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# THE IMPACT OF CLOUD COMPUTING IN SUPPLY CHAIN COLLABORATIVE RELATIONSHIPS, COLLABORATIVE ADVANTAGE AND RELATIONAL OUTCOMES

by

MARIA E. AVILES

(Under the Direction of Stephen Rutner)

ABSTRACT

The purpose of this study is to explore the collaborative advantages and relational outcomes that organizations obtain from having strong collaborative relationships. With business competing as supply chains of multiple relationships, the reliance on inter-firm relationships has increased and become central strategy for organizations. Logistics computing technologies in the cloud may facilitate collaboration in the supply chain, although there are conflicting viewpoints regarding cloud viability. This study also evaluates the effect that cloud computing technology has on collaborative advantage and relational outcomes in small and large organizations. The model developed here is based on a cross-disciplinary theoretical perspective, which combines the relational view of the firm, the transaction cost economics and the task technology fit theories. This study demonstrates that maintaining collaborative relationships provide value added capabilities that logistics organizations require in order to remain competitive and be successful in some cases strengthen by the use of cloud computing.

INDEX WORDS: Logistics, Supply Chain, Cloud Computing, Collaborative Relationships, Collaborative Advantage, Relational Outcomes, Partial Least Squares (PLS-SEM), Small and Large Organizations.

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Partial Fulfillment of the Requirements for the Degree

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THE IMPACT OF CLOUD COMPUTING IN SUPPLY CHAIN COLLABORATIVE RELATIONSHIPS, COLLABORATIVE ADVANTAGE AND RELATIONAL OUTCOMES

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Spring 2015

DEDICATION

This dissertation is dedicated to my loving husband, Enrique Sotelo, for his patience and support through this journey that included long hours, extensive travel and limited accessibility for the past years . Enrique thanks for being by side encouraging me and believing in me with unconditional love. To our beloved children, Isabella Marie and Pablo Antonio, whose arrival to our lives brought happiness and desire to become exemplar parents for you. Isabella and Pablo, you are my inspiration, I hope taking the time away from you to complete this dissertation set an example of perseverance, courage and dedication to accomplish your objectives with God's blessings. I also dedicate this work to my loved parents, Mrs. Beatriz Ramirez and Mr. Pablo Aviles, who instilled in me a love of learning, accompanied and supported me not only now but always in everything I have done. My brother Juan Pablo, my nieces Michelle, Angie and Andrea, and my uncle Hernan that helped and provided moral support during the PhD. To you and all my family and friends whose names are not mentioned here, but have helped me one way or the other to achieve this success, thanks.

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# CHAPTER 1

# INTRODUCTION

Organizations within a supply chain are increasingly using technology to aid them in collaboration. Investments in information technology (IT) make their greatest competitive contribution when they enable collaboration (Fawcett, Wallin, Allred, Fawcett, & Magnan, 2011). Collaboration is defined as "the ability to work across organizational boundaries to build and manage unique value-added processes to better meet customer needs." (Fawcett, Magnan, & McCarter, 2008, pp., p. 93). IT is defined as technology used to acquire, process and transmit information for more effective decision making (Grover & Malhotra, 1997). One could argue that efficient supply chain management requires high levels of collaboration often achieved through the use of different types of IT tools (Cassivi, Lefebvre, Lefebvre, & Léger, 2004). The technology must be aligned to the business objectives in order to have efficient business operations (Belalem, Bouamama, & Sekhri, 2011). According to Johnston and Vitale (1988), organizations that have joined their systems have increased collaboration and improved the economic performance of each partner.

Collaborative investments and behaviors provide tools and processes to manage the large amount of information and support goals and objectives of the collaborating supply chain members. The use of technology has helped firms differentiate from competitors by enhancing their relationships with suppliers and customers (Closs & Savitskie, 2003). For example, Toyota's collaborative supply chain relationships with its suppliers have obtained a 140% greater output per worker, 25% decreased inventory and fewer defects than rivals (Spekman & Carraway, 2006). Firms with a better ability to plan and integrate their IT resources and provide

timely, accurate, and reliable information to key stakeholders are more effective in improving supply chain relationships (Karimi, Somers, & Gupta, 2001). Collaborative relationships among partners have demonstrated meaningful savings for all members. However, acquiring, hosting and maintaining IT infrastructure for effective business operations is challenging or even unattainable for some organizations.

For small and medium enterprises (SMEs) it is more challenging to acquire and maintain IT infrastructure (Low, Chen, & Wu, 2011). Larger firms have more financial resources and technological knowledge to more effectively utilize IT in ways that smaller firms cannot afford (Bienstock, Royne, Sherrell, & Stafford, 2008; Byrd, Pitts, Adrian, & Davidson, 2008; Chan, Yee-Loong Chong, & Zhou, 2012; Gunasekaran & Ngai, 2008; Zhu, Kraemer, & Xu, 2006). For example, SMEs will often not possess transportation management systems due to high cost (Pappu, Mundy, & Paswan, 2001). SMEs are unable to take advantage of the computational power that large organizations possess, potentially losing substantial amounts of revenues. "With the advent of web-based supply chain applications, supply chain management is now accessible to smaller firms dealing with larger business partners." (Cassivi, et al., 2004, p. 93).

One possible solution to help SMEs might be the implementation of cloud computing. A new technology, known as cloud computing, offers an opportunity to many firms to harness the tools, equipment, (Barney, 1991)know-how and expertise necessary to aid collaborative relationships. Cloud computing is defined as "an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of devise (i.e. Smartphone, tablet, laptop) and location." (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011, p. 177). Cloud computing

refers to shared software and information that can be accessed on demand via the internet (Armbrust et al., 2010; Buyya, Yeo, & Venugopal, 2008). Cloud computing offers a possible solution to some organizations to quickly increase their capacity without huge investments (Belalem, et al., 2011). As such, cloud computing provides faster implementation times and lower upfront investments in that organizations do not have to spend their resources acquiring infrastructure (Marston, et al., 2011; Zhang, Cheng, & Boutaba, 2010). Cloud computing is particularly suitable for SMEs that outsource their infrastructure and want to expand their capacity as needed - "on demand" (Belalem, et al., 2011).

Cloud computing started to gain popularity in 2007 as a resource optimizer that provided services to geographically separated clients on-demand (Etro, 2011; Ruan, Baggili, Carthy, & Kechadi, 2011; Siegle, 2010; Wang et al., 2010). Adoption rates are highest in areas of collaborative sourcing and procurement, demand planning, global trade management, and transportation management systems (McCrea, 2012). According to McCrea (2012) cloud computing will lead to new forms of collaboration that couldn't be developed with traditional solutions in traditional architectures. Multiple business processes can be managed across businesses using this technology. A growing number of third party logistics providers (3PL's) are turning to cloud computing technology to successfully support customers enabling them to see further along both sides of the supply chain (Monkmeyer, 2011). Collaborative relationships are allowing shippers to improve decision making and the costs are spread across users. Cloud computing is now offering an opportunity that will enable small organizations to share the same services as larger companies, including the benefits from the ability to transparently interact and manage processes outside the organization, which reducing the cost of ownership for supply chain collaboration.

Cloud computing research has increased in the past few years providing a better understanding of the design and research directions of this area. Topics related to the design challenges, concepts. principles and implementation were first researched (Benlian & Hess, 2011; Marston, et al., 2011; Vouk, 2004; Zhang, et al., 2010). Research has also examined the factors affecting the adoption of cloud computing technology (Wu, Cegielski, Hazen, & Hall, 2013), the impact of cloud to the value network (Ojala & Tyrväinen, 2011), process agility (Schniederjans & Özpolat, 2013) IT outsourcing with cloud computing security issues (Heiser & Nicolett, 2008; Subashini & Kavitha, 2011), privacy, costs (Armbrust, et al., 2010; Belalem, et al., 2011; Etro, 2011; Low, et al., 2011; McCrea, 2012; Ruan, et al., 2011; Wang, et al., 2010), and business intelligence (Ouf & Nasr, 2011; Thompson & van der Walt, 2010).

To this date, the effect of using cloud computing technologies on collaborative relationships has not been studied in the literature. IT implementations have influenced the competitive position and performance of firms through interactions with various resources (Laframboise & Reyes, 2005). Cloud computing characteristics of low cost and high accessibility have the potential of developing collaborative relationships among members of the supply chain because partners can easily implement cloud based applications instead of purchase and install expensive software allowing organizations to work together faster. This research study seeks to contribute to the academic and practitioner knowledge of inter-firm relationships by studying the collaborative impact of a new technology, such as cloud computing. This research also intends to provide actionable recommendations for organizations looking to improve their collaborative capabilities with their business partners. Finally, this research makes an academic contribution by utilizing the relational view of the firm (Dyer & Singh, 1998), the transaction cost economics (Williamson, 1975) and the task-technology fit theories (Goodhue &

Thompson, 1995) to evaluate the impact of a ubiquitous technology in collaborative relationships which according to Allred et al. (2011) more research is needed to understand the relational effects of collaboration.

