit), market value (Explore*Exploit Market) and productivity (Explore*Exploit Product) of organizations. SCM explorative competence and SCM exploitative competence level of organizations are calculated by averaging the four relevant measurement items for each construct.

3.2.2.4. Overall Organizational Performance Measures

Overall organizational performance is used as an indicator of an organization's success regarding its market and financial goals (Nandakumar, Ghobadian, & O'Regan, 2011). Overall organizational performance can be defined as 'the extent to which SCM competencies contribute to various performance measures at the organizational level (Janvier-James, 2012). This can be measured both at the individual organization level (e.g., Li, 2012) or at the supply chain network level (e.g., Straub et al., 2004). However, since this research focuses on the focal organization in supply chains, individual organization-level measures are adopted. Three general types of overall organizational outcome are used in the prior literature: (1) profitability, (2) productivity, and (3) market value (Raisch & Birkinshaw, 2008).

Prior research examines the relationship between IS investment and these three aspects of organizational performance (Hitt & Brynjolfsson, 1996). Performance outcomes of supply chain activities and effective IOS usage in organizations are vital issues in both the IS and operations management literature. Basically, two different approaches can be followed to measure overall

organizational performance. While some studies use subjective measures based on questionnaire responses (He & Wong, 2004; Li, 2012; Sanders, 2008), other studies use financial measures as objective indicators (Hitt & Brynjolfsson, 1996; Hsu et al., 2013). Both approaches have their own advantages and disadvantages. However, objective indicators are not available for all of the organizations that participated in this dissertation. Consequently, subjective indicators are used to evaluate the organizational performance.

Subjective indicator based scales are used extensively in the prior literature (Chen et al., 2014; Flynn, Huo, & Zhao, 2010; Jeffers, Muhanna, & Nault, 2008; Kaynak, 2003; Kim et al., 2006; Kim, Shin, Kim, & Lee, 2011). Drawing from the prior research, a 12-item Likert scale, which is anchored at 'much worse' (1), 'much better' (7), and 'about the same' (4), is developed to measure the organizational performance. Of these 12 items of Q4 of the survey, first six items measure profitability, middle four items (items 7-10) measure market value, and last two items measure productivity.

3.2.2.5. Control Variable Measures

Previous literature on business value of IS identifies several factors that affect the overall organizational performance. Organizational characteristics are acknowledged as one of the main factors that might significantly affect organizational performance. Organization's size is one of the organizational characteristics that affect overall organizational performance (e.g., Altinkemer et al., 2011). As larger organizations might have more resources devoted for both exploration and exploitation, size might be a main effect on organizational ambidexterity (e.g., Blome et al., 2013). Hence, the effect of the size should be controlled. Additionally, industry characteristics appear to be affecting both organizational performance and organizational ambidexterity (e.g., Oh et al., 2012). As a result, the industry effect needs to be controlled.

In order to control the effect of the organization size, two control variables – number of employees (Q8) and total revenue (Q9) – are measured in the survey. Furthermore, to control the effect of the industry characteristics, a dummy variable for each industry except the base industry is created based on 2-digits NAICS codes, which is identified based on Q3 of the survey. These three control variables are included to the structural model to test their effect on the conceptual model.

3.2.3. Step 3: Content Validity: — Pretesting with Academic and Practitioner Panel

After the measurement items are developed, the survey instrument is pretested to enhance the measurement items and provide additional support for content validity, as suggested in the literature (Chandrasekaran et al., 2012). To do that, measurement items are grouped according to their theoretical construct and they are presented to five experienced faculty members and three practitioners in related areas. Each expert is asked to detect the items that need to be modified and deleted. The goal of the pretesting is to ensure the relevance of each construct's definition and clarify the wordings of the measurement items. Furthermore, redundancies and ambiguities are removed based on the insightful feedbacks from the panel.

3.2.4. Step 4: Construct Validity and Reliability — Pilot Study Using Q-Sort Method

The fourth step is to test the convergent and discriminant validity and reliability of the modified measurement items based on the pretest panel's comments using the Q-sort method. It is an iterative and manual factor sorting method in which initial construct validity and reliability are assessed by the level of agreement between judges (Moore & Benbasat, 1991). Although the Q-sort method offers an assessment for initial reliability, convergent validity, and discriminant validity, other common approaches should also be applied after data collection to ensure validity of the measurement items.

The Q-Sort method is conducted by using a web survey. In the first part, definitions of the three main constructs — effective ERP usage for SCM, SCM explorative competence, and SCM exploitative competence — are provided to the respondents, and they are asked whether the definitions are clear. In the next part, the respondents are asked to act as judges and sort the measurement items (see Appendix C) into appropriate subcategories. Other than these three main constructs, a "not applicable" category is included as a fourth subcategory, so that the judges do not feel obligated to force any item into a subcategory. If the respondents assign any item into a different subcategory than that which was previously conceived, those items are examined for possible clarification.

In this research, measurement items are subjected to three sorting rounds of Q-sorting by two independent judges per round. Two of the six judges are practitioners – an analytics manager and a merchandise distribution center manager– and other four are academics – two professors of information systems and two professors of operations management.

Four different type of measures are calculated for each pair of judges to assess validity and reliability of items: (1) Inter-judge raw agreement scores are calculated by counting number of items that both judges agreed to place into certain category and dividing it by the total number of items. An item is considered as an agreed item when both judges place the item into the same subcategory, even if that subcategory might not be the previously conceived one. (2) Cohen's Kappa (κ) is calculated by using the methodology explained in Appendix D. (3) Perreault and Leigh's index of reliability (Ir) is calculated by using the methodology explained in Appendix E. Finally, (4) item placement ratios are calculated by counting all of the items that were correctly sorted into the targeted subcategory by each of the judges and dividing them by twice the total number of items.

In the first sorting round, a merchandise distribution center manager and an operations management professor participated as judges. The inter-judge raw agreement scores was 0.50, κ was 0.11, I_r was 0.58, and item placement ratios was 0.39 (see Appendix G). All four validity and reliability scores below the acceptable threshold of 0.65 (Moore & Benbasat, 1991). Results of the first round indicated that there were problematic areas in the instrument. Low validity and reliability scores lead to a detailed analysis of the constructs. Based on the feedbacks provided by the judges, it is identified that the label of the one construct — ERP usage efficiency — was not compatible with the definition and measurement items of the construct. Therefore, the label of the construct was modified as "ERP usage effectiveness" before the second round.

The modified instrument was entered into the second round. In this round, an analytics manager and a professor of information systems contributed as two judges. The inter-judge raw agreement score for the second round was 0.64, κ was 0.53, I_r was 0.72, and the item placement ratio was 0.79. Although all four validity and reliability scores were significantly higher than the first round's scores, inter-judge raw agreement score and κ were still below the threshold value. Furthermore, investigation revealed that some measurement items required slight modification and rewording for clarification. These modifications, as well as the modifications made in first round, are shown in Table 7.

Finally, the updated instrument was entered into the final sorting round. A professor of operations management and a professor of information systems served as two judges in the third round. The final inter-judge raw agreement score was 0.86, κ was 0.78, *I*r was 0.90, and the item placement ratio was 0.93. The results indicated a high validity and reliability for all four validity and reliability scores. Consequently, no further iteration was required. Measurement scales of this round are used in the final questionnaire.

Construct	Original Item / Label	Modification	Reasons for Modification
Effective ERP usage for SCM	ERP usage efficiency	ERP usage effectiveness	In the first round, judges stated that the measurement items measure effectiveness rather than efficiency.
Effective ERP usage for SCM	There is a good fit between ERP implementation and SCM process initiatives	There is a good fit between ERP and SCM process initiatives	The results of the second round pointed out that implementation is related to the development process, not the usage process
Effective ERP usage for SCM	Our ERP enhances higher-quality of decision making	Our ERP is used for enhancing higher-quality of decision making for SCM processes	Judges of the second round indicated that the wording of this item is too general and it does not specify SCM processes
SCM Exploitative Competence	We have the ability to improve our shipment accuracy	We have the ability to improve our shipment and delivery accuracy	In the second round, judges emphasized that shipment accuracy lacks completeness of the capability.
SCM Exploitative Competence	We have the ability to improve information sharing with suppliers and customers	We have the ability to improve communication with our suppliers and our customers	The feedback from the second round stated that communication fits better than information sharing in this item's context

Table 7. Construct and Item modifications based on Q-sort Method

3.3. DATA COLLECTION

3.3.1. Institutional Review Board (IRB) Approval

If an empirical research involves data collection from human participants, it is required to obtain approval or exemption from the Institutional Review Board (IRB) at the corresponding university. IRB approval guarantees that the survey questions are developed following specific guidelines so that the study does not harm the rights and welfare of the participants.

Data collection for this study did not begin until the IRB approval was received from the IRB at Old Dominion University (ODU). To get the approval, an application package for an IRB exemption was submitted to the IRB at ODU on December 22, 2014. If needed a full application package would be submitted for full IRB approval. Yet, further application was not necessary, as the written exempt letter from IRB at ODU for this research was received on January 13, 2015.

3.3.2. Data Collection Procedure

Data collection began Jun 4, 2015. The data was collected using a web survey to increase response rate and to lower the response time and data collection cost (Deutskens, De Ruyter, & Wetzels, 2006). Initially, the cover letter and measurement items were uploaded into the online platform and the flow of the questions was tested to determine accuracy and the reliability of the survey. Once the completion and display setting for each measurement item was established and the accuracy of the web survey was proven, a message was sent to the potential respondents via the LinkedIn message tool. The message included an introduction to explain the main purpose the dissertation, the eligibility criteria for participation and invitation to participate, and the web survey link. Two weeks after the first message, a reminder was sent to those who did not respond to the original participation request.

Potential respondents had the opportunity to accept or decline to participate in the survey. The first page of the web survey displayed the cover letter. The second and third pages had the two screening questions. Respondents that answered yes to both screening questions were given access to the survey questions (see Appendix B). Any participant who wished not to complete the survey could opt out by simply closing the web browser at any time.

To maximize the response rate, the questionnaire was carefully developed and validated through pretesting and pilot studies. Further, the questionnaire was deliberately kept short. The average response time was below 5 minutes. Additionally, in the cover letter, the objective and importance of the dissertation were clearly explained and it was emphasized that this study was a part of a Ph.D. dissertation. Additionally, the confidentiality of the information provided in the survey was guaranteed and no questions requesting sensitive information were asked. Finally, an executive summary of results of the study was offered to provide an incentive to the respondents.

3.3.2.1. Advantages of Web Survey

Web survey is chosen as the data collection approach to reach as many respondents as possible in relatively short amount of time. Web survey provides faster response compared to mail survey, particularly after the increasing usage of smartphones, which increases connectivity to the Internet (Dillman et al., 2014). Additionally, web survey is relatively cheaper, as there are no mailing or printing expenses (Simsek & Veiga, 2001).

Other than the low cost and fast response, web surveys provide additional advantages. Web surveys allow researchers to transmit nonverbal cues, such as audio or video, reach a higher response rate, avoid human errors during data entry as there is no need for data entry, and access a unique, worldwide population (Deutskens et al., 2006; Simsek & Veiga, 2001; Wright, 2005; Zutshi, Parris, & Creed, 2007). In addition, unlike mail surveys, web surveys offer the flexibility to add, delete, or edit questions for error correction after the survey is launched. Web surveys provide sophisticated tools to improve the accuracy and effectiveness of the questionnaire. For example, researchers can determine mandatory questions, so that they ensure there is no missing data in critical questions. In addition, the flow of the survey can be manipulated and a block of questions can be skipped based on the answers of the respondent to shorten the completion time.