At present, businesses don't compete as autonomous entities, but as supply chains of multiple relationships (Lambert & Cooper, 2000). Fawcett and Magnan, (2002, p. 358) introduced the term "collaborative competition" meaning "competing as allied team of companies from end-to-end of the supply chain". The authors suggested that although collaborative competition was ideal, it was rarely seen in supply chain management (Fawcett & Magnan, 2002). It is not entirely clear whether collaborative competition can be both possible and easily accessible with the use of cloud computing, what is clear is that cloud computing brings significant advantages, including lower costs and tighter links to customers and suppliers. IT allows the physical linking of the supply chain members (Spekman & Sweeney, 2006). Long and complex supply chains use information technologies to improve information exchange, generate cost savings, reduce inventory, reduce cycle times, for knowledge sharing, improve decision making, and simplify the logistics process (Banker, Bardhan, & Asdemir, 2006; Carr & Smeltzer, 2002; McLaughlin, Motwani, Madan, & Gunasekaran, 2003; Xu & Xie, 2010). According to Fawcett et al (2012) the competitive environment is changing and requires more effective collaboration to improve customer value at lower costs. Combining and configuring skills and technology across boundaries is hard work and rarely occurs (Stalk, Evans, & Sgulman, 1992). Cloud computing has the potential for organizations to increase service levels quickly at an affordable cost.

## Background

Reliance on inter-firm relationships has increased and become a central strategy for organizations (Badaracco, 1991; Gulati, 1995; Mowery, 1988). Leading firms have developed an interacting platform with selected partners to share knowledge and information, making it difficult for unconnected competitors to pursue innovative practices (Lorenzoni & Lipparini, 1999). Research has identified collaboration as a way to promote distinctive relational advantage, superior productivity and satisfaction (Allred, et al., 2011; Barratt, 2004b; Madhok & Tallman, 1998). A survey of 289 companies showed that 53% are collaborating with suppliers through internet based collaboration technology that enhance connectivity and coordination of complex supply chains. For example, GE Plastics reduced costs and improved time to market using internet based collaboration systems; on the other hand, Nike, Kellogg and Kmart had difficulty leveraging their IT systems (Songini, 2002). High-level collaboration is valuable but rare, as it requires structural enablers to achieve sustained advantage and performance (Allred, et al., 2011). Research has shown the positive relationship between investment in information technologies and other constructs (See Table 1) related to collaboration (Kent & Mentzer, 2003).

Table 1. Information Technology and Collaboration

| Information Technology (IT) | Collaboration/Relational constructs | Results | Source |
|---|---|---|---|
| Internal Logistics IT and External Logistics IT | Customer Integration | Internal logistics IT does not positively relates to customer integration; on the other hand, external logistics IT has substantial and significant influence on customer integration. | Closs and Savitskie (2003) |
| Collaboration Technology | Collaboration | CPC implementation is associated with significant improvements in the degree of team collaboration during product development. | Banker et al. (2006) |
| IT Capability | Internal and External Collaboration and Firm Performance | Both, IT internal and external capability has positive impact on collaboration and firm performance. | Sanders and Premus (2005) |
| Enabling Role of IT | Collaborative Strategy and Interorganizational Systems | Technology facilitate interaction process. But, also human activity systems subject to risks of joint human endeavor. | Kumar and van Dissel (1996) |
| IT integration | Supplier Integration and Customer Integration | The majority of plants do not align their technology to the focus of supply chain integration. | Thun (2010) |
| SC Connectivity | SC Collaboration | Technological connectivity is a strong precursor of a collaboration capability. Marginal benefits of investments in connectivity decrease as the level of collaboration sophistication increases. Collaboration is related to operational performance but not to customer satisfaction. | Fawcett et al. (2011) |
| Buyer-Supplier IT Alignment | Buyer-Supplier Integration | Buyer-Supplier IT alignment impacts firm performance both directly and indirectly, by promoting firm integration. | Sanders (2005) |
| Information Technology | External Logistics Integration | IT and buyer-supplier stimulate effective external logistics integration. IT can moderate the positive link between strategic buyer-supplier relationship and external logistics integration. | Paulraj and Chen (2007) |
| Internet Technology Application | Trading Partners Relationships | Moderately strong and significant positive correlation between Internet technology and trading partner relationships. | Power and Singh (2007) |
| Collaborative Product Commerce Software | Collaboration | Implementation of CPC software has a positive impact on collaboration. | Banker et al. (2006) |
| Technological Innovativeness and Technological Complementarity | Collaboration | Technological innovativeness has no significant relationship with supplier-retailer collaboration; technological complementarity has positive relationship with supplier-retailer collaboration. | Richey et al. (2012) |

Sanders and Premus' (2005) research assert that information technology promotes both internal and external collaborative relationships as a support for human interactions but not a replacement. Investing in technologies compatible with those used by suppliers assist organizations in gaining mutual collaborative advantage (Richey, et al., 2012). Collaborative advantage refers to common benefits that accrue to collaborative partners through combination, exchange and co-development of distinctive resources (Dyer & Singh, 1998). Complementary resources and collaborative process results in improved firm performance (Cao & Zhang, 2011). Developing collaborative relations results not only in cost reduction, but in a combination of service improvements and service operations (Sahay & Mohan, 2006). For logistics operations, a growing awareness that competitive advantage comes from the delivery process as much as from the product has been crucial for developing collaborative improvements where both partners gain profitability (Prockl, Pflaum, & Kotzab, 2012). Pressures in the business environment, such as customer requirements, shorter life cycles, and inventory reductions, has forced supply chains to minimize logistics costs, and maximize customer service in turbulent and competitive environments (Sohrabi & Montreuil, 2011). Organizations aiming to cultivate positive buyer-supplier relationships adopt innovations that are mutually beneficial and put forth the effort and resources that are necessary to gather positive results (Hazen & Byrd, 2012). High investments needed to acquire technology might exclude many organizations from interacting with partners (Low, et al., 2011).

Cloud computing is turning IT into utility computing (i.e. metered services and charged per usage such as electricity) accessible to all organizations for managing and delivering services over the internet. It is attractive for businesses because of its internet characteristics of a ubiquitous, on-demand, self-service, highly scalable, pay-as-you go pricing of IT (Mell & Grace,

2011; Zhang, et al., 2010). Cloud computing allows businesses to start small and increase resources as and when demand augments (Zhang, et al., 2010). Cloud computing is accessible to all organizations and lowers the cost of entry for smaller firms that benefit from increased business analytics, computing power, in relatively short time. Also, it enhances connectivity with third-world countries that lack the resources for extensive deployment of IT services (Marston, et al., 2011). Cloud computing allows operation of large scale IT-capabilities via pay-for-use systems for global rapid provisioning of vast on-demand IT services (Mell & Grace, 2011; Rodero-Merino et al., 2010). In the past, large computing capabilities were only funded and controlled by the government, academic research centers and large corporate enterprises (Riedel, 2012). Cloud computing may cause a fundamental change in the management of computing needs.

## Research Objectives and Questions

Although organizations are developing collaborative capabilities to respond to increased competition and customer expectations (Fawcett, et al., 2012), organizations may lack the resources and capabilities needed for competitive success (Fawcett & Magnan, 2002). Fawcett and Magnan (2002) affirm that appropriate relationships are formed to improve performance, unfortunately proper collaboration beyond immediate supplier or customer is rare. Cloud computing improves visibility and connectivity, facilitating access to information of the extended supply chain (Namjoshi & Gupte, 2009). Companies that collaborate develop a rare and valuable capability that competitors cannot easily replicate (Fawcett, et al., 2012). Collaboration research has focused on long-term collaborative relationships, reasons to collaborate, circumstances in which collaboration is beneficial, relationship characteristics and processes

facilitating collaboration (Vickery, Jayaram, Droge, & Calantone, 2003). In the information systems, management, marketing, and supply chain management literature, there is extensive literature about relationships, collaboration and IT; however, to date the supply chain management (SCM) literature has not generally addressed the emerging technology of cloud computing. Little research has focused on understanding the overall collaborative advantage, the strategic benefits gained over competitors as well as the relational outcomes from their association using cloud computing.

This study will examine the logistics managers' perception of cloud computing on inter-firm relationships, collaborative advantage and relational outcomes. The purpose of this research is to contribute to the literature and explore a cross-disciplinary theoretical perspective, which combines the relational view of the firm, the transaction cost and task-technology theories, by highlighting the impact of cloud computing on inter-firm relationships and the perceived benefits organizations are developing into their collaborative capabilities. The previous introduction addressed some issues that motivated this study and are summarized in the Table 2.

**Table 2. Issues and Contributions to the Literature**

| Issues | Why needed | This study |
|---|---|---|
| Why is high-level collaboration valuable but rare? (Allred, et al., 2011) | Collaboration promotes distinctive relational advantage, superior productivity and satisfaction. | Examines the collaborative advantage that collaborative relationships provide. Also, describes what relational outcomes are enhanced by collaborative relationships. |
| Why is combining and configuring technology across boundaries hard work and rarely occur? (Stalk et al., 1992) | Internet based collaboration technology enhance connectivity and coordination of complex supply chains. | Evaluates the characteristics of cloud computing that improve the relational outcomes of the extended supply chain. |
| Why is IT implementation different for small and large organizations? (Chan et al., 2012) | Low IT implementation in small organizations. | Determines whether cloud computing enables small organizations to share the same services as larger companies. |

The key points for the table identify a number of critical questions. First, should strategic efforts to develop collaborative relationships be prioritized? Initiatives such as goal and metrics alignment, information sharing, and collaborative mind setting advance high-level collaboration (Allred, et al., 2011). Second, collaboration is recognized as an important competitive strategy (Fawcett & Magnan, 2002); would sharing responsibility for developing upstream and downstream relationships increase collaborative relationships beyond the immediate supplier or customer? Third, how can organizations achieve collaborative relationships? Collaborative relationship is referred as the extent to which the chain members implement and maintain collaborative practices such as sharing key information, process and resources that contribute to higher performance (Simatupang & Sridharan, 2005). Collaboration might be challenging for organizations that are protective of their business information or are not confident on the benefits of technology (Chan, et al., 2012). Finally, collaboration occurs between organizations based on motivations such as not having the resources that other firms control (Uzzi, 1997). Firms seek efficiency through interactions with other firms in the environment in which one operates (Zacharia, Sanders, & Nix, 2011). May cloud-based software offer complete solutions for small and midsize enterprises (Monkmeyer, 2011) that motivate organizations to join resources and achieve better results? Accordingly, the main objectives for this study and the research questions that attempt to answer through this research are listed below:

**RQ 1.** What is the perception of logistics managers of the impact of collaborative relationships on collaborative advantage?

**RQ 2.** What is the perception of logistics managers of impact of collaborative relationships on relational outcomes?

**RQ 3.** Do logistics managers perceive that the use of cloud computing moderates the relationship between a collaborative relationship and collaborative advantage?

**RQ 4.** Do logistics managers perceive that the use of cloud computing moderates the relationship between collaborative relationship and relational outcomes?

**RQ 5.** Do logistics managers perceive that the impact of cloud computing is different for small enterprises and large organizations?

## Structure of the Dissertation

This dissertation is organized in five chapters: (1) Introduction, (2) Literature Review, (3) Research Design and Methodology, (4) Research Results and Findings and (5) Conclusion, Discussion and Recommendations. This Introduction has provided an overview of the research, a background and contextual information on the problem, an explanation of the purpose and significance of the study, and the research questions of this study. In Chapter Two, the Literature Review presents a synthesis of prior research related to the research question. The Literature Review starts with the collaborative relationship literature and its links to collaborative competitive advantage and collaborative performance outcomes. Then, given the emergent nature of cloud computing, an overview of other information technologies (IT) use is presented. Chapter Three, Research Design and Methodology, presents the methodology used to address the research question. Then, Chapter Four analyzes and interprets the empirical data and results. Finally, Chapter Five provides discussion of the results, conclusions, and recommendations for academic and practitioners obtained from the study.

# CHAPTER 2

# LITERATURE REVIEW

## Introduction

This chapter develops the theoretical foundation for the research. First, the chapter reviews theories relating to collaborative relationships in which the theoretical lenses for this dissertation are presented where each theory provides a different lens through which to view collaborative relationships. For this study, the Relational View of the firm, Task-Technology Fit and Transaction Cost Economics are primarily employed. These are particularly relevant to underpinning a study of inter-organizational relationships in a technical environment as they focus on the ability of a firm to rely not only on its own resources, but on joint resources (Relational View), the alignment between the technology and the tasks that must be performed (Task-Technology Fit Theory), and the arrangements that minimize transaction costs (Transaction Cost Economics) to gain sustained competitive advantage.

Secondly, the research examines the literature in the areas of inter-organizational relationships, collaborative relationships, collaborative advantage, relational outcomes, cloud computing and information technology implementation. The first portion of this section defines, inter-organizational relationships and describes the key aspects of supply chain relationship research. This section then addresses the new and potentially disruptive technology of cloud computing, examines the relevant literature and discusses the potential impact of cloud computing on collaborative relationships. It then discusses how working across organizational boundaries creates collaborative relationships in order to gain collaborative advantage and improved performance outcomes.

Thirdly, the avenues for research are developed into testable hypothesis. The importance of developing and maintaining relationships has been recognized and their benefits are continually sought by organizations operating in supply chain management. Potential for further studies investigating nuances of a continuously changing environment and technological changes should be considered. A new technology, cloud computing, is believed to have the potential to substantially change the way software and information is delivered and accessible to organizations via the web on a subscription basis. This research is based on the premise that organizations adopting cloud computing will be able to augment the collaborative advantage and relational outcomes. Collaborative advantage are the strategic benefits gained over competitors that could not be achieved by any firm acting alone and relational outcomes are the result of customer relationship and cooperation and financial performance of the organization. Finally, the chapter presents a visual representation of the hypothesized relationships in a research framework extending current theory.

## Theoretical Foundation

This section provides a summary of three paradigms that provide a substantial rationale as to why cloud computing may influence the relationship between collaborative relationships, collaborative advantage and relational outcomes. First, the Relational View of the firm (Dyer & Singh, 1998) suggest that competitiveness arises not from the firm, but inter-firm, sources of advantage. The combination of resources martialed through cloud computing may well develop into providing an advantage over competing firms who are unable or unwilling to do so. Benefits are possible through the reduction of upfront costs and operations with cutting-edge technology. Second, the Task-Technology Fit theory (TTF) suggests that technology use and

performance benefits results when the characteristics of the technology complement the tasks that should be performed (Goodhue & Thompson, 1995). Organizations potentially can gain a competitive advantage through the adoption of cloud computing, but it is important that organizations have their business goals and expectations aligned. Finally, the Transaction Cost Economics (TCE) proposes that organizations need to consider the cost of transactions and investment in specific assets for exchange (Williamson, 1981, 1989). Cloud computing dramatically lowers the cost accessing computer-intense business analytics for smaller firms and widespread deployment of IT services (Marston, et al., 2011).

*Relational View of the Firm*

The Relational View of the Firm (RV) is an extension of the Resource Based View (RBV) that argues that differential firm performance and competitive advantage is achieved by individual firms that accumulate resources that are rare, valuable, non-substitutable, and inimitable (Barney, 1991). In the context of inter-firm relationships, the Relational View of the Firm expands the firm's boundaries, its resources and relationships. Instead of emphasizing that competitive advantage results from resources housed within a firm, the RV indicates that firms who combine resources in unique ways may realize an advantage (Dyer & Singh, 1998). The authors suggest that non collaborative relationships referred as " Arm-length relationships" are incapable of generating relational rents which are defined as "supernormal profit jointly generated in an exchange relationship that cannot be created by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific partners" (Dyer & Singh, 1998, p. 662). As a result, four sources of collaborative advantage from collaborative relationships were identified:

(1) Investment in relation-specific assets; specialized or unique investments in resources to develop a competitive advantage. Williamson (1985) identifies three types of asset specificity: site (i.e. closeness), physical asset (i.e. capital investment) and human asset (i.e. know how).

(2) Knowledge-sharing, joint learning and inter-firm interactions that permit the combination or creation of specialized knowledge that result in competitive advantage (i.e. know how transferred to partners outperform competitors).

(3) Combination of complementary resources and capabilities to generate greater benefits. Distinctive and indivisible resources of partners that collectively generate greater rents than those obtained individually.

(4) Lower transaction cost through effective governance. Telser (1980) identifies two types of governance: third party enforcer (i.e. state contracts) and self-enforcer (i.e. organization authority). Effective governance generates relational rents by lowering transaction-costs or providing incentives for value-creation (investments, knowledge, or combining resources).

Value may be created and shared through joint action (Barringer & Harrison, 2000). Cloud computing is allowing organizations to share information, resources and enhance collaboration (Wang, et al., 2010). Collaborative relationships and relational outcomes have been enhanced when supply chain partners deploy their valuable resources and capabilities for mutual gains (Chen, Daugherty, & Landry, 2009; Shin, Collier, & Wilson, 2000). The Relational View takes the inter-organizational level of analysis and addresses the extent to which relational capabilities enable firms to gain and sustain collaborative advantages (Kanter, 1994). In this research, the use of cloud computing has the potential to generate rents due to the inter-organizational communication and visibility that provides (Viswanathan, 2010). Value-adding initiatives, such as the use of cloud computing, develop new resources and routines that result in

relational rents and competitive advantage. The joint decision of organizations to invest and use an integrative technology can realize advantages from their inter-firm connections and information exchanges (Dyer & Singh, 1998). Using cloud computing may facilitate developing and maintaining inter-firm relationships and increase value added and benefits from those relationships.