3.3.2.2. Disadvantages of Web Survey

However, web survey method is not error free. Unfortunately, it has few disadvantages. One of the biggest concerns related to web survey is the quality of the sampling frame (Simsek & Veiga, 2001). When using web surveys, researchers need to be sure that the online sampling frame is a good representation of the population, and the entire sampling frame can be accessible (Wright, 2005). More than any other survey methods, web survey method is subject to a higher risk of nonresponse bias and incomplete survey (Zutshi et al., 2007). Thus, researchers should be

cautious when constructing the sampling frame and take extra measures to prevent nonresponse bias.

3.4. METHOD

First-generation statistical techniques, such as analysis of variance (ANOVA), multiple regressions, discriminant analysis, and cluster analysis are powerful techniques that can be used for confirmatory or exploratory research. However, as these methods have several limitations, second generation statistical techniques increased their popularity in recent experimental studies (Hair et al., 2014). Structural equation modeling (SEM), which is a second-generation statistical technique, can analyze relationships among multiple and unobservable variables (Wong, 2013). SEM includes observed (manifest) and unobserved (latent) variables into the model while testing both direct and indirect relationships between constructs (Byrne, 2010). Thus, this dissertation uses SEM, as the purpose is to examine the interrelationship between latent variables.

SEM can be grouped into two main types: (1) covariance-based SEM (CB-SEM) and (2) partial least square SEM (PLS-SEM) (Hair et al., 2014). CB-SEM method takes a confirmatory approach while testing theory based models (Byrne, 2010). Further, it requires assumptions to be met for accuracy, including normal distribution, no missing data, and sufficiently large sample size (Hair et al., 2006). It follows a two-step approach to test the hypotheses. The first step — measurement model — identifies relationships between manifest and unobserved variables. The measurement model establishes the reliability and validity of each variable. The second step of CB-SEM — structural model — tests the structural relationship between latent variables. On the other hand, PLS-SEM is primarily used in exploratory studies (Wong, 2013). Unlike CB-SEM, PLS-SEM does not require normal distribution of data, and it can handle missing values, small

sample size, and complex models (Hair, Ringle, & Sarstedt, 2013). Therefore, this research uses PLS-SEM to test the proposed model.

Unlike CB-SEM, PLS-SEM aims to minimize the error term, and maximize the explained variance of the endogenous (latent dependent) variables (Hair, Ringle, & Sarstedt, 2011). PLS-SEM has two main sub-models: (1) measurement (outer) models, and (2) structural (inner) model (Wong, 2013). Measurement models consist of unidirectional predictive relationships among a latent variable and its observed indicators, whereas the structural model specifies the relationship among exogenous variables (latent independent) and endogenous variables (Hair et al., 2011). Each observed indicator could be associated with only one latent construct.

Further, both models are developed based on two theories: (1) measurement theory, and (2) structural theory (Hair et al., 2014). Measurement theory identifies the relationship between indicator variables and construct variables, and states that PLS-SEM can handle both formative and reflective measurement models (Ringle, Sarstedt, & Straub, 2012). A formative indicator is shown by single-headed arrow pointing toward the construct variable from the indicator variable to represent that the indicator variable causes the latent variable. In contrast, reflective indicators are symbolized by a single-headed arrow pointing from the construct variable to the indicator variable to represent that indicator variables are a function of the latent variable. Additionally, structural theory explains the relationships between latent constructs. The exogenous variables and endogenous variables are determined based on the structural theory (Hair et al., 2014).

Like CB-SEM, PLS-SEM fallows a two-step approach to test the proposed model: (1) assess the reliability and validity of the measurement model, and (2) assess the structural model (Hulland, 1999). § 3.4.1 and § 3.4.2 provide a detailed explanation of this two-step approach, and § 4.2.2 and § 4.3 discuss results of these steps.

3.4.1. Testing the Measurement Model

Unlike CB-SEM, there is not only a single goodness of fit measure available for PLS-SEM. Furthermore, it is important to distinguish between reflective and formative models when assessing the measurement model. Reliability and validity of the reflective model can be tested by individual item reliabilities, discriminant, and validity convergent validity of the individual construct measures (Hulland, 1999). Nevertheless, it is not possible to use traditional evaluation criteria for testing the reliability and validity of the formative model as indicators do not highly correlate (Hair et al., 2011). Thus, the bootstrapping procedure is used to assess the significance of coefficients of the formative indicators. Besides, loadings of the indicators are used to assess the significance of the indicator. If both the weight and loading of an indicator are insignificant, then it needs to be dropped from the measurement model.

3.4.1.1. Measurement and Item Reliability

Measurement reliability tests the internal consistency in a latent variable. It is commonly tested with: (1) Cronbach's alpha (α) (e.g., Kaynak, 2003), (2) correlated-item total correlation (e.g., Shi et al., 2010), and (3) composite reliability (Cheng et al., 2014). However, composite reliability is the recommended method for assessing the item reliability in a PLS-SEM research (Hair et al., 2014). Consequently, composite reliability is chosen to evaluate the reliability of all measures in this study. The suggested minimum composite reliability score is 0.70 (Nunnally, 1978). Any score lower than 0.7 indicates a lack of measurement reliability. In that case, further investigation of item reliability is necessary.

Item reliability is tested by evaluating the measurement loadings (outer loadings) with their respective construct. The loading needs to be, at minimum 0.3 to be considered meaningful, but only loadings higher than 0.7 is accepted as good loadings (Chin, 1998a). Any loading lower

than 0.7 indicates one of three problems: (1) a poorly worded measurement item, which causes low-level reliability, (2) an inappropriate item, which leads to poor content validity, and (3) an improper transfer of an item from one context to another, which raises non-generalizability of the item across contexts (Hulland, 1999). Hence, measurement items with low loadings should be carefully evaluated and dropped if necessary, if there is an indication of low reliability.

3.4.1.2. Convergent Validity

Convergent validity describes the level of each latent construct variance captured by its own measures. It is measured by using at least one of the four common tests: (1) confirmatory factor analysis (CFA) (e.g., Kristal et al., 2010), (2) Cronbach's alpha (e.g., Liu et al., 2013), (3) Fornell and Larcker's internal consistency measure (e.g., Nicolaou et al., 2011) and/or (4) the average variance extracted (AVE) measure (e.g., Wu & Chang, 2012). The threshold for all of these tests, except AVE, is accepted as 0.7, similar to item reliability (Nunnally, 1978), but the threshold for AVE is 0.5 (Hair et al., 2014). Additionally, factor loading can be used to assess convergent validity (e.g., Saeed et al., 2005). In line with the literature, this study uses AVE to test the convergent validity.

Low convergent validity scores refers to either poor construct definition, which damages the determination of relevant measures for the construct or construct multidimensionality, which leads to poor internal consistency (Hulland, 1999). Hence, researchers should consider dropping one of these items or splitting the construct into two separate sub-constructs if the convergent validity is low.

3.4.1.3. Discriminant Validity

Discriminant validity shows the uniqueness of measurement items that form a construct, which is independent form other constructs. Parallel to convergent validity, discriminant validity

can be confirmed by using at least one of the four measures: (1) the average variance extracted (AVE) measure (e.g., Rajaguru & Matanda, 2013), (2) Fornell and Larcker's internal consistency measure (e.g., Hartono et al., 2010), (3) cross factor loadings of the indicators (e.g., Lee et al., 2014), and (4) the CFA (e.g., Wu et al., 2006). In line with the previous research, Fornell and Larcker's internal consistency measure and cross factor loadings of the indicators are used in this research to confirm discriminant validity. When considering the AVE measure, the square root of AVE for each construct is compared with the latent variable correlations. If the square root of the AVE score of a construct is greater than the highest correlation with any other construct in the model, that construct is assumed to be discriminant (Hulland, 1999). In addition, if the outer loading of an indicator variable on an associated latent variable is greater than all of its loadings on other latent variable, it is assumed that the discriminant validity is reached (Hair et al., 2014).

If the square root of AVE score is not greater than the highest correlation value of a latent variable, or there is an outer loading that exceeds the indicator's outer loading, the latent variable cannot be discriminated. Consequently, one of the related constructs needs to be dropped or two constructs should be merged.

3.4.2. Testing the Structural Model

After establishing the reliability and validity of the measurement model and creating the best measurement model, the structural equation model is analyzed. The structural model should be developed based on the confirmed measurement model to test structural relationships (Hair et al., 2014). The structural model displays relationships among latent constructs. In other words, the structural model tries to find what dependence relationship exists among constructs. After the structural model is identified, the model validity and the hypotheses need to be tested. There are two main differences between testing the structural model fit and measurement model fit. First,

alternative, or competing models can be compared when testing the structural model; second, particular emphasis is placed on the estimated parameters for the structural relationships, as these parameters provide evidence for testing proposed hypotheses.

The overall fit of the structure model is assessed by the R^2 measure and significance of the path coefficients (Ringle et al., 2012). Moreover, the f^2 effect size and the q^2 effect size are used to evaluate the structural model (Hair et al., 2014). R^2 is one of the most commonly used measures to test the fit of the structural model. The structural model is considered poor if R^2 has very low value (Chin, 1998a). Even though there is no clear cut point for R^2; 0.75 is considered substantial; 0.50 is considered moderate; and 0.25 is considered week (Hair et al., 2011). Hence, the higher the R^2, the better the structural model fit. The path coefficient is the second common measure, which is used to test the structural model's overall fit. The path coefficient indicates a strong positive relationship when it is close to +1, and strong negative relationship when close to -1. On the other hand, the relationship is assumed to be insignificant when the path coefficient is equal to zero (Hair et al., 2014). To test the significance of the path coefficient, the bootstrapping method is applied. The relationship is accepted as significant when the calculated t value is larger than the critical t value.

Further, the f^2 effect size measure can be used to assess the significance of an exogenous construct. The measure of f^2 is calculated as:

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

where $R^2_{included}$ is the R^2 of the endogenous variable when the selected exogenous variable is included, whereas $R^2_{excluded}$ is the R^2 of the endogenous variable when the selected exogenous variable is excluded. Besides, q^2 effect size measure is calculated as:

$$q^2 = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}}$$

where $Q^2_{included}$ is the Stone-Geisser's Q^2 (Q^2) of the endogenous variable that is an indicator of the structural model's predictive relevance, when the selected exogenous variable is included. Besides, $Q^2_{excluded}$ is the Q^2 of the endogenous variable, when the selected exogenous variable is excluded. The effect for both f^2 and q^2 are assumed to be small if the calculated value is 0.02, medium if the calculated value is 0.15 and large if the calculated value is 0.35 (Hair et al., 2014).

CHAPTER 4

4. RESULTS OF THE STUDY

This chapter describes the findings of the research. The first part offers a detailed outline of the characteristics of the sample. The second part presents results of the PLS-SEM model. The final part summarizes the findings of the empirical research.

4.1. RESPONDENT AND ORGANIZATION CHARACTERISTICS

Respondents are asked to specify their position, and main line of business (industry), total number of employees and total revenue of their organization. The results show that the sample of this dissertation is a good representation of organizations of all sizes from variety of industries. The demographics and descriptive statistics are discussed below.

4.1.1. Demographics of Respondents

The target-sampling frame in this study was upper level managers of U.S. organizations. Drawing from previous literature, supply chain managers, operations managers, and procurement managers were identified as key respondents. A detailed analysis of respondent demographics indicated that the majority of respondents were supply chain managers, operations managers or procurement managers, as expected (64.6%). Additionally, 13 respondents (11.5%) also hold a managerial title such as IT manager, ERP manager, project manager, or production manager. A follow up message via LinkedIn was sent to these managers to define their position in detail, as these titles were not directly related to SCM. These managers' answers to the follow up message revealed that their duties are aligned with the desired key respondents. Hence, these managers were eligible to participate in this research. Table 8 presents the distribution of the titles of the respondents.