*Task-Technology Fit*

The Task-Technology Fit theory (TTF) is an extension of the Information Systems Success model of DeLone and McLean (1992) which highlights the importance of Task-Technology Fit in explaining how technology leads to performance. The key premise of Task-Technology Fit theory (TTF) is that performance outcomes are dependent upon the level of fit that exists between the information system and the tasks to be performed (Goodhue & Thompson, 1995). TTF has its roots in organizational contingency theory that argues that the organizational effectiveness depend upon the alignment of the characteristics of the organization and the environment and circumstances that the organization faces (Galbraith, 1973). For example, Wu et al., (2007) used TTF to explore the degree to which an organization's information system meet the information needs of the tasks.

This research extends TTF theory application by evaluating if the capabilities of cloud computing as a component of an information system match the needs or problems and the task performed to solve the problems. Goodhue and Thompson (1995) proposed that performance impacts will result from task-technology fit, when a technology used provides features and support ideal to the requirements of an assignment. In this study, organizations using cloud computing are expected to improve relational outcomes and collaborative advantage, if the

technology fits the collaborative objective of the organizations. More utilization of a system will not necessarily lead to improved performance, but the use of an appropriate system that meets the organizational objectives will lead to improved performance. Task-Technology Fit is the "degree to which a technology assists and individual in performing his or her portfolio of tasks" (Goodhue & Thompson, 1995, p. 216). The majority of TTF research has been conducted at the individual level, but some group/team level experimental research, manipulating fit to examine performance outcomes, has also been performed (Fuller & Dennis, 2009; Goodhue, Klein, & March, 2000). Furneaux (2012) suggest that TTF empirical research at other levels of analysis is valuable. This research will apply TTF theory in the inter-organizational context.

*Transaction Cost Economics*

The notion of the firm as a core economic entity (Coase, 1937) has advanced to suggest that firms invest in assets specific to exchange fulfillment to meet transactional needs (Williamson, 1989). Transaction Costs Economics (TCE) refer to the costs of resources incurred to complete and exchange goods and services between parties (Dyer, 1997). From a transaction cost analysis perspective organizations focus on minimizing their own total transaction costs (Williamson, 1975). In the context of inter-firm relationship, the transaction cost should focus on the development of relationships to minimize costs. "The principal factor responsible for transaction cost differences among transactions is variations in asset specificity" (Riordan & Williamson, 1985, p. 367). Asset specificity are investments made to support specific transactions that have higher value if they are used for another purpose, is a key driver of transaction costs and the relationship between supply chain partners (Devaraj, Vaidyanathan, & Misra, 2012). Asset specificity investments may be site (i.e. closeness), physical asset (i.e.

capital investment), human asset (i.e. know how) and dedicated assets (i.e. specific investments) (Williamson, 1983). Prior research found relationship-specific asset investments such as time, money, and effort supported collaboration among partners (Joskow, 1988).

Research has shown that the economic benefits of being in a network of organizations working successfully, counteract the potential for opportunistic behavior (Maitland, Bryson, & Van de Ven, 1985). Williamson (1979) suggested that transactions are characterized by the uncertainty in the environment, the frequency with which transactions recur and the degree to which durable transaction-specific investments are incurred. Investments in IT constitute a physical asset specific investment that positively influence performance benefits of both parties within the relationship (Klein, 2007). For this research, cloud computing is promoted as a technology that offers a competitive cost advantage through its economies of scale and the ability to offer advanced information technology services at a reasonable cost (Vouk, 2004). At the same time, the use of cloud computing may result in other issues that increase the costs such as security risks of compromised data, inappropriate user access, or lack of availability and recovery of data (Heiser & Nicolett, 2008). Can transaction-specific investments, such as in cloud computing technology, pose few hazards to collaborative relationships as partners can easily turn to alternative sources?

## Overview of the Literature

The purpose of this section is to define (see Table 3) key terms, describe what has been researched in the literature, and identify the gaps that can be later developed into testable hypotheses. First, a review of the inter-organizational relationship literature is presented in order

to have an overview of the interest and importance of inter-organizational research. Then, a summary of the cloud computing research is presented to understand the technology, its relevance and applicability. Third, a summary of the research in collaborative relationship, collaborative advantage and relational outcomes is summarized to substantiate the basis for this study. Finally, hypotheses are developed from the gaps identified in the previous literature.

The synergy gained though shared expertise and resources and the business advantages (i.e. lower product costs, reduced time to market, improved quality, advanced technology or improved service/delivery) from the relationships among organizations have prioritized the management of relationships (Daugherty, 2011). Inter-organizational relationships consist of economic exchanges and governance embedded in the interpersonal relationship between buyer and suppliers (Schakett, Flaschner, Gao, & El-Ansary, 2011). Firms can realize advantages from inter-firm connections and preserve performance from firm-to-firm relationships (Dyer & Singh, 1998). To help the reader understand the main constructs and the following discussions, Table 3 presents definitions of the following literature.

**Table 3. Definitions of Main Constructs**

| Constructs | Definition | Source |
|---|---|---|
| Inter-Organizational Relationships | Linked aspects of the firm's business toward a common end, including sharing information, risks and rewards. | Ellram (1992) |
| Collaborative Relationships | A relationship where participants cooperate, share information and work together to plan and modify their business practices to improve joint performance. | Whipple et al. (2010) |
| Collaborative Advantage | Focuses on joint value creation from partners working toward common goals and benefits that cannot be achieved acting alone. | Jap (2001) |
| Relational Outcomes | Promoting both parties' cooperative behavior that increases efficiency and creativity of their actions. | (Nahapiet & Ghoshal, 1998) |
| Cloud Computing | Is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. | Mell and Grace (2011) |

## Inter-Organizational Relationships

Ellram (1992) defined inter-organizational relationships as linked aspects of the firm's business toward a common end, including sharing information, risks and rewards. The review of the importance of developing buyer-supplier relationships that extend over time (Dwyer, Schurr, & Oh, 1987), the determinants of inter-organizational buyer-supplier relationships (Morgan & Hunt, 1994; Oliver, 1990) and the nature of relationships and their development have been a fertile area in marketing research (Moberg & Speh, 2003). Relationship research is also an important area of supply chain management because of the interaction of multiple organizations to improve the efficiency and effectiveness of their operations (Bechtel & Jayaram, 1997; Cooper, Lambert, & Pagh, 1997). The increased demands for better, faster, cheaper logistics

service in the supply chain has motivated organizations to build more cooperative relationships in order to improve their competencies and achieve productivity and service enhancements (Daugherty, 2011; Stank & Daugherty, 1997). As a result, the need to develop better relationships has motivated researchers to explore key aspects of supply chain relationships (Moberg & Speh, 2003), including:

1) Characteristics of relationships,
2) Benefits from the relationship,
3) Implementation and management of relationships.

For this study, learning about the key aspect of successful supply chain relationships, serves as a pillar for understanding the impact of collaborative relationships and its outcomes. IT infrastructure, connectivity and low-cost processing capability has been recognized as an significant enabler for business collaboration (Chen, Zhang, & Zhou, 2007). The use of cloud computing may leverage previously unavailable IT capacity for a fraction of its cost and be specially useful for managing the supply chain (Cegielski, Jones-Farmer, Wu, & Hazen, 2012). A technology such as cloud computing employed by various members of different organizations may be more valuable in a collaborative supply chain context. Moberg and Speh's (2003) classification helps organize and summarize the relevant relationship research for this study.

*Characteristics of Supply Chain Relationships*

The first examination of supply chain relationships, started with Morgan and Hunt' (1994) study of the nature of Relationship Marketing. They explored two key characteristics associated with effective cooperation required for inter-organizational success: trust and commitment. The authors concluded that organizations that shared resources, developed partnerships, communicated valuable information and acted in bona-fide were able to achieve sustainable competitive advantage. Relationship marketing, the development of mutually beneficial long-term relationships between suppliers and customer (Davies, 1996), is relevant to the supply chain relationships literature that by nature involves enhancing relationships with other members of the supply chain (Lambert, Cooper, & Pagh, 1998). Relationship research is also an essential component of supply chain management because requires that multiple trading partners work together to improve efficiency and effectiveness of operations for each member of the supply chain (Moberg & Speh, 2003).

> Supply chain management "encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners which can be suppliers, intermediaries, third party service providers and customers. Supply chain management integrates supply and demand management within and across organizations. (Mentzer, Stank, & Esper, 2008, p. 32)

Some of the characteristics of inter-firm relationships studied in the supply chain literature include: trust and commitment, cooperation, relationship length, and communication.