Position of the Respondent	N	%
Owner/Co-Owner	5	4.43
CEO/General Manager	4	3.54
Vice President/Director of Supply Chain, Operations, Procurement	8	7.08
Manager (Supply Chain, Operations, Procurement)	73	64.60
Manager (Others)	13	11.50
Others (Non-Manager)	6	5.31
Missing	4	3.54
Total	**113**	**100**

Table 8. Profile of Respondents

4.1.2. Descriptive Statistics of Organizations

Usually, researchers focus on a single industry to avoid the effects of different industries in a study. Yet, this reduces the generalizability of the results. Thus, no industry restriction was applied in this research. Although the 45.14% of the respondents stated that their organizations operate in the manufacturing industry (NAICS 31, 32, and 33), the sampled organizations were from a wide range of industries. Table 9 illustrates the industry distribution of the respondents.

Industry	N	%
Mining, Quarrying, and Oil and Gas Extraction	2	1.77
Utilities	4	3.54
Construction	8	7.08
Manufacturing (Food, Beverage, Textile, Apparel, Leather)	3	2.66
Manufacturing (Wood, Paper, Petroleum, Chemical, Plastic, Nonmetallic Products)	10	8.85
Manufacturing (Primary and Fabricated Metal Industries, etc.)	38	33.63
Wholesale Trade	3	2.66
Retail Trade (Sporting, General Merchandise, Miscellaneous, Non-store)	6	5.31
Transportation and Warehousing (Air, Rail, Water, Truck, Transit, Pipeline, Scenic, etc.)	6	5.31
Transportation and Warehousing (Postal, Courier, Warehousing)	2	1.77
Professional, Scientific and Technical Services	13	11.5
Educational Services	5	4.42
Health Care and Social Assistance	5	4.42
Arts, Entertainment, and Recreation	2	1.77
Accommodation and Food Services	5	4.42
Public Administration	1	0.89
Total	**113**	**100**

Table 9. Industry Profile based on 2 digits NAICS Code

Besides, the organization size was measured by number of employees and total revenue. Number of employees show that, even though the largest group of organizations (30.97%) had 5001 or more employees, there was a virtually equally distributed sample in terms of number of employees. Yet, revenue profile of sample organizations displayed that majority of organizations had revenue of either $100 million or less (42.48%), or more than $2 billion (27.43%). Employee and revenue profiles are shown in Table 10 and Table 11, respectively.

Number of Employees	N	%
100 or fewer	21	18.58
101–500	26	23.01
501–1000	12	10.62
1001–5000	19	16.82
5001 or more	35	30.97
Total	**113**	**100**

Table 10. Employee Profile of Organizations

Total Revenue	N	%
$100 million or less	48	42.48
MORE than $100 million, up to $500 million	22	19.47
MORE than $500 million, up to $1 billion	7	6.19
MORE than $1 billion, up to $2 billion	5	4.43
MORE than $2 billion	31	27.43
Total	**113**	**100**

Table 11. Revenue Profile of Organizations

4.2. RESULTS OF THE PLS-SEM

Measurement validation involves assessing the validity and construct reliability of the scales. Various methods have been proposed in the prior literature (e.g., Chin, 1998b). Yet, the appropriate approaches should be chosen based on the statistical method used in a study. Thus,

AVE, composite reliability, Fornell and Larcker's internal consistency measure, assessment of outer loadings, and assessment of cross factor loadings approaches, which are recommended for PLS-SEM, were chosen to validate the measurement scale (Hair et al., 2014).

4.2.1. Step 5: Assessing Reliability and Validity — Testing Measurement Model

SmartPLS 3.2.1, which is acquired from its website (www.smartpls.de), was used to run PLS-SEM. The measurement model was developed consistent with the literature. All constructs were modeled to be reflective in the measurement model as the measures of each construct were caused by the same construct and they were highly correlated each other. Nevertheless, it was necessary to ensure the reliability and validity of each constructs and measures before testing the hypotheses

Measurement Reliability was tested using the composite reliability scores and Cronbach's alpha. All scores were above the threshold (.70) indicating there is no reliability issue. Table 12 illustrates the measurement reliability scores for each constructs.

Constructs	Composite Reliability Scores	Cronbach's Alpha
CRM	0.970	0.963
CSM	0.970	0.963
SRM	0.973	0.967
SCM Explorative Competence	0.977	0.969
SCM Exploitative Competence	0.957	0.941
Profitability	0.978	0.973
Market Value	0.956	0.939
Productivity	0.969	0.936

Table 12. Measurement Reliability Scores of Constructs

Further, the outer loadings are examined to test the reliability of all items. Outer loadings gives the results of regression of each measurement item on their corresponding latent construct

(Hair et al., 2014). The highest outer loading was 0.971 and the smallest outer loading was 0.894. Thus, all outer loading were much higher than the threshold score of 0.70. These results verified that there was no reliability issue. Table 13 shows the outer loadings of each measurement item.

Items	CRM	CSM	SRM	Explore	Exploit	Profit	Market	Product
CRM1	0.915							
CRM2	0.926							
CRM3	0.925							
CRM4	0.915							
CRM5	0.920							
CRM6	0.911							
CSM1		0.913						
CSM2		0.930						
CSM3		0.926						
CSM4		0.900						
CSM5		0.931						
CSM6		0.913						
SRM1			0.900					
SRM2			0.934					
SRM3			0.934					
SRM4			0.920					
SRM5			0.928					
SRM6			0.939					
Explore1				0.950				
Explore2				0.963				
Explore3				0.963				
Explore4				0.949				
Exploit1					0.919			
Exploit2					0.922			
Exploit3					0.909			
Exploit4					0.936			
Profit1						0.928		
Profit2						0.938		
Profit3						0.934		
Profit4						0.947		
Profit5						0.947		
Profit6						0.939		
Market1							0.927	
Market2							0.931	
Market3							0.925	
Market4							0.894	
Product1								0.968
Product2								0.971

Table 13. Outer Loadings of Measurement Items

Moreover, multiple analyses were used to test the convergent and discriminant validity of all constructs. Analysis of AVE is used to test the convergent validity. AVE is a measure that assesses the degree to which a latent construct explains the variance of its measurement items (Hair et al., 2014). The highest AVE is 0.940, whereas the smallest AVE is 0.844. Thus, result of the analysis revealed that all AVE values were higher than 0.50, which confirmed the convergent validity of all constructs. AVE scores of all constructs are showed in Table 14.

Constructs	Average Variance Extracted
CRM	0.844
CSM	0.844
SRM	0.857
SCM Explorative Competence	0.915
SCM Exploitative Competence	0.849
Profitability	0.882
Market Value	0.845
Productivity	0.940

Table 14. Average Extracted Variance of Constructs

Finally, in order to test the discriminant validity, two different approaches were used, as the literature recommends. The first approach is the Fornell and Larcker's internal consistency measure. It compares the square root of latent construct's AVE values with the latent variable correlations. If the square root of AVE values for each latent variable is greater than its highest correlation with any other latent variable, the variable passes the validity test (Hair et al., 2014). A detailed investigation of the Fornell and Larcker's internal consistency measures showed that the square root of AVE value for each latent construct (CRM = .919, CSM = .919, SRM = .926, Explore = .956, Exploit = .921, Profit = .939, Market = .919, and Product = .970) is greater than its highest correlation with any other construct. The results of this analysis provide support for

the discriminant validity of all constructs. Results of the internal consistency measure are shown in Tables 15.

Constructs	CRM	CSM	SRM	Explore	Exploit	Profit	Market	Product
CRM	0.919							
CSM	0.790	0.919						
SRM	0.686	0.727	0.926					
Explore	0.719	0.728	0.623	0.956				
Exploit	0.699	0.604	0.714	0.776	0.921			
Profit	0.517	0.437	0.599	0.529	0.740	0.939		
Market	0.459	0.516	0.546	0.607	0.620	0.794	0.919	
Product	0.518	0.523	0.587	0.540	0.638	0.626	0.536	0.970

Table 15. Fornell and Larcker's Internal Consistency of Constructs

The second approach for testing the discriminant validity is to compare the cross loadings of the measurement items. This approach compares the outer loading of measurement items and all other loadings on the associated latent construct. The presence of a cross loading of an item that exceeds the outer loadings of the same item indicates a discriminant validity problem (Hair et al., 2014). A inspection of all other cross factor loadings of measurement items revealed that the outer loading of each measurement item on the associated latent construct (CRM1 = .915, CRM2 = .926, CRM3 = .925, CRM4 = .915, CRM5 = .920, CRM6 = .911, CSM1 = .913, CSM2 = .930, CSM3 = .926, CSM4 = .900, CSM5 = .931, CSM6 = .913, SRM1 = .900, SRM2 = .934, SRM3 = .934, SRM4 = .920, SRM5 = .928, SRM6 = .939, Explore1 = .950, Explore2 = .963, Explore3 = .963, Explore4 = .949, Exploit1 = .919, Exploit2 = .922, Exploit3 = .909, Exploit4 = .936, Profit1 = .928, Profit2 = .938, Profit3 = .934, Profit4 = .947, Profit5 = .947, Profit6 = .939, Market1 = .927, Market2 = .931, Market3 = .935, Market4 = .894, Product1 = .968, Product2 = .971) is greater than all of its cross loadings. Cross loadings of all items are shown Table 16.

Items	CRM	CSM	SRM	Explore	Exploit	Profit	Market	Product
CRM1	0.915	0.709	0.590	0.655	0.644	0.455	0.383	0.444
CRM2	0.926	0.704	0.606	0.641	0.633	0.450	0.386	0.485
CRM3	0.925	0.731	0.599	0.671	0.636	0.445	0.402	0.412
CRM4	0.915	0.724	0.667	0.692	0.667	0.497	0.475	0.513
CRM5	0.920	0.759	0.678	0.677	0.652	0.522	0.473	0.504
CRM6	0.911	0.725	0.639	0.627	0.623	0.477	0.404	0.495
CSM1	0.714	0.913	0.624	0.682	0.594	0.399	0.457	0.443
CSM2	0.734	0.930	0.615	0.685	0.553	0.408	0.520	0.482
CSM3	0.768	0.926	0.699	0.669	0.576	0.414	0.470	0.451
CSM4	0.694	0.900	0.672	0.634	0.534	0.395	0.477	0.525
CSM5	0.743	0.931	0.723	0.683	0.554	0.407	0.482	0.498
CSM6	0.697	0.913	0.677	0.657	0.515	0.387	0.438	0.491
SRM1	0.621	0.600	0.900	0.506	0.616	0.513	0.431	0.495
SRM2	0.642	0.699	0.934	0.594	0.658	0.520	0.504	0.543
SRM3	0.669	0.679	0.934	0.624	0.710	0.578	0.512	0.538
SRM4	0.609	0.647	0.920	0.573	0.640	0.558	0.510	0.578
SRM5	0.621	0.712	0.928	0.584	0.666	0.585	0.549	0.543
SRM6	0.648	0.695	0.939	0.572	0.672	0.570	0.520	0.560
Explore1	0.656	0.700	0.585	0.950	0.734	0.495	0.561	0.521
Explore2	0.702	0.687	0.612	0.963	0.750	0.502	0.587	0.534
Explore3	0.709	0.725	0.616	0.963	0.747	0.514	0.568	0.497
Explore4	0.685	0.672	0.570	0.949	0.738	0.515	0.605	0.514
Exploit1	0.667	0.537	0.643	0.729	0.919	0.659	0.542	0.592
Exploit2	0.649	0.562	0.642	0.721	0.922	0.635	0.544	0.545
Exploit3	0.631	0.568	0.679	0.722	0.909	0.701	0.573	0.619
Exploit4	0.631	0.558	0.667	0.691	0.936	0.726	0.623	0.592
Profit1	0.454	0.362	0.513	0.464	0.665	0.928	0.726	0.548
Profit2	0.511	0.430	0.550	0.512	0.703	0.938	0.730	0.595
Profit3	0.474	0.360	0.523	0.445	0.637	0.934	0.719	0.558
Profit4	0.495	0.431	0.600	0.508	0.709	0.947	0.772	0.579
Profit5	0.503	0.455	0.598	0.537	0.740	0.947	0.764	0.612
Profit6	0.471	0.417	0.584	0.510	0.705	0.939	0.761	0.630
Market1	0.459	0.481	0.493	0.560	0.587	0.738	0.927	0.504
Market2	0.431	0.485	0.493	0.543	0.547	0.743	0.931	0.523
Market3	0.390	0.457	0.471	0.541	0.570	0.726	0.925	0.500
Market4	0.406	0.473	0.547	0.585	0.575	0.714	0.894	0.446
Product1	0.518	0.517	0.577	0.511	0.602	0.607	0.520	0.968
Product2	0.486	0.498	0.562	0.537	0.634	0.607	0.519	0.971