Trust and Commitment

Trust has been defined as "willingness to rely on an exchange partner in whom one has confidence (Moorman, Zaltman, & Deshpande, 1992, p. 315)". A study of virtual collaborative relationships concluded that interpersonal trust positively impacted performance (Paul & McDaniel Jr, 2004). The importance of trust has increased with firms seeking fewer, more intense relationships within supply chains (Kumar, 1996). Commitment to a relationship is an enduring desire to maintain a valued relationship (Moorman, et al., 1992). Another study showed that trust, commitment, and dependence are good indicators of the strength of the relationship between organizations (Golicic & Mentzer, 2006). Successful management of supply chains requires organizations to develop strong relationships in order to achieve improved performance. In collaborative relationships trust was found to directly impact performance; commitment, on the other hand impacted satisfaction with the relationship and satisfaction with the results (Nyaga, Whipple, & Lynch, 2010). It is possible to achieve common goals, when firms are engaged in a committed and trusting relationships (Morris & Carter, 2005).

Cooperation

Cooperation has also been acknowledged as an important factor for strong relationships. Cooperation consist on behaviors of mutual perception of a situation in which two parties are acting congruently and one or both parties are sustaining the relationship towards a goal (Chen, Chen, & Meindl, 1998; Frazier, 1983; Morgan & Hunt, 1994). Increased cooperation in

relational exchanges allows firms to reduce uncertainty and improve logistics performance through information management, enhanced coordination and better forecasting (Morris & Carter, 2005). The benefits of cooperation can be realized if the cooperation is sustained and all parties continue to perceive the arrangements to be fair and beneficial (Kumar & van Dissel, 1996). Continued relationships are more familiar and comfortable and create an incentive to further collaborate; the length of the relationship influences collaboration (Ganesan, 1994; Pimentel Claro & Oliveira Claro, 2010).

Relationship Length

Another aspect of supply chain relationships include the length of the relationship. Relationship length has been used as a proxy for relationship history that referred to the time invested in the relationship. The length of the relationship has been used to help control for patterns that arise from time to time and that may confound results in the relationships or duration on supplier benefits (Subramani, 2004). Research that has posited the relationship length as a driver of logistics outsourcing quality has shown show inconsistent results (Cai & Yang, 2008; Chu & Wang, 2012; Golicic & Mentzer, 2005; Joshi & Stump, 1999). Other studies have explored the impact of relationship length and other variables. For example, Chu and Wang (2012) demonstrated that relationship length, information sharing, and legal contract are important characteristics of collaborative relationships. Legal contracts have been found to weakly influence cooperative relationships, but the authors suggest that legal contracts may provide value for the participants as they specify obligations of trade partners (Cai & Yang, 2008; Chu & Wang, 2012). Information sharing and length of the relationship were identified as

very important elements of successful logistics outsourcing relationships (Tian, Lai, & Daniel, 2008).

Communication

Researchers suggest that having long-term relationships is necessary but not sufficient for achieving strategic advantage and supply chain managers should improve their skills for effective communication (Paulraj, Lado, & Chen, 2008). Research showed that communication plays an critical role in predicting performance and satisfaction in collaborative relationships (Whipple, et al., 2010). Collaborative communication influence buyer-supplier relationships by developing commitment, cooperation and performance (Mohr, Fisher, & Nevin, 1996; Prahinski & Benton, 2004). Collaborative communication is considered a critical element to foster and maintain inter-organizational relationships (Mohr, et al., 1996). Strategic communication and information flows in collaborative relationships between buyer and suppliers generate performance benefits such as financial gains from improved asset management, lowered operating costs, and increased productivity , improved planning, resource control and process flexibility (Klein & Rai, 2009). By communicating downstream, in the supply chain fosters collaborative buyer-supplier relationships by dictating the necessary investments in joint actions and flexibility between a firm and its partner to achieve mutual goals (Pimentel Claro & Oliveira Claro, 2010).

In order to promote the flow of strategic information, buyer and suppliers should generate dependence through greater complementarities of resources, such as investing in IT assets (Klein & Rai, 2009). Collaborative relationships must share critical information such as operational

data, financial data, forecasting data and supply chain data to gain efficiency, effectiveness and profit sharing from the relationship (Kwon & Suh, 2004).

Trust, commitment, cooperation, relationship length, communication and information sharing have been referred as critical characteristics of supply chain relationships. "The cloud computing model offers organizations the possibility to leverage previously unavailable IT capacity for a fraction of the traditional resource commitment" (Cegielski, et al., 2012, p. 185). The use of cloud computing may influence the level of significance of these characteristics.

*Benefits of Supply Chain Relationships*

In a review of the logistics relationship research, Daugherty (2011) suggested that the reason organizations develop more relationship-oriented strategies was typically made because of perceived benefits to be gained. It is very attractive for organizations working together to gain synergy through shared expertise and resources, exchange of information, better planning and support, joint problem solving and improved decision making (Stank, Crum, & Arango, 1999). Organizations integrate activities and develop relationships with other organizations with the purpose of complementing resources and reaching potential that would not be possible to achieve alone, such as lower product costs, reduced time-to market, improved quality, advanced technology or improved service/delivery (Rinehart, Eckert, Handfield, Page, & Atkin, 2004). Allred et al. (2011) affirm that even moderate levels of collaboration lead to superior productivity and satisfaction enhanced by new skills that embrace change, structural enablers that facilitate joint decision making, and time and resources that develop a collaboration capability (Allred, et al., 2011).

Multiple benefits from closer relationships have been addressed in the literature including improved customer service, reduced inventory, transportation, ordering, and warehousing costs, increased efficiency of goods moving between various channel members to the end customer, and firm performance (Brewer & Speh, 2000; Fawcett, et al., 2011; Gentry, 1996; Mentzer, Foggin, & Golicic, 2000). For example, Wal-Mart relationships with partners have resulted in reductions of inventory, and other logistics costs for the retailer and vendors (Mentzer, 1999). Strong relationships have allowed buying organizations to improve product fill rates and on-time deliveries and has shortened lead time (Morris & Carter, 2005). Moreover, in a virtual environment the use of technology and management collaboratively has allowed organizations to improve business operations in terms of speed, agility, real time control and customer response (Manthou, Vlachopoulou, & Folinas, 2004).

Whipple et al. (2010) explored collaborative and transactional relationships to better understand which relationship offer greater benefits. Transactional relationship defined as "a buying-selling agreement where participants conduct business for a specific time period according to terms generally outlined in a standard contract"; while collaborative relationship is defined as "a long-term relationship where participants generally cooperate, share information, and work together to plan and even modify their business practices to improve joint performance." (Whipple, et al., 2010, p. 507). The researchers found that collaborative relationships offered higher levels of satisfaction and improved logistics performance (e.g. fill rate, order cycle time, lead time) than transactional relationships that anticipate short term outcomes and minimum cooperative efforts (Whipple, et al., 2010). On the other hand, Rinehart et al (2004) affirmed that close relationships are not always the best option for organizations. The authors suggested that moving towards a relational perspective with suppliers can be costly

and might not always generate the expected benefits (Rinehart, et al., 2004). The success on a e-supply chain depended on the partners and the way they cooperate efficiently and effectively with each other (Manthou, et al., 2004). Information technology has shown to facilitate communication, coordination, and collaboration across organizational boundaries (Autry, Grawe, Daugherty, & Richey, 2010; Liu, Ke, Wei, Gu, & Chen, 2010). Additionally, IT can be an important tool in achieving collaboration, allowing coordination of efforts and reducing mismatches in demand and supply (Richey, et al., 2012).

Table 4 illustrates further some of the benefits of developing and maintaining collaborative relationships among firms. Because of cloud computing characteristics' of scalable on-demand services, rapid deployment, reduced infrastructure and low cost (Marston, et al., 2011; Mell & Grance, 2010) may become more accessible to organizations working together to maximize the benefits from their supply chain collaborative relationships.