Table 16. Cross Loadings of Measurement Items

4.2.2. Step 6: Confirmatory Testing — Testing the Structural Model

After the measurement model was identified to be within the acceptable level in terms of reliability and construct validity, the collinearity issue of the structural model had to be checked

before interpreting the results. The variance inflation factors (VIFs), which were calculated by SmartPLS, were used to assess the collinearity. The interaction variables for SCM explorative competence and SCM exploitative competence were also added to assess the ambidexterity on profitability (Explore*Exploit Profit), market value (Explore*Exploit Market) and productivity (Explore*Exploit Product) of organizations. The highest VIF value was 3.207 and lowest VIF value was 1.103. Therefore, all VIF values were lower than the recommended threshold score of five (Hair et al., 2014). These results indicate that there is no collinearity issue. The VIFs of all latent contracts are reported in Table 17.

Constructs	Explore	Exploit	Profit	Market	Product
CRM	2.858	2.858			
CSM	3.207	3.207			
SRM	2.282	2.282			
Explore			3.245	3.252	3.247
Exploit			2.530	2.529	2.530
Explore*Exploit Profit			1.798		
Explore*Exploit Market				1.798	
Explore*Exploit Product					1.800
Size			1.104	1.105	1.103
Industry			1.181	1.181	1.182

Table 17. Inner VIF Values of Exogenous Variables

Subsequently, the significance level of the path coefficients in the structural model was evaluated through running the bootstrapping option, which is an resampling method, with 113 cases (equal to the number of observation in the original sample) and 5000 samples to obtain the t-values for all path coefficients (Hair et al., 2014). The moderating effects of SCM explorative competence were tested as part of the overall structural model. Since each path in the structural model was designed to denote one hypothesis in the theoretical model, significance of the path

coefficients was used to evaluate whether the hypotheses were supported or not. Prior literature stated that path coefficients with standardized values above 0.20 are usually significant (Hair et al., 2014). Thus, initial screening of the path coefficients indicated that control variables (size and industry) were not significant, thus, they were excluded from further analyses (Hair et al., 2013). Table 18 shows the results of the bootstrapping analysis.

Paths	Original Sample	Standard Error	t Values
CRM -> Explore (H_{1a})	0.350	0.157	2.235**
CRM -> Exploit (H_{1b})	0.449	0.176	2.549**
CSM -> Explore (H_{2a})	0.367	0.173	2.115**
CSM -> Exploit (H_{2b})	-0.097	0.163	0.599
SRM -> Explore (H_{3a})	0.116	0.177	0.656
SRM -> Exploit (H_{3b})	0.477	0.153	3.112***
Explore -> Profit (H_{4a})	0.040	0.166	0.242
Explore -> Market (H_{4b})	0.460	0.163	2.824***
Explore -> Product (H_{4c})	0.145	0.155	0.934
Exploit -> Profit (H_{5a})	0.848	0.133	6.392***
Exploit -> Market (H_{5b})	0.394	0.169	2.328**
Exploit -> Product (H_{5c})	0.554	0.146	3.797***
Explore*Exploit -> Profit (H_{6a})	0.221	0.085	2.596***
Explore*Exploit -> Market (H_{6b})	0.206	0.086	2.391**
Explore*Exploit -> Product (H_{6c})	0.045	0.086	0.522

*p < 0.10, **p < 0.05, ***p<0.01,

Table 18. Bootstrapping Analysis Results of Path Coefficients

Additionally, adjusted R^2 values were analyzed to evaluate the explained variance of an endogenous variable by all of the exogenous variables with a path to it. Whereas the R^2 value of 0.25 for a endogenous variable was considered weak, 0.50 was considered moderate and 0.75 was considered substantial (Hair et al., 2011). The highest R^2 value was 0.585 and the lowest R^2 value was 0.398. Hence, all R^2 values of latent dependent constructs were considered moderate. Adjusted R^2 values for all endogenous variables are presented in Table 19.

Endogenous Variables	Adjusted R^2
SCM Explorative Competence	0.580
SCM Exploitative Competence	0.585
Profitability	0.580
Market Value	0.444
Productivity	0.398

Table 19. Adjusted R^2 Valued of Endogenous Variables

In addition, effect sizes of the significant path coefficients were used to assess the relative importance of each exogenous variable as a predictor of its related endogenous variables. To do that, first f^2 is assessed. As explained in § 3.4.2, f^2 is calculated by using $R^2_{included}$, which is the R^2 value when the selected latent construct is added to the model, and $R^2_{excluded}$, which is the R^2 value when the selected latent construct is not added to the model. The change in the R^2 gives the effect size of that specific latent construct. However, the f^2 values were automatically calculated by SmartPLS 3.2.1 and they are illustrated in Table 20.

Constructs	Explore	Exploit	Profit	Market	Product
CRM	0.105	0.175			
CSM	0.103	0.007			
SRM	0.015	0.247			
Explore			0.001	0.126	0.012
Exploit			0.696	0.113	0.207
Explore*Exploit Profit			0.098		
Explore*Exploit Market				0.064	
Explore*Exploit Product					0.003

Table 20. f^2 Effect Sizes of Exogenous Variables

Recommended thresholds to assess f^2 values are 0.02 for small effect, 0.15 for medium effect, and 0.35 for large effect (Hair et al., 2014). Based on these thresholds, results of this study

indicate that the effect of CRM on SCM explorative competence is small (.105), and on SCM exploitative competence is medium (.175). Similarly, CSM has small effect on SCM explorative competence, but no effect (.007) on SCM exploitative competence. On the other hand, SRM has no effect on SCM explorative competence (.015), but it has medium effect on SCM exploitative competence. SCM explorative competence has small effect on market value (.126), but it has no significant effect on profitability (.001) and productivity (.012). Furthermore, SCM exploitative competence has small (.113) effect on market value, medium (.207) effect on productivity, and large (.696) effect on profitability.

The second method, which is used to test the effect size, was q^2.The q^2 values required to be hand calculated based on the formula provided in § 3.4.2, as SmartPLS 3.2.1 does not provide these values. Q^2 values were obtained via the blindfolding option with an omission distance of seven. Table 21 illustrates the q^2 values for each path.

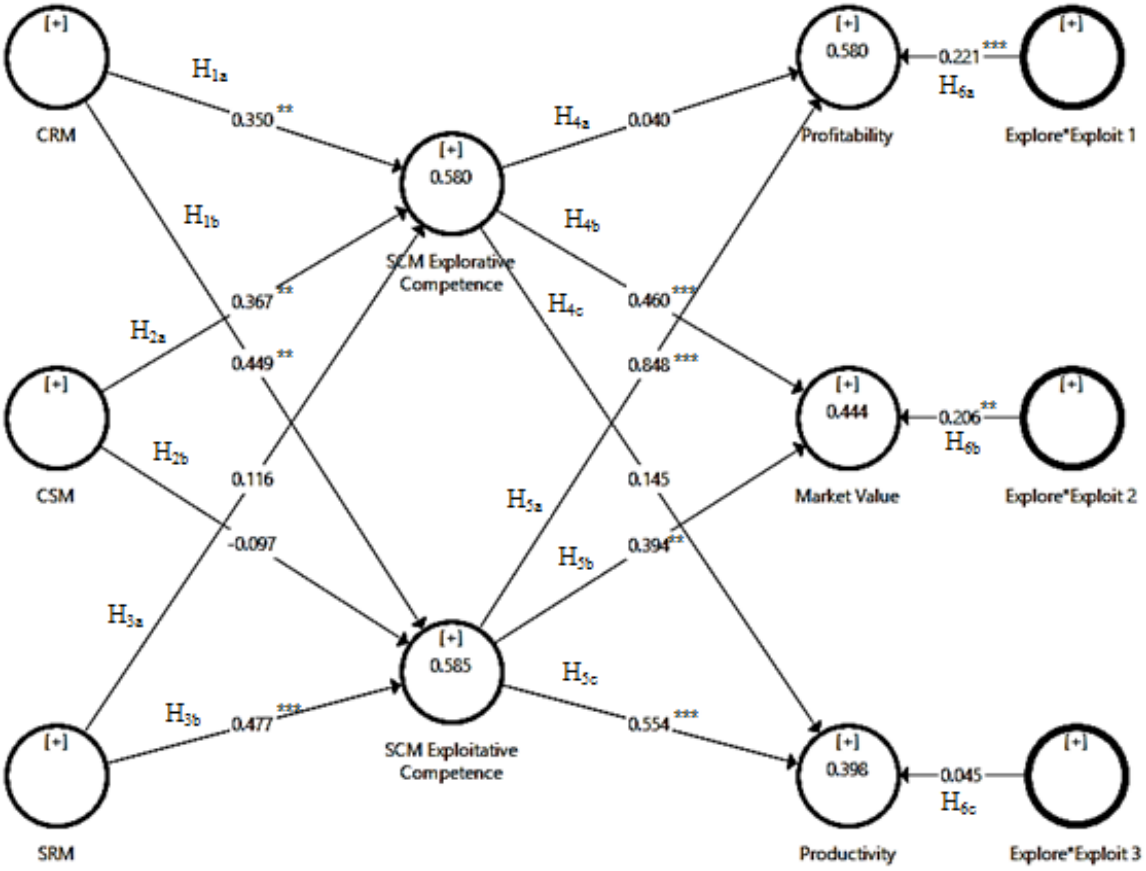
Constructs	Explore	Exploit	Profit	Market	Product
CRM	0.089	0.122			
CSM	0.084	0.000			
SRM	0.011	0.168			
Explore			0.026	0.052	-0.040
Exploit			0.493	0.080	0.146
Explore*Exploit Profit			0.022		
Explore*Exploit Market				0.011	
Explore*Exploit Product					-0.017

Table 21. q^2 Effect Sizes of Exogenous Variables

Similar to f^2, suggested thresholds to assess q^2 values are 0.02 for small effect, 0.15 for medium effect, and 0.35 for large effect (Hair et al., 2014). Therefore, examination of Table 21 reveals that the effect of each construct on its associated contract shows same pattern with the f^2.

4.3. SUMMARY OF THE RESULTS

In conclusion, 10 out of 15 hypotheses proposed in this research were supported. Yet, each of the unsupported hypotheses led to interesting results and further avenues for research. Before providing a detailed discussion of these results, an overview is demonstrated in Figure 8.



*p < 0.10, **p < 0.05, ***p<0.01,

Figure 8. Results of the PLS Structural Model

PLS-SEM places a major emphasis on the explained variance, as well as establishing the significance of all path estimates (Hair et al., 2011). Therefore, interpretation of the structural model starts with the analysis of each endogenous variable's R^2 values. The results indicated that

effective ERP usage for SCM front and end processes explained 58% and 58.5% of the variance in SCM explorative competence and SCM exploitative competence, respectively, which could be considered as moderate effect. Furthermore, SCM explorative competence and SCM exploitative competence, combined, explained 58%, 44.4%, and 39.8% of variance in profitability, market value, and productivity, respectively, which could also be considered moderate effect.

Second, the significance of the path coefficients was tested by examining their t-values. Findings of the bootstrapping analysis suggested that the relationship between CRM and SCM explorative competence was positive and significant, therefore H_{1a} was supported (path = 0.350, t = 2.235, p = 0.025). This finding indicated that the effective use of ERP to manage customer relations increased the SCM explorative competence of the organization. Results of this research showed that CRM also positively affected the SCM exploitative competence, which provided support for H_{1b} (path = 0.449, t = 2.549, p = 0.011). Therefore, establishing an effective CRM processes via ERP usage not only benefited exploration of SCM competence, but also positively influenced the SCM exploitative competence of the organization. Similar to CRM, CSM also positively affected the SCM explorative competence, therefore supporting H_{2a} (path = 0.367, t = 2.115, p = 0.034); nevertheless, H_{2b} was not supported (path = -0.097, t = 0.599, p = 0.549) as the relationship between CSM and the SCM exploitative competence was non-significant. Thus, these results indicated that, even though the effective use of ERP for managing customer services positively affected the SCM explorative competence, it had no effect on the SCM exploitative competence. Additionally, the relationship between SRM and the SCM explorative competence was not significant, which did not yield any support for H_{3a} (path = 0.116, t = 0.656, p = 0.512), whereas the relationship between SRM and the SCM exploitative competence was significant, hence supporting H_{3b} (path = 0.477, t = 3.112, p = 0.002). As a result, the finding claimed that

effective ERP usage for SCM positively influenced only the SCM exploitative competence, and it had no significant effect on the SCM explorative competence.

Subsequent hypotheses tests examined the relationship between SCM explorative and exploitative competencies and overall organizational performance. The results revealed that the SCM explorative competence had a positive impact on the market value of organizations, which supported H_{4b} (path = 0.460, t = 2.824, p = 0.005), yet it had no influence on the profitability or the productivity, therefore it did not support H_{4a} (path = 0.040, t = 0.242, p = 0.809) or H_{4c} (path = 0.145, t = 0.934, p = 0.351). Results of this study showed that increasing the SCM explorative competence helped organizations to increase market value, rather than increasing profitability or productivity. In contrast, these results indicated that the relationship between SCM exploitative competence and profitability, market value or productivity are all positive and significant, thus they provided support H_{5a} (path = 0.848, t = 3.392, p = 0.000), H_{5b} (path = 0.394, t = 2.328, p = 0.002), and H_{5c} (path = 0.554, t = 3.797, p = 0.000). Thus, the results showed that organizations that find ways to increase their exploitative capabilities in SCM experienced higher profitability, market value, and productivity.

The final set of hypotheses tested the role of ambidexterity in SCM competencies. The findings suggested that the SCM explorative competence positively and significantly moderated the relationship between the SCM exploitative competence and profitability, and market value, therefore providing support for H_{6a} (path = 0.221, t = 2.596, p = 0.009) and H_{6b} (path = 0.206, t = 2.391, p = 0.017). Nevertheless, the results showed no evidence for a moderating effect of the SCM explorative competence on the relationship between the SCM exploitative competence and productivity, which did not provide support for H_{6c} (path = 0.045, t = 0.522, p = 0.601). Table 22 provides a summary of all hypotheses and their associated findings.

No	Hypothesis	Finding
H_{1a}	The greater the use of ERP to manage CRM process in an organization, the greater the SCM explorative competence will be.	Supported
H_{1b}	The greater the use of ERP to manage CRM process in an organization, the greater the SCM exploitative competence will be.	Supported
H_{2a}	The greater the use of ERP to manage CSM process in an organization, the greater the SCM explorative competence will be.	Supported
H_{2b}	The greater the use of ERP to manage CSM process in an organization, the greater the SCM exploitative competence will be.	Not Supported
H_{3a}	The greater the use of ERP to manage SRM process in an organization, the greater the SCM explorative competence will be.	Not Supported
H_{3b}	The greater the use of ERP to manage SRM process in an organization, the greater the SCM exploitative competence will be.	Supported
H_{4a}	The greater the SCM explorative competence in an organization, the better the profitability of the organization will be.	Not Supported
H_{4b}	The greater the SCM explorative competence in an organization, the better the market value of the organization will be.	Supported
H_{4c}	The greater the SCM explorative competence in an organization, the better the productivity of the organization will be.	Not Supported
H_{5a}	The greater the SCM exploitative competence in an organization, the better the profitability of the organization will be.	Supported
H_{5b}	The greater the SCM exploitative competence in an organization, the better the market value of the organization will be.	Supported
H_{5c}	The greater the SCM exploitative competence in an organization, the better the productivity of the organization will be.	Supported
H_{6a}	The higher the ambidexterity levels of SCM competencies in an organization, the better the profitability of the organization.	Supported
H_{6b}	The higher the ambidexterity levels of SCM competencies in an organization, the better the market value of the organization.	Supported
H_{6c}	The higher the ambidexterity levels of SCM competencies in an organization, the better the productivity of the organization.	Not Supported

Table 22. Summary of the Hypotheses and Findings

CHAPTER 5

5. SUMMARY AND RECOMMENDATIONS

The aim of this research is to explore the mediating effect of SCM competencies on the relationship between effective ERP usage for SCM and overall organizational performance. It uses data from 113 U.S. organizations to empirically test the proposed model. Drawing from the IOS literature, organizational ambidexterity and dynamic capabilities theory, this study proposes the concept of effective ERP usage for SCM as multiple latent constructs. Thus, these constructs help organizations to dynamically explore and exploit their SCM competencies to address rapid changes in the business environment. This study adopts the dynamic capabilities perspective, as the extant literature argues that organizations have to constantly adjust their capabilities to stay competitive (Eisenhardt & Martin, 2000), and simultaneous pursuit of capability exploration and exploitation increases the competiveness of organizations (Raisch & Birkinshaw, 2008). Hence, this dissertation conceptually defines and empirically examines the role of effective ERP usage for CRM, CSM, and SRM on dynamic capabilities such as SCM explorative competence and SCM exploitative competence. In addition, this study explores the consequences of ambidextrous SCM capability development on organizational performance over the moderating role of SCM explorative competence because organizations that follow ambidextrous supply chain strategy should outperform their competitors.

The final chapter presents discussion of the findings and provides recommendations for future research. In the first part, key findings are summarized. After that, theoretical implications are discussed, followed by managerial contributions. Furthermore, discussion of the limitations and future research directions of the current study are presented. Finally, concluding remarks are stated in the last part of this chapter.

5.1. KEY FINDINGS AND INSIGHTS

This research contributes to the IS, strategic management, and SCM literatures through developing a comprehensive framework. It links effective ERP usage for SCM, SCM explorative and exploitative competencies, and overall organizational performance constructs to understand how ambidexterity in development of such competencies through effective ERP usage affects overall organizational performance. This study offers new insights into capability development through ERP usage and mediating roles of these SCM capabilities on the relationship between effective ERP usage and overall organizational performance. In addition, to our knowledge, this dissertation is the first study that separately explores the role of effective ERP usage in different SCM processes on SCM explorative and exploitative competence development.

The extant literature that relates effective IS usage to ambidextrous supply chain strategy is relatively inadequate. One stream of research focuses on effective IS usage and its benefits for exploration and exploitation (Li, 2012; Sanders, 2008; Subramani, 2004), while another stream of research focuses on ambidextrous strategy and capability development (Kristal et al., 2010; Oh et al., 2012). This study combines and extends these two streams of research by examining a wider scope of effective ERP usage in addition to associating these various ERP based processes with SCM competence development.

Findings of this dissertation suggest that effective use of ERP for CRM is related to both SCM explorative competence and exploitative competence. In contrast, the results indicate that organizations that effectively use ERP for CSM experience better SCM explorative competence, while organizations that utilize ERP for SRM gain better SCM exploitative competence. These outcomes emphasize that, even though different SCM processes, which are integrated with ERP help organizations to develop SCM competencies, they vary in consequences. Accordingly, these

interesting results can be explained by two key factors: (1) Customers of an organization can be individuals and/or businesses. CSM is critical for customer satisfaction. It allows organizations to manage product and service agreements with customers, and design and implement customer response procedures. Listening to demands of customers through CSM gives organizations the ability to explore new procedures for increasing their customer satisfaction. On the other hand, when organizations interact with their customers via CSM to manage their existing products and services, the opportunity of improving their existing capabilities and approaches can be limited. (2) Furthermore, organizations use SRM to communicate with their suppliers. SRM identifies the essential suppliers, and establishes and maintains relationships with those suppliers. Suppliers are the key players in supply chains. Therefore, a healthy communication and relationship with the suppliers leads to improvement of the existing approaches and capabilities. Yet, this may not always lead to development of new approaches and capabilities, as it is hard to change processes in established relations. Furthermore, these results provide support for previous literature, which shows that based on data provided from Taiwan, Honk Kong and U.S., CRM positively effects innovation, while SRM positively influences process efficiency (Carr & Pearson, 1999; Li et al., 2007; Lin et al., 2010). Hence, these findings suggest that communication with both suppliers and customers is necessary for U.S organizations to pursue ambidextrous supply chain strategy.

Results of this research also indicate that although SCM exploitative competence affects all three different indicators of organizational performance, SCM explorative competence affects only the market value of the organizations. As expected, these results recommend that improving existing capabilities directly affect all aspects of organizational performance. Yet, searching for new capabilities or approaches affects only the market value of the organization. There can be multiple explanations behind these results. First, exploration requires capital, and investing in

new approaches and capabilities reduces the profit. Hence, the benefits of exploration might not be initially reflected in profitability. Second, productivity paradox literature suggests that there is a lag between IS investment and productivity improvement of productivity because of the time required to learn new IS applications (Hitt & Brynjolfsson, 1996). Similarly, new approach or capability development in SCM involves a learning process for employees. This learning process initially decreases the productivity of the employees and organization.

Overall, findings of this dissertation provide evidence to support the importance of the mediating role of SCM explorative and exploitative competencies on the relationship between effective ERP usage and overall organizational performance. This indicates that effective ERP usage for SCM does not have a direct effect on overall organizational performance, nevertheless it will significantly improve overall organizational performance through development of SCM explorative and exploitative competencies.

Results of this dissertation suggest that organizations that pursue an ambidextrous supply chain strategy outperform their competitors in terms of profitability and market value. However, there is no significant difference between regular organizations and ambidextrous organizations in terms of productivity. This result can be also explained by the productivity paradox. The time required for employees to learn new approaches and capabilities initially decrease productivity of organizations. Overall, these results support the value of ambidextrous supply chain strategy.

In conclusion, findings of this study indicate that the combined effect of effective ERP usage for SCM and SCM competencies has varying effects on organizational performance. The results provide several important and interesting conclusions to both practitioners and academics. While § 5.2 explains the theoretical implications of results of this research, § 5.3 discusses the managerial implications of these results.