**Table 4. Benefits of Inter-Organizational Relationships**

| Relationship Benefits | Source |
|---|---|
| Lower product costs, reduced time-to market, improved quality, advanced technology or improved service/delivery | Rinehart et al. (2004) |
| Superior productivity and satisfaction | Allred (2011) |
| Greater mutual commitment, more open information sharing, greater respect for each other's capabilities and contribution | Zacharia et al. (2009b) |
| Improve performance, reduced costs, improved quality. reduced cycle time, improved service or value delivered to customers | Koufteros et al. (2002), Zacharia et al. (2009b) |
| Speed, agility, real time control and customer response | Manthou et al. (2004) |
| Inventory and logistics costs reductions | Mentzer (1999) |
| Improved product fill rates, on-time deliveries and shorten lead time | Morris and Carter (2005) |
| Satisfaction and improved logistics performance | Whipple et al. (2010) |
| Increase customer retention, reduce cycle times, increase customer satisfaction, improve service levels | Sinkovics and Roath (2004) |
| Informed decision and reduction of risks, coordination of operations, improved logistics service performance (time, delivery, quantity, order, customer expectations) | Stank et al. (2001) |
| Reduced logistics costs, reduced lead times, improved delivery reliability, enhanced logistics management capability | Chen et al. (2010) |

*Implementation and Management of Supply Chain Relationships*

The importance of developing formal long-term relationships with implementation of alliances and partnerships have received considerable coverage. Partnerships are ongoing relationships between two firms that involve a commitment over time to mutually share information, risk and rewards related to the relationship (Ellram & Hendrick, 1995). Strategic alliances are considered the next step beyond a partnership where strengths are combined and mutual benefits must exist over a long term collaborative relationship (Whipple & Frankel, 2000). According to Dougherty's (2011) review of the relationship literature, the terminology has replaced the terms partnering and alliances with collaboration. True collaboration is the agreement among supply chain partners to combine their resources for mutual gain (Bowersox,

Closs, & Stank, 2003). Collaboration among organizations consists of combining human, financial and technical resources for mutual benefits (Daugherty, 2011).

It has been stated that collaboration is difficult to implement and that it has over-reliance on technology (Barratt, 2004a). A company that is looking to achieve supply chain collaboration must be enabled by people and personal interaction, instead of just technology and infrastructure (Mentzer, et al., 2000). As an enabler of collaborative supply chain management, IT has changed the way of doing businesses (Fawcett, et al., 2011). Some organizations have relied in technology (i.e. vendor-managed inventory, continuous replenishment, and collaborative planning systems) to develop closer relationships and information exchange in the supply chain. Unfortunately, the lack of understanding of the information technology's relational capabilities are substantial barriers to IT implementation and success (Barratt, 2003; Barratt & Oliveira, 2001). Technology is necessary but not sufficient to develop collaborative relationships.

Fawcett et al. (2011) suggest that IT may provide differential results when it enables the creation of a dynamic supply chain (SC) collaboration capability. A SC collaboration capability is the ability of firms to transform its resources as to promote goal alignment, information sharing, managerial interaction, and willingness to share risks/rewards in order to maximize their competitive potential in a rapidly changing environment (Fawcett, et al., 2011). IT and strategic buyer-supplier relationships have helped firms to improve performance and integrate activities as a result of their superior relational and technological initiatives (Paulraj & Chen, 2007). For example, without effective partnerships, technology such as ERP has no advantage or distinctiveness (Koh, Gunasekaran, & Rajkumar, 2008). IT can enable collaborative communication between supply chain partners by providing real-time information about product

availability, inventory levels, shipment status (Paulraj & Chen, 2007). Members of supply chain in a virtual environment have used IT and collaborative management to improve business operations in terms of speed, agility, real time control and customer response (Manthou, et al., 2004). If managers communicate and manage the technology adequately, IT may enhance collaborative relationships across the supply chain.

## Cloud Computing

According to the National Institute of Standards and Technology (NIST), cloud computing is defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grace, 2011, p. 2). According to Zhang et al. (2010), the cloud is composed of four layers (see Figure 1):

1) Hardware/datacenter: the physical resources of the cloud, such as physical servers, routers, switches, power.
2) Infrastructure: creates a collection for storage and computing resources using virtualization technologies.
3) Platform: operating systems and applications frameworks.
4) Applications: actual cloud applications that help to achieve better performance, availability and lower operating cost.

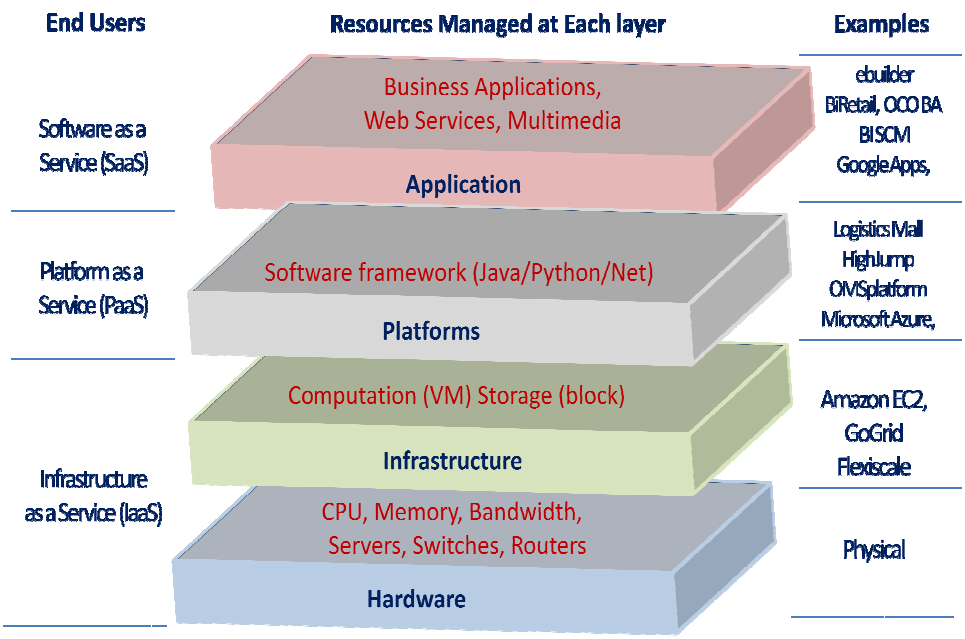


**Figure 1.Zhang et al. (2010), Four Layers of Cloud Computing**

Moreover, computing users have access to three types of services:

1) Software as a service (SaaS) allows users to run existing on-demand online applications accessed over the Internet (i.e. Warehouse Management Systems, Transportation Management Systems, BIRetail, BISCM, Salesforce.com, Rackspace and SAP Business by Design).

2) Infrastructure as a service (IaaS)— allows users to run any applications of their own choice on cloud hardware (e.g. AmazonEC2, GoGrid and Flexiscale). Users can access computers or virtual machines and other resources to scale services up or down according to needs.

3) Platform as a service (PaaS) allows users to create their own applications using supplier-specific tools and languages (e.g., OMSPlatform, eBuilder, Google App Engine, Microsoft Windows Azure and Force.com). User receive a computing platform which includes operating

systems, programming language, database, and web server and does not have to allocate resources manually (Marston, et al., 2011; Zhang, et al., 2010).

Cloud computing applications can be deployed via public, private or hybrid clouds (Armbrust, et al., 2010). The type of deployment depends on the company's desired level of security, reliability, performance and cost.

1) In public clouds, the infrastructure and services are available for open use by the general public (Mell & Grace, 2011). In public clouds, firms are not required to invest in infrastructure, but firms lack control over data, network and security settings.

2) Private clouds (e.g., internal data centers) are designed exclusively for a single organization with multiple consumers and are not available to the general public (Armbrust, et al., 2010; Mell & Grace, 2011). Private clouds offer the highest degree of control over performance, reliability and security, but they do not provide up-front capital savings.

3) In hybrid clouds, one part of the service infrastructure runs in private clouds, and another part runs in public clouds, giving tighter control and security and also facilitating on-demand service expansion and reduction. (Mell & Grace, 2011; Zhang, et al., 2010). Firms select different types of deployment depending on individual business needs (see Figure 2).