5.2. THEORETICAL IMPLICATIONS

This dissertation uses findings of the literature from different fields to propose a set of SCM dynamic capabilities and their antecedents in effective IOS usage, and their consequences to overall organizational performance. By proposing and testing a theoretical framework, which explains ambidextrous supply chains from dynamic SCM competencies perspective, it extends prior literature and offers several important contributions for researchers in the field of: (1) IS, (2) strategic management and (3) SCM.

The main contribution of this research to the IS field is to expand the literature and offer new insights into effective ERP usage for SCM. The most important contribution of this study to the IS literature is the strong direct effect of effective ERP usage for SCM on SCM competence development, and its indirect effect on overall organizational performance. Specially, this study shows varying effects of each SCM front and end process on SCM competency development. While a large base of research on the notion of IOS exists, prior studies either focus on IS use and its benefits for exploration and exploitation (Li, 2012; Sanders, 2008; Subramani, 2004), or on ambidextrous strategy and capability development (Kristal et al., 2010; Oh et al., 2012). This study combines and extends these two streams of research. Hence, it represents one of the first attempts to explore these key SCM front and end processes separately. Thus, rather than viewing the IOS application — ERP — as a solid concept, this dissertation opens up the black box and proposes that every module in an ERP application constitutes the application's silent dimensions. Findings of this research position effective ERP usage for SCM as a key driver of dynamic SCM competencies. These findings also confirm that the effective IS usage improves competencies of organizations, and implementing IS applications such as ERP alone is not sufficient in single-handedly improving overall organizational performance (Oh et al., 2012). Finally, this research

proposes a clear conceptualization and measurement approach for effective ERP usage for SCM front and end processes. All three scales consist of six measurement items with high construct reliability. Thus, these scales expected to provide an important foundation for the future studies on the effects of effective ERP usage on SCM capacities and organizational performance.

Further, a growing body of strategic management literature examines how organizational ambidexterity (e.g., Kristal et al., 2010) and dynamic capabilities (e.g., Oh et al., 2012) emerge and affect performance. Nevertheless, their applicability to IOS and SCM are largely missing. The conceptualization of two specific SCM competencies and the theorization of the relationship between these capabilities and overall organizational performance serve to extend the dynamic capabilities and organizational ambidexterity literatures. Two dynamic SCM competencies were developed as a result of effective ERP usage for SCM; interactions of these SCM competencies are linked to three aspects of organizational performance. Results of this dissertation validate the role of SCM explorative and exploitative competence on overall organizational performance. In addition, results of this dissertation show that SCM explorative competence positively influences the relationship between SCM exploitative competence and two of the three aspects of overall organizational performance. Moreover, this dissertation extends the current explanations of the origins of organizational ambidexterity. Although a wide selection of mechanisms for reaching ambidexterity are proposed in the previous literature (Raisch & Birkinshaw, 2008), they all fail to address the role of SCM and its competencies. Thus, the empirical support for organizational ambidexterity lies at the core of the framework. Consequently, the primary contribution of this study to the strategic management literature is the theoretical model that represents the nature and role of organizational ambidexterity and dynamic capabilities on SCM and organizational performance.

Additionally, this study extends the SCM literature. It focuses on the focal organization perspective and provides evidence that ambidextrous supply chains achieve better results than their competitors do. The proposed model predicts organizational performance for effective ERP usage based on the dynamic capabilities theory and organizational ambidexterity. Findings of this study reveal that effective ERP usage for front and end SCM processes plays critical role for SCM competence development. As effective ERP usage for CRM, CSM, and SRM increases, organizations gain dynamic capabilities for SCM exploration and exploitation. Additionally, the results indicate that organizations' balanced efforts on SCM explorative competence and SCM exploitative competence development positively influences overall organizational performance. Therefore, results of this dissertation advance the literature by examining ambidextrous supply chains and their connection with IOS applications. Specially, this study treats ERP applications as indirect platforms for developing contextual ambidexterity in SCM. ERP users balance their explorative and exploitative activities within single platform that, in turn, supports development of SCM capabilities. In addition, this dissertation comprehensively conceptualizes and develops a measurement scale for SCM explorative and exploitative competencies.

5.3. PRACTICAL IMPLICATIONS

Managing and utilizing supply chains within and across organizational boundaries is a major challenge in today's competitive environment, as supply chain cost constitutes the major percentage of the total production cost. This study demonstrates the importance of developing SCM explorative and exploitative competencies through effective ERP usage to achieve desired organizational performance. To remain competitive, organizations have to implement a SCM module of ERP and use it effectively. An important concern for top-managers is how to develop,

maintain, and dynamically change these SCM competencies to improve overall organizational performance. The practical implications of this research can be summarized in four key criteria that managers should be aware of as they pursue an ambidextrous supply chain strategy: (1) the effective ERP usage for SCM and their role on competence development, (2) the indirect effect of effective ERP usage for SCM on overall organizational performance, (3) the impact of SCM explorative competence and SCM exploitative competence on all three aspects of organizational performance, and (4) the organizational ambidexterity strategy in SCM and benefits of pursuing such strategy on overall organizational performance.

IOS applications, which creates connected supply chain networks, are recommended to organizations as a solution for supporting supply chain activities (Kumar & Crook, 1999). Yet, as business value of IS literature suggests the contribution of IS usage to overall organizational performance, specifically its effect on the organizational productivity, has been questioned for decades (Dedrick et al., 2003). Hence, this research provides guidance to managers on this issue. It offers insights to managers into structural configuration of ERP that can assist in developing SCM explorative and exploitative competencies. In other words, results of this study emphasize that each key SCM process needs to get specific attention during ERP implementation and usage, as each process has a different influence on capability development in SCM. Thus, this research helps managers to better understand effective ERP usage for SCM. As a result, managers have to ensure the integration of each key SCM process onto ERP and confirm the effective use of all SCM modules in ERP. Increasing effective ERP usage enables organizations to achieve higher levels of SCM explorative and exploitative competencies.

Further, most organizations understand the value of IOS and ERP usage today, but the ambiguity lies in configuring ERP modules properly to achieve competitive advantage over other

organizations (Trinh et al., 2012). This dissertation offers insights to managers on how they can enhance overall organizational performance. Specifically, results of this research emphasize the importance of a mediating mechanism between effective ERP usage and overall organizational performance. This finding indicates that practitioners should align ERP processes and relevant competencies to improve organizational performance.

Additionally, this dissertation provides valuable information regarding the role of SCM competencies on overall organizational performance. The findings indicate that SCM explorative and exploitative competence positively affect overall organizational performance. Nevertheless, influences of SCM competencies on each aspect of performance are different. Thus, managers have to balance between developing SCM explorative and exploitative competencies to increase all aspects of overall organizational performance. Failure to balance these two kinds of capability development might lead to a loss of organizational performance (Schulze et al., 2008). Although exploration activities might increase market value, it might reduce profitability and productivity due to expenditures and the learning curve of employees. Therefore, these results indicate that, effective ERP usage for SCM significantly affects overall organizational performance via SCM capability development.

This research also informs managers regarding the organizational performance benefits of ambidextrous supply chain strategy. Findings of this study indicate that, even though developing SCM explorative competence and SCM exploitative competence separately has positive impact on overall organizational performance, simultaneous improvement of these SCM competencies will boost overall organizational performance. Specially, it increases the profitability and market value of organizations. Hence, organizations can benefit from implementing ERP as an indirect platform to develop SCM capabilities and following the ambidextrous supply chain strategy to

manage SCM processes. Managers should realize that, as hard as it is, achieving organizational ambidexterity in SCM would pay off in the end.

5.4. LIMITATIONS AND FUTURE RESEARCH

Even though this dissertation provides insights regarding the role of ERP usage and SCM competencies on overall organizational performance, it has several potential limitations. As with all empirical research, findings of this research should be interpreted in light of these limitations. First, due to the nature of the self-reported scales, there is a possibility of common method bias. The common method bias is cited as one of the most crucial concerns in survey based research (Sanders, 2008). It occurs when the structure of the questionnaire affects the construct measures. For example, because of the ordered and/or grouped structure of the survey, the respondents are likely to correlate the answers of two subsequent questions. Such a bias may affect the overall results of the study. However, the common response bias is unavoidable as far as a survey with self-report scales is used to collect data.

Second, this study relies on a set of cross-sectional data, where all variables are measured at one point in time with an online survey. The cross-sectional data provides a snapshot of the relationships among constructs. This method creates a limitation due to the inherent nature of its constructs. As repeatedly concluded in the prior business value of IS research (Lee & Kim, 2006; Yaylacicegi & Menon, 2004), the realization of overall performance benefits of implemented IS might require time. Thus, longitudinal research needs to be conducted to further test the proposed relationship in the theoretical model of this study. Nevertheless, the dynamic nature of today's business environment increases the difficulty of conducting a longitudinal research, which is a common concern for studies of this nature.

Lastly, use of a single respondent from each organization can be considered one of the main limitations of this dissertation (Kristal et al., 2010). This approach can suffer from potential response bias, including the over-reporting or under-reporting of certain phenomenon. Further, data collection from multiple respondents in an organization enables cross validation and offers evidence for inter-rater reliability. Yet, the content of this research and the difficulty of reaching multiple managers from the same organization restricted the ability to get multiple responses for the survey. To manage this limitation, the key respondents were selected based on the previous literature findings (Kristal et al., 2010; Liu et al., 2013). It is assumed that respondents' judgment regarding ERP usage, SCM competencies, and organizational performance are objective.

As a result, findings of this dissertation serve as an empirical base for future research. Future researchers should address the limitations outlined above: (1) common method bias, (2) cross-sectional data, and (3) use of key respondents. Common method bias can be avoided by obtaining data through multiple methods. Hence, future research should combine qualitative and quantitative research methods such as survey, case study, and interview to enhance the reliability of findings. In addition, future research might benefit from longitudinal data to investigate how ERP usage improves SCM competencies over time, and how this affects overall organizational performance, due to the dynamic nature of constructs. Particularly, such research is helpful to identify the lag between constructs. Finally, although the key respondent approach is consistent with previous research in IOS literature and is assumed to be suitable when respondents present unique insights and are considered knowledgeable about the topic(s) at hand, the use of multiple informants from the same organization enhances the validity of findings.

Apart from overcoming these limitations, for future research to advance the literature, it is suggested that: (1) a dyadic relationships between supply chain partners is used, (2) other key

supply chain processes should be taken into account, (3) the proposed framework is examined outside of U.S. organizations, and (4) a detailed investigation of interesting findings is presented. Although focal organizations are the owners of the supply chain, customers and suppliers play a key role in the success of the network. Therefore, it might be fruitful to investigate the dyadic relationships to understand the suppliers' perspectives as well. In addition, this research focuses on the front and end SCM processes; nevertheless, any key SCM processes that influence SCM explorative and exploitative competence should be useful in explaining ambidexterity in supply chains. Therefore, future research should investigate all eight key SCM processes. Moreover, the level of ERP usage and its effectiveness might vary among countries; as such, this variance may cause different results across countries. Further, cultural differences may affect the relationship among supply chain partners in other countries. For example, organizations in a more traditional country, like China, might rely on personal ties more than organizations in the U.S. As a result, a geographically limited sample framework might weaken the generalizability of results of study in different geographical settings. Finally, it might be fruitful to examine the differences among SCM processes and multiple aspects of organizational performance in more detail. Specifically, investigating the effects of ambidextrous supply chain strategy on organizational productivity provides valuable insights and extension to the business value of IS research and productivity paradox literature.