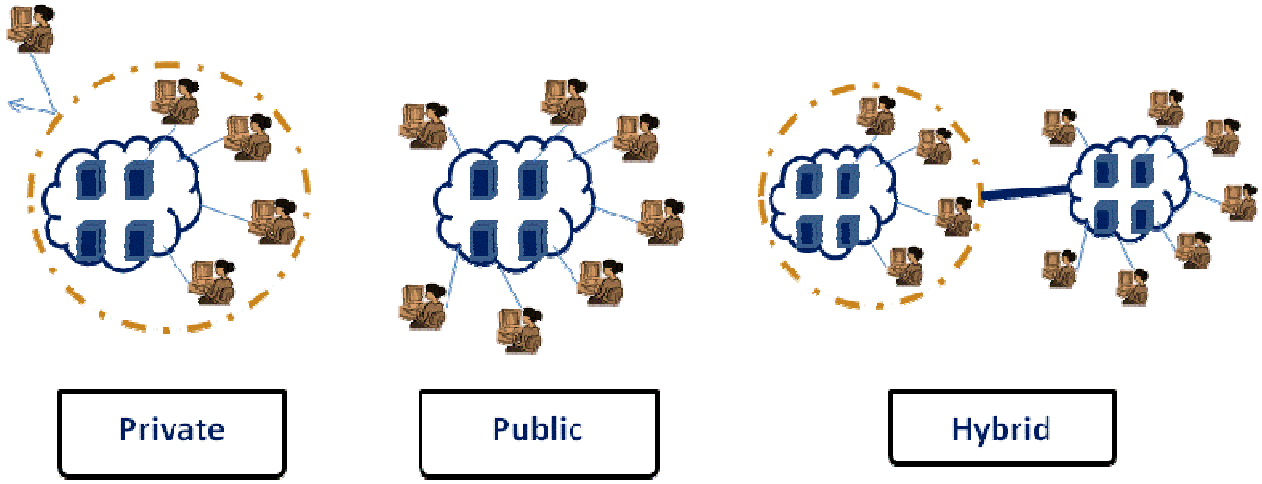


**Figure 2. Types of Cloud Computing Deployment**

Cloud computing represents a shift from locally installed programs, servers and computers to the Internet deployment of software and computing capacity. As such, it helps reduce IT upfront and maintenance costs (Armbrust, et al., 2010). Users are offered a variety of services and payment options scaled according to their needs; allowing alignment in terms of communication and incentives received from cloud computer use (Schniederjans & Özpolat, 2013). Also, computer needs such as storage or software can be easily turned on and off and scaled up or down depending on demand. For example, during peak season when a spike in computing workload occurs, cloud computing allows the company to meet the excess requirements without incurring the costs of implementing infrastructure that will not be used throughout the year (Marston, et al., 2011). Small organizations are relying more on cloud computing in order to cut costs and improve efficiency (Martin, 2010). Large organizations increasingly discover that their substantial IT investments are underutilized (Marston, et al., 2011) because their servers use 10%-30% of their capacity (VMWare, 2008). Installation, licensing, consulting and maintenance costs are also simplified with cloud computing adoption,

as providers of the service own, operate and deliver service to organizations (Marston, et al., 2011).

Mainly driven by economic factors, enterprises adopt cloud services to reduce their total cost of ownership and to offer more flexibility, agility, collaboration and other technical services across firms in distant locations that cannot afford their own data centers (KPMG, 2011, Martin, 2010, McKendrick, 2011). Research has shown that collaboration is enhanced by the alignment of communication, incentives and information flow (Hendricks & Singhal, 2003). According to Lambert et al. (1996b) firms cannot collaborate with every customer because collaborative relationships often require greater resource commitment and investment. Schniederjans and Ozpolat (2013) found support for the positive association between cloud computing use and collaboration among humanitarian organizations and their suppliers.

Cloud computing may facilitate collaboration across the supply chain. The cloud computing benefits of enhanced information processing, mobile interactivity, greater utilization of computer resources and increased information sharing with partners can greatly impact collaboration (Benlian & Hess, 2011; Iyer & Henderson, 2010; Marston, et al., 2011; Parmigiani, Klassen, & Russo, 2011). For instance, the implementation of cloud-based procurement systems are allowing organizations to better collaborate within— with software that brings together cross-functional departments and beyond their organizations— with mobile apps that allows for working with a fragmented set of suppliers (Koploy, 2011).

Cloud computing provides IT efficiency (Marston, et al., 2011). IT efficiency refers to the use of computing resources more efficiently through scalable deployment, and business agility (i.e. competitiveness through rapid deployment, and real time interaction and response

that can be shared by a numerous users). Also, cloud computing offers potentially infinite computing resources on demand, eliminates up-front commitment, enables pay for use of computing resources on short term basis, generates economies of scale due to very large data centers, simplifies operations and increases utilization (Armbrust, et al., 2010). This relationship specific asset investments support richer forms of collaboration and process management among partners (Joskow, 1988).

In manufacturing, the use of cloud tools to quickly assess and implement supplier-manufacturer-customer collaboration platforms and quality management dashboards, improve design services through a cost effective way to rise value-added design-in services, and improve early cross-partner collaboration accelerates product development and introduction strategies (Baljko, 2013). In logistics, cloud based transportation management systems (TMS) replace operations now handled manually, by phone, fax or mail and help managers streamline their processes, save time, costs and resources. TMS allow real-time connectivity with partners worldwide, provides full order visibility, arranges and tracks shipments, identifies delays including order information and routing progress, and provides data on parcel and freight shipment spending during any period (Kontoravdis, 2011). The logistics industry may now have evolved to a point where buyers have baseline expectations for information sharing from suppliers (Klein & Rai, 2009). Asset specific investments enhance the richness of inter-firm collaboration (Joskow, 1988).

The use of cloud computing services should enable organizations to manage their entire process.

> For example, for disaster response, the American Red Cross adopted cloud computing to obtain a key communication tool that delivers adequate supplies, teaches lifestyle skills and coordinates international humanitarian aid and support for military members and families (Courion, 2012).

"The effectiveness of cloud computing to enhance collaboration leading to increased agility, which in turn may save lives in the process" (Schniederjans & Özpolat, 2013, p. 3). Cloud computing offers mobile interactivity which enhances information sharing with partners using different media (Benlian & Hess, 2011; Marston, et al., 2011). Cloud computing gives access to most supply chain management technologies (i.e. EDI, ERP, TMS, WMS) and services at an affordable cost, and all services are scalable to meet the specific needs for the organization (Covalentworks, 2013; Oracle, 2013). For instance, a cloud-based transportation management system (TMS) is allowing real-time connectivity and collaboration with worldwide partners to resolve issues as they arise (Kontoravdis, 2011). Cloud-based warehouse management system (WMS) are now suitable for complex distribution centers, accessed via a Web browser and obtain the functional benefits of new WMS such as put away/flow through, inventory management, order processing, replenishment, loading and shipping and the ability to organize process using configuration tools (Highjump, 2013). The variety of applications that cloud computing offers is an asset investment with the potential to generate rents through recurring inter-firm interactions (Dyer & Singh, 1998).

Cloud computing, however, causes organizations some concerns related to security, confidentiality, and regulatory compliance. Per Marston et al. (2011) the weaknesses and threats of cloud computing adoption include the organization's idea of losing control over data and

entrusting critical information to another company, concerns of cloud computing providers going bankrupt, lack of standards and regulations, and security. The research firm, IDC, showed that about 75 percent of IT executives and CIOs are concerned about security, then performance and reliability (Wired.com, 2009). A survey of managers or executives of manufacturing, retail and logistics industries listed business process complexity, entrepreneurial culture and degree of compatibility and functionality affect a firm's propensity to adopt cloud computing technologies (Wu, et al., 2013). Organizations considering the adoption of cloud computing must clearly understand its inherent risks (Brender & Markov, 2013).

The cloud computing industry continues to make rapid improvements in this areas. For example, to reduce security concerns research has focused on providing data security by storing and accessing related data in different locations so pieces of information is not valuable for malicious users or offering "Security as a Service" based on the application requirements to make the security system less predictable (Subashini & Kavitha, 2011, p. 10). Also, event management simulations tools like GridSim perform cloud computing scenario simulations by modeling of network entities, users, machines and traffic and provide economic functions that reduce the cost of processing and assure effective acquisition of computing resources (Belalem, et al., 2011).

According to Fuerst (2013), more companies are moving to the cloud for three major reasons: innovation, scaling the cloud, and because everyone else is doing it. "The IT applications are more accessible than ever and a company can add complex capabilities as demand requires, access more or less power to adjust to seasonal changes in demand and certified vendors provide extremely high levels of data security even surpassing internal

standards" (Fuerst, 2013, p. 1). Because some technology is too costly and highly technical to have in-house, many organizations have chosen to outsource technology in order to improve its operations (Logan, 2000). IT provides the necessary information in supply chains to improve communication between chain and actors in collaborative conditions (Forza, 1996). Cloud computing characteristics may enhance collaborative relationships among supply chain partners.

## Collaborative Relationships

Collaboration is mandatory where complex process of inter-organizational relations are involved (Trist, 1981) and collaborative relationships offer meaningful benefits to both buyers and suppliers (Nyaga, et al., 2010). A collaborative relationship is defined as "a relationship where participants cooperate, share information and work together to plan and modify their business practices to improve joint performance" (Whipple, et al., 2010, p. 507). Collaborative partners work together to achieve mutual objectives, such as, increased visibility, higher service levels, greater customer satisfaction, increased flexibility and reduced cycle times (Anderson & Narus, 1990; Daugherty et al., 2006; Morgan & Hunt, 1994). A core premise of collaborative relationships imply that a firm cannot compete successfully in isolation, it needs to collaborate with other firms in the supply chain (Min et al., 2005).

The information a firm obtains from downstream sources influences collaboration in buyer-supplier relationships (Pimentel Claro & Oliveira Claro, 2010). Openness of communication should be emphasized when collaborating with suppliers and customers to foster information sharing, secure customer satisfaction and improve collaborative intentions (Handfield & Nichols, 1999; Wagner, Eggert, & Lindemann, 2010). Building and sustaining

business relationship through communication in collaborative relationships helps partners to have a better understanding of the value-sharing process (Wagner, et al., 2010).