5.5. CONCLUSION

Supply chain management is one of the key topics in today's hypercompetitive business environment as supply chain cost generates the major part of the production cost. A supply chain involves flow of products or services as well as flow of knowledge among supply chain partners.

Consequently, IS applications that are used by organizations to transfer knowledge within supply chain network, come to be critical as these networks become the unit of competition in today's competitive environment (Jessup & Valacich, 2006). Specially, IS usage remains important for capability development (Kristal et al., 2010; Oh et al., 2012). Hence, this study builds upon and contributes toward research on the business value of IS, dynamic capabilities and organizational ambidexterity in SCM. Particularly it intends to understand the role of effective ERP usage for SCM on SCM competencies development, which facilitates ambidextrous supply chain strategy, and the influence of these competencies on overall organizational performance from perspective of a focal organization.

To achieve this goal this dissertation postulates three research questions:

1. How does the effective usage of ERP for SCM affect SCM explorative competence and SCM exploitative competence of organizations?
2. How do SCM explorative competence and SCM exploitative competence of organizations directly affect overall organizational performance?
3. How does SCM explorative competence of organizations moderate the relationship between SCM exploitative competence of organizations and overall organizational performance?

In order to address the first research question, three SCM processes — CRM, CSM, and SRM — are used to theorize the effective ERP usage construct. Further, SCM competencies are conceptualized as SCM explorative competence and SCM exploitative competence. Results of this dissertation indicate that effective ERP usage for each of the SCM processes has a different impact on both SCM explorative and exploitative competencies. Although CRM improves both SCM explorative competence and SCM exploitative competence, CSM and SRM only influence

one of these SCM competencies. Specifically, CSM improves SCM explorative competence and SRM improves SCM exploitative competence. These results add value from academic research perspective as this dissertation is the first to measure the explicit influence of effective usage of ERP for these processes on SCM competencies. Additionally, these results suggest that effective ERP usage for SCM has an overall positive influence on both SCM explorative competence and SCM exploitative competence. However, each ERP based SCM processes has their unique effect on these competencies. Thus, to realize potential benefits of ERP implementation, organizations should adapt and improve SCM processes and ensure that all ERP based SCM processes are used for communicating with their supply chain partners.

Furthermore, to address the second research question, overall organizational performance construct is conceptualized as productivity, market value, and productivity. The research model investigates the impact of SCM explorative competence and SCM exploitative competence on these three aspects of overall organizational performance. The results show that SCM explorative competence improves market value of organizations. In contrast, SCM exploitative competence has a positive effect on all three aspects of overall organizational performance. Results of this dissertation indicate that SCM exploitative competence of an organization has more influence on overall organizational performance. Yet, SCM explorative competence is critical for expending market value of organizations. Therefore, these findings suggest that although SCM explorative competence is vital to improve organizational performance, SCM exploitative competence is the key for higher organizational performance. This means that, exploitative strategy is more critical than explorative strategy. Therefore, organizations should choose to pursue exploitative strategy over explorative strategy, if they do not have necessary resources to simultaneously pursue both explorative and exploitative strategy.

Finally, to address the third research question, level or organizational ambidexterity in SCM is measured as the multiplication of SCM explorative competence and SCM exploitative competence scores of organizations. It is assumed that organizations that pursue ambidextrous supply chain strategy maintain high level of both of these competencies. Using these developed scores, this dissertation investigates the impact of ambidextrous supply chain strategy on three aspects of overall organizational performance — profitability, market value and productivity. The results indicate that ambidextrous supply chain strategy outperforms other strategies in terms of profitability and market value; nevertheless, there is no statistically significant organizational productivity difference between ambidextrous organizations and standard organizations. Thus, these results show that ambidextrous supply chains overall outperform their competitors. Yet, productivity is not one of the initial benefits of ambidextrous supply chain strategy. As a result, this dissertation suggests that organizations that can balance their SCM explorative competence and SCM exploitative competence level will show higher organizational performance compared to their competitors. Therefore, pursuing the ambidextrous supply chain strategy is beneficial for organizations.

Overall, this study illustrates the value of effective ERP usage for SCM and ambidextrous supply chain strategy on overall organizational performance. Specifically, it emphasizes the role of ERP in improving SCM competencies, and in turn increasing organizational performance. In line with the literature, this study confirms that there is a indirect relationship between IS usage and overall organizational performance (Li, 2012; Oh et al., 2012). In other words, effective IS usage impact organizational performance by enabling other organizational resources like SCM explorative competence and SCM exploitative competence. This dissertation also provides a new perspective in studying the organizational performance. The significant relationship between the

interaction of two competencies and overall organizational performance highlights the theoretical and empirical importance of ambidextrous supply chain strategy. Based on findings of this study, organizations should pay attention to the alignment between SCM business processes and SCM competencies. Organizations will realize higher organizational performance, when they manage to improve existing competencies and develop new competencies based on the business process improvements caused by ERP implementation, and balance their explorative and exploitative activities. Additionally, findings of this dissertation can help both researchers and practitioners to develop effective ERP usage measures for SCM and offer new venues of research. Especially, the insignificant relationship between SCM processes and SCM competencies requires further investigation.

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APPENDICES

APPENDIX A

A. SURVEY COVER LETTER

Dear Respondent:

I invite you to participate in a research study titled "Ambidexterity: The Interplay of Supply Chain Management Competencies and Enterprise Resource Planning Systems on Organizational Performance". I am currently a Ph.D. candidate at Old Dominion University, and I am in the process of writing my dissertation. The purpose of this study is to determine how Enterprise Resource Planning systems impact the efficiency and innovation of the supply chain management capabilities in organizations, and how these capabilities affects overall firm performance. Because you work in the supply chain field, I invite you to participate in this research study by completing the following survey.

In this study, you will be asked to complete an electronic survey, which will require **approximately 5 minutes** to complete. **It is encouraged to use a desktop or laptop computer for the ease of reading questions.** There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please do not include your name. Data from this research will be kept under lock and no one other than the researchers will know your individual answers to this questionnaire. Your participation in this study is completely voluntary and you are free to withdraw your participation from this study at any time. You may decline altogether, or leave blank any questions you do not wish to answer. If you choose to participate in this project, please answer all questions as honestly as possible.

Thank you for taking the time to assist me in my educational endeavors. The data collected will provide useful information regarding benefits of Enterprise Resource Planning systems on supply chain management capabilities and firm performance. If you would like a summary copy of this study, please complete the contact information at the end of the survey. Completion and return of the questionnaire will indicate your willingness to participate in this study. If you require additional information or have questions, please contact me at sturedi@odu.edu or 216-816-8202.

Sincerely,
Serdar Turedi
PhD Candidate
Old Dominion University
Norfolk, VA

APPENDIX B

B. SURVEY INSTRUMENT

Q1. Do you currently hold a position as Supply Chain Manager, Operations Manager, Procurement Manager, or a similar position in your company?

- ❍ Yes
- ❍ No
- ❍

Q2. Does your company use Enterprise Resource Planning (ERP) software for supply chain management?

- ❍ Yes
- ❍ No

Q3. The following questions aim to collect information regarding your company. Please try to answer each question openly and truthfully.

a) Company's Name _____

b) Main Line of Business _____

c) Industry and NAICS code (if available) _____

d) Stock Ticker Symbol (If available) _____

e) Your Position _____

Q4. Please indicate the level of your firm's performance, over the last 3 years, compared to major industry competitors. (1='Much worse'; 4='About the same'; 7='Much better'; N/A='Do not know / Does not apply)

	1	2	3	4	5	6	7	N/A
Average annual growth in return on total assets	❍	❍	❍	❍	❍	❍	❍	❍
Average annual growth in return on sales	❍	❍	❍	❍	❍	❍	❍	❍
Average annual growth in return on investment	❍	❍	❍	❍	❍	❍	❍	❍
Return on assets	❍	❍	❍	❍	❍	❍	❍	❍
Return on sales	❍	❍	❍	❍	❍	❍	❍	❍
Return on investment	❍	❍	❍	❍	❍	❍	❍	❍
Average annual growth in revenue	❍	❍	❍	❍	❍	❍	❍	❍
Average annual growth in sales	❍	❍	❍	❍	❍	❍	❍	❍
Average annual growth in market share	❍	❍	❍	❍	❍	❍	❍	❍
Market share	❍	❍	❍	❍	❍	❍	❍	❍
Overall productivity	❍	❍	❍	❍	❍	❍	❍	❍
Labor productivity	❍	❍	❍	❍	❍	❍	❍	❍

Q5. Please indicate which of the following supply chain management (SCM) processes does your company use in ERP to manage the supply chain.

- ❑ Customer Relationship Management (CRM)
- ❑ Customer Service Management (CSM)
- ❑ Supplier Relationship Management (SRM)

Q6a. Please indicate the extent to which the following practices are used to communicate with your primary supply chain partners (buyer and/or supplier) to improve Customer Relationship Management (CRM) (1=‘Not at All; 4='Somewhat same'; 7='To a great extent'; N/A='Do not know / Does not apply)

	1	2	3	4	5	6	7	N/A
Our ERP is used for integrating CRM within the company and across the supply chain	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for providing better use of organizational data resource for CRM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for enhancing higher-quality of decision making for CRM	❍	❍	❍	❍	❍	❍	❍	❍
There is a good fit between ERP and CRM initiatives	❍	❍	❍	❍	❍	❍	❍	❍
Data provided by ERP match well with the data required for CRM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP will help us take advantage of our current/future CRM programs	❍	❍	❍	❍	❍	❍	❍	❍

Q6b Please indicate the extent to which the following practices are used to communicate with your primary supply chain partners (buyer and/or supplier) to improve Customer Service Management (CSM)(1=‘Not at All; 4='Somewhat same'; 7='To a great extent'; N/A='Do not know / Does not apply)

	1	2	3	4	5	6	7	N/A
Our ERP is used for integrating CSM within the company and across the supply chain	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for providing better use of organizational data resource for CSM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for enhancing higher-quality of decision making for CSM	❍	❍	❍	❍	❍	❍	❍	❍
There is a good fit between ERP and CSM initiatives	❍	❍	❍	❍	❍	❍	❍	❍
Data provided by ERP match well with the data required for CSM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP will help us take advantage of our current/future CSM programs	❍	❍	❍	❍	❍	❍	❍	❍

Q6c. Please indicate the extent to which the following practices are used to communicate with your primary supply chain partners (buyer and/or supplier) to improve Supplier Relationship Management (SRM) (1=‘Not at All; 4='Somewhat same'; 7='To a great extent'; N/A='Do not know / Does not apply)

	1	2	3	4	5	6	7	N/A
Our ERP is used for integrating SRM within the company and across the supply chain	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for providing better use of organizational data resource for SRM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP is used for enhancing higher-quality of decision making for SRM	❍	❍	❍	❍	❍	❍	❍	❍
There is a good fit between ERP and SRM initiatives	❍	❍	❍	❍	❍	❍	❍	❍
Data provided by ERP match well with the data required for SRM	❍	❍	❍	❍	❍	❍	❍	❍
Our ERP will help us take advantage of our current/future SRM programs	❍	❍	❍	❍	❍	❍	❍	❍

Q7. Adoption of the Supply Chain Management (SCM) process of ERP has provided the following benefits: (1=‘Not at All; 4='Somewhat same'; 7='To a great extent'; N/A='Do not know / Does not apply)

	1	2	3	4	5	6	7	N/A
We have the ability to reduce our supply chain costs	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to improve our inventory accuracy	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to improve communication with our suppliers and our customers	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to improve our shipment and delivery accuracy	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to pursue new supply chain solutions	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to provide new ways of performing supply chain processes	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to improve supply chain by exploring new opportunities	❍	❍	❍	❍	❍	❍	❍	❍
We have the ability to reallocate resources quickly in response to changes in market conditions	❍	❍	❍	❍	❍	❍	❍	❍

Q8. Please indicate the total number of employees in your company (all locations) by checking the appropriate line:

- ❍ 100 or fewer
- ❍ 101–500
- ❍ 501–1000
- ❍ 1001–5000
- ❍ 5001 or more

Q9. Please indicate the total revenue for your company (all locations) in 2014 by checking the appropriate line:

- ❍ $100 million or less
- ❍ MORE than $100 million, up to $500 million
- ❍ MORE than $500 million, up to $1 billion
- ❍ MORE than $1 billion, up to $2 billion
- ❍ MORE than $2 billion

Q10. Please indicate any additional comments.