> Chrysler collaborative relationships with its suppliers removed more than 2 billion dollars in costs from the supply chain (Hartley, Greer, & Park, 2002). The collaborative relationships that Chrysler developed with its suppliers were also the strongest driver of future collaboration intention and the satisfaction of customers and suppliers (Wagner, et al., 2010).

Research on collaborative relationships has explored the antecedents and outcomes of inter-organizational collaboration. Per Whipple et al. (2010), the most widely accepted antecedents of collaborative relationships relationship include: activities (e.g. cooperation, collaboration, and joint partner activities), commitment, trust, reward/cost sharing, dedicated investments, communication and information sharing. Paulraj et al. (2008), linked key antecedents (e.g. long term relationship orientation, network governance, and IT) and outcomes (e.g. buyer performance and supplier performance) of inter-organizational communication within the context of collaborative buyer-supplier relationships. Buyers and suppliers are mostly satisfied with their collaborative relationships, the results of the relationship and the performance benefits they have gained investing in relationships (Nyaga, et al., 2010). Nesheim (2001) explored three dimensions of vertical collaborative relationships:

1) The level of trust refer to the reduced possibility that a partners will act opportunistically and stimulate organizational learning.
2) Information exchange; a condition for developing collaborative relationships.

3) Bilateral projects; formal mechanisms for joint-problem solving, sharing of ideas and mutual learning.

The fundamental enablers of collaborative relationships, trust, customer focus and the use of technology have enabled a transformation in mindset and behavior of firms' administrators (Spekman & Carraway, 2006). Dyer and Singh's (1998) argument that complementary resources and capabilities serve to enable value creation through inter-firm resource combination using IT (Klein & Rai, 2009). A positive managerial attitude, open to exchanges of information, appropriate processes, behaviors and actions that enhance collaboration, and the use of information technology to provide external interconnectivity and internal linkages are necessary elements to achieve the anticipated benefits from the relationships (Spekman & Carraway, 2006).

Emberson and Storey (2006) explained that collaborative relationships may fail if organizational and behavioral issues, such as competing strategies and priorities interfere. As a result, sustained and coordinated actions within and between organizations are necessary to maintain collaborative relationships with partners and attaining its benefits. Spekman and Carraway (2006) research demonstrate how to overcome barriers to collaboration and increase the benefits of a collaborative relationship. Finally, collaborative initiatives between supply chain partners offer potential for competitive advantage (Petersen, Ragatz, & Monczka, 2005), collaborative advantage and firm performance (Cao & Zhang, 2011). Supply chain collaborations has been found to increase collaborative advantage, through better collaboration among supply chain partners, complementary resources and collaborative processes (Cao & Zhang, 2011).

## Collaborative Advantage

Collaborative advantage refers to the strategic benefits gained over competitors that could not be achieved by any firm acting alone (Cao & Zhang, 2011; Jap, 1999; Vangen & Huxham, 2003). Cao and Zhang (2011) explored the impact of collaboration on firm performance on a paradigm of collaborative advantage. Collaborative advantage is the result of collaborative partners combining, exchanging and co developing resources; it is a relational view of " inter-organizational competitive advantage" (Dyer & Singh, 1998, p. 663) conceptualized as:

1) Process efficiency— to be cost competitive among primary competitors (Bagchi, Ha, Skjoett-Larsen, & Soerensen, 2005)

2) Offering flexibility— to support changes in product or service offerings in response to environmental changes (Cao & Zhang, 2011)

3) Business synergy— to achieve supernormal benefits by combining complementary and related resources (Cao & Zhang, 2011)

4) Quality— to create higher value for customers (Gray & Harvey, 1992; Li, Ragu-Nathan, Ragu-Nathan, & Subba Rao, 2006)

5) Innovation— to work jointly to introduce new processes, products or services (Cao & Zhang, 2011)

Collaborative advantage is also called joint competitive advantage (Jap, 2001) because it focuses on joint value creation from partners working toward common goals and benefits that cannot be achieved acting alone. This is in contrast to competitive advantage that focuses more on appropriate common benefits and private benefits (Lavie, 2006). The benefits from

collaborative advantage may include cost savings by application of best practices, enhances capacity and flexibility better decision making, increased revenue and sharing of ideas (Cao & Zhang, 2011). Most research uses the term, competitive advantage, to evaluate the benefits of supply chain relationships (Autry, Skinner, & Lamb, 2008; Brewer & Speh, 2000; Derocher & Kilpatrick, 2000). Allred et al., (2011) provided insights into how firms can exploit inter-firm resources for competitive advantage by aligning goals and metrics, improving information sharing and investing in collaborative skills. Also, supply chain advantages has been shown to be accrued more effectively from relational mechanisms and virtual integration (Wang & Wei, 2007).

According to the relational view, adequate management of complementary resources generates competitive advantage of partners. Some of the resources needed to achieve distinctive advantage are embedded in inter-firm resources and routines (Dyer & Singh, 1998). Managers must align goals and benefits with supply chain partners to create collaborative advantage; cost efficiency is the most often cited goal, and flexibility is also considered an important goal mainly enabled by IT to facilitate information exchange in collaborative relationships. Cao and Zhang (2011) showed that collaborative advantage increases firm performance and bring financial benefits to firms by combining value and rarity of all shared resources.

## Relational Outcomes

The interest of organizations on developing collaborative relationships with its partners should result in differential performance from this relationships. Performance is the evaluation

of effectiveness and efficiency of completing a given task; effectiveness being the extent to which goals are accomplished and efficiency being the measure of how well resources are utilized (Mentzer & Konrad, 1991). The supply chain management literature recognizes that investing in mechanisms that allow supply chain members to integrate, collaborate and coordinate foster value creation beyond the boundaries of the firm (Sanders, 2008). In this research relational outcomes comes from promoting both parties' cooperative behavior that increases efficiency and creativity of their actions (Nahapiet & Ghoshal, 1998).

In many cases collaborative practices focus on short term cost savings and operational improvements, but to develop more collaborative initiatives it is necessary to improve visibility (i.e. accuracy of plans, reacting proactively to changes downstream, and synchronizing activities across the chain) (Kaipia & Hartiala, 2006). Palmatier et al, (2006) measured three types of relational outcomes:

1) Customer relationship performance, refers to the level of customer satisfaction and loyalty offered through quality services (Moorman & Rust, 1999),
2) Customer cooperation performance, refers to the level of coordinated and complementary actions between the customer and the firm in their endeavors to accomplish mutual goals,
3) Financial performance, is defined as the degree of a firm's ability to perform profit and sales growth (Moorman & Rust, 1999; Palmatier, et al., 2006).

Nyaga et al. (2010), on the other hand, examined the following outcome measures:

1) Satisfaction with the relationship and the results. The authors defined satisfaction in both economic (i.e., economic rewards from relationship) and non-economic (i.e., positive affective response), terms.

2) Performance, viewed as operational measures that improve for each partner as a result of the relationship.

Zacharia (Zacharia, et al., 2011) explored operational and relational outcomes from an episodic supply chain collaboration, suggesting that collaboration between firms not only affects operational outcomes such as improving product quality, reducing product cycle, or improving customer value, but also relational outcomes such as trust, credibility and relationship effectiveness. These relational outcomes have been frequently seen as antecedents to collaboration, but they may develop over time based on experience.

Collaborative relationships have created opportunities for firms to improve operational (i.e., cost and inventory reductions) and logistics performance (i.e., fill rate, cycle time, lead time) (Daugherty, et al., 2006; Whipple & Frankel, 2000). The implementation of cloud computing technology should facilitate the development of inter-firm collaborative relationships, improve the outcomes from the relationship and generate a collaborative advantage when compared to other organizations not using cloud computing.

## THEORETICAL AND HYPOTHESIS DEVELOPMENT

As discussed previously, firms are pressured to no longer compete as individual silos for scarce resources, but to integrate resources extending to external buyers and suppliers who work together to maximize the overall effectiveness of the supply chain (Spekman, Kamauff Jr, & Myhr, 1998). Due to the level of competition, cost advantages, buyer experience, technology

uncertainty, asset specificity (i.e. asset not redeployable for alternative uses), joint investments and new technology, a migration from transactional relationships to more relational practices (i.e. cooperation, coordination, collaboration) allowed organizations to increase responsiveness and willingness to assume greater risks (Hoyt & Huq, 2000). Competition has changed companies to focus on the quality of interactions and relationships companies establish with their customers and markets (Rayport & Jaworski, 2004). Organizations should focus on maintaining a collaborative behavior that preserve and continue with the relationship even when pure self-interest may suggest otherwise (Bercovitz, Jap, & Nickerson, 2006). Successfully managing relationships and collaborating with members enables value creation for organizations (Bowersox, Closs, & Stank, 2000). Further, as indicated by Daugherty