Q11. Please provide your e-mail address, if you wish to receive the summary of the results.

APPENDIX C

C. MEASUREMENT ITEMS ENTERING Q-SORT

ERP Usage Effectiveness

Our ERP is used for integrating SCM within the company and across the supply chain
Our ERP is used for providing better use of organizational data resource for SCM
Our ERP enhances higher quality of decision-making
There is a good fit between ERP implementation and SCM process initiatives
Data provided by ERP match well with the data required for SCM
Our ERP will help us take advantage of our current/future SCM programs

SCM Exploitative Competence

We have the ability to reduce our supply chain costs
We have the ability to improve our inventory accuracy
We have the ability to improve information sharing with suppliers and customers
We have the ability to improve our shipment accuracy

SCM Explorative Competence

We have the ability to pursue new supply chain solutions
We have the ability to provide new ways of performing supply chain processes
We have the ability to improve supply chain by exploring new opportunities
We have the ability to reallocate resources quickly in response to changes in market conditions

APPENDIX D

D. COHEN'S KAPPA

In empirical research design, when two judges (raters or observers) are used to measure a categorical variable, it is important to determine interrater reliability of judges. There are two possible outcomes of agreement: Judges either agree or disagree in their rating. Q-Sort analysis is an iterative methodology that measures the agreement between judges to form the validity and reliability. Thus, the interrater reliability of judges needs to be assessed to determine the validity and reliability of constructs. Cohen's Kappa (κ) is one of the most robust measurement methods, which is used to identify the agreement level of judges. It is calculated from the observed and expected frequencies on the diagonal of a square contingency table.

Let us assume that Judge 1 and Judge 2 independently classified N subjects into g distinct categories. Further, let f_{ij} donate the frequency of the number of subjects with the i^{th} category for Judge 1 and j^{th} category for Judge 2. Then, the observed frequencies of the number of subjects in each category can be arranged in the following g x g table.

Raters	Judge 1					
Judge 2	Categories	1	2	…	g	Total
	1	f_{11}	f_{12}	…	f_{1g}	f_{1+}
	2	f_{21}	f_{22}	…	f_{2g}	f_{2+}
	…	…	…	…	…	…
	g	f_{g1}	f_{g2}	…	f_{gg}	f_{g+}
	Total	f_{+1}	f_{+2}	…	f_{+g}	N

Furthermore, the above table can be also organized in a form to represent the observed proportionate values by dividing each observed frequencies by N. Consequently, the new table would look like:

Raters	Judge 1					
Judge 2	Categories	1	2	…	g	Total
	1	P_{11}	P_{12}	…	P_{1g}	P_{1+}
	2	P_{21}	P_{22}	…	P_{2g}	P_{2+}
	…	…	…	…	…	…
	g	P_{g1}	P_{g2}	…	P_{gg}	P_{g+}
	Total	P_{+1}	P_{+2}	…	P_{+g}	1

Using this new table, two relevant quantities need to be calculated. First, the observed proportional agreement between judges can be calculated as:

$$p_0 = \sum_{i=1}^{g} P_{ii}$$

and second, the expected agreement between judges by chance can be calculated as:

$$p_e = \sum_{i=1}^{g} P_{i+} P_{+i}$$

Then, the Cohen's kappa can be calculated as:

$$\kappa = \frac{p_o - p_e}{1 - p_e}$$

APPENDIX E

E. PERREAULT AND LEIGH'S INDEX OF RELIABILITY

Another commonly used interrater reliability measurement methodology is Perreault and Leigh's index of reliability (I_r). Similar to Cohen's κ, I_r also captures the observed proportion of agreement between judge pairs, while taking into account the number of construct categories (k). Therefore, using the observed proportionate values table shown above I_r can be calculated as:

$$I_r = \sqrt{\frac{p_o - 1/k}{k/(k-1)}}$$

APPENDIX F

F. NONRESPONSE BIAS ANALYSIS RESULTS

Nonresponse bias is one of the main concerns in survey research. It is critical to identify whether respondents chose not to participate independently or in a systematic pattern. To assess the participation pattern of the respondents, number of employees, total revenue, and industry of early and late respondents are compared. Early respondents are identified as the respondents who completed the survey in the first two weeks. To test the nonresponse bias chi-square (χ^2) is used because of the categorical nature of the variables. IBM SPSS 19, which is a software licensed by ODU, is chosen to execute the analysis. The three tables in this appendix show the results of the χ^2 tests for determining nonresponse bias. Results of nonresponse bias test indicate that there is no significant difference between early and late responders.

NAICS Codes	Early Responder	Later Responder	χ^2 test
21	1	1	$\chi^2 = 16.276$ df = 15 p = 0.364
22	3	1	
23	4	4	
31	3	0	
32	6	4	
33	17	21	
42	1	2	
45	2	4	
48	5	1	
49	2	0	
54	8	5	
61	4	1	
62	2	3	
71	2	0	
72	4	1	
92	0	1	

Table 23. Industry – Nonresponse Bias Test

Number of Employees	Early Responder	Later Responder	χ^2 test
100 or fewer	12	9	$\chi^2 = 7.034$ df = 4 p = 0.134
101–500	18	8	
501–1000	8	4	
1001–5000	6	13	
5001 or more	20	15	

Table 24. Number of Employees – Nonresponse Bias Test

Total Revenue	Early Responder	Later Responder	χ^2 test
$100 million or less	30	18	$\chi^2 = 4.799$ df = 4 p = 0.309
MORE than $100 million, up to $500 million	10	12	
MORE than $500 million, up to $1 billion	4	3	
MORE than $1 billion, up to $2 billion	1	4	
MORE than $2 billion	19	12	

Table 25. Total Revenue - Nonresponse Bias Test

APPENDIX G

G. Q-SORT ANALYSIS RESULTS

First Round Q-Sort Results

CONSTRUCTS		ACTUAL					
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total	% Hits
THEORETICAL	ERP Usage Effectiveness	1	7	4	0	12	8.33
	SCM Exploitative Competence	1	3	4	0	8	37.50
	SCM Explorative Competence	0	1	7	0	8	87.50

Item Placements: 28 Hits: 11 Overall Hit Ratio: 39%

Table 26. First Round Item Placement Ratio

		Judge 1				
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total
Judge2	ERP Usage Effectiveness	0	0	0	0	0
	SCM Exploitative Competence	0.14	0.14	0.14	0	0.42
	SCM Explorative Competence	0	0.22	0.36	0	0.58
	N/A	0	0	0	0	0
	Total	0.14	0.36	0.50	0	1

$p_{o:}$	0.5	$p_{o:}$	0.5
$p_{e:}$	0.43877551	1/k:	0.25
κ:	0.109090909	$I_{r:}$	0.577350269

Table 27. First Round κ and I_r Scores

Second Round Q-Sort Results

CONSTRUCTS		ACTUAL					
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total	% Hits
THEORETICAL	ERP Usage Effectiveness	10	0	0	2	12	83.33
	SCM Exploitative Competence	0	5	1	2	8	62.50
	SCM Explorative Competence	0	1	7	0	8	87.50

Item Placements: 28 Hits: 22 Overall Hit Ratio: 79%

Table 28. Second Round Item Placement Ratio

		Judge 1				
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total
Judge2	ERP Usage Effectiveness	0.29	0	0	0.14	0.43
	SCM Exploitative Competence	0	0.14	0.07	0.07	0.28
	SCM Explorative Competence	0	0	0.21	0.07	0.29
	N/A	0	0	0	0	0
	Total	0.29	0.14	0.29	0.28	1

$p_{o:}$	0.642857143	$p_{o:}$	0.642857143
$p_{e:}$	0.244897959	1/k:	0.25
κ:	0.527027027	$I_{r:}$	0.723746864

Table 29. Second Round κ and I_r Scores

Third Round Q-Sort Results

CONSTRUCTS		ACTUAL					
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total	% Hits
THEORETICAL	ERP Usage Effectiveness	11	1	0	0	12	91.67
	SCM Exploitative Competence	1	7	0	0	8	87.50
	SCM Explorative Competence	0	0	8	0	8	100

Item Placements: 28 Hits: 26 Overall Hit Ratio: 93%

Table 30. Third Round Item Placement Ratio

		Judge 1				
		ERP Usage Effectiveness	SCM Exploitative Competence	SCM Explorative Competence	N/A	Total
Judge2	ERP Usage Effectiveness	0.36	0.07	0	0	0.43
	SCM Exploitative Competence	0.07	0.21	0	0	0.28
	SCM Explorative Competence	0	0	0.29	0	0.29
	N/A	0	0	0	0	0
	Total	0.43	0.28	0.29	0	1

$p_{o:}$	0.857142857	$p_{o:}$	0.857142857
$p_{e:}$	0.346938776	1/k:	0.25
κ:	0.78125	$I_{r:}$	0.899735411

Table 31. Third Round κ and I_r Scores

VITA

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EDUCATION

Ph.D. in Business Administration, Old Dominion University, Norfolk, VA, – May 2015
Concentration: Information Technology and International Business
M.Sc. in Management of Information Systems, Marmara University, Istanbul, TR, – Aug 2009.
B.Sc. in Statistics(with High Honors), Istanbul Commerce University, Istanbul, TR, – May 2006.

RESEARCH INTEREST

Strategic Management of IT
Business Analytics
Enterprise Resource Planning (ERP)
Information Supply Chain

CONFERENCE PROCEEDINGS

Turedi, S. (2012). Spatial Analysis of Ohio Police Station Locations Using Geographical Information Systems, *COM.Geo '12 Proceedings of the 3rd International Conference on Computing for Geospatial Research and Applications*, Paper 23
Turedi, S., & Zhu, H. (2012). Business Value of IT: Revisiting Productivity Paradox through Three Theoretical Lenses and Empirical Evidence, *AMCIS 2012 Proceedings*, Paper 18.

OTHER PUBLICATIONS

Turanli, M., Ozden, U. H., & Turedi, S. (2006). Cluster Analysis of the Economical Similarities of European Union Members and Candidate Countries. *Istanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi*, 5(9), 95-108 (Undergraduate Dissertation – Turkish)

PROFESSIONAL EXPERIENCE

Purdue University – Northwest, Westville, IN – *Assistant Professor*, May 2016 – Present
Northeastern University, Boston, MA – *Visiting Assistant Professor*, Aug 2015 – May 2016
Valparaiso University, Valparaiso, IN - *Adjunct Instructor*, Jan 2015 – May 2015
Old Dominion University, Norfolk, VA – *Adjunct Instructor*, Aug 2011 – Jun 2014
Cleveland State University, Cleveland, OH – *Research Assistant*, Aug 2009 – May 2011
Bizitek Software Development, Istanbul, Turkey – *Project Manager, Jun* 2006 – Jul 2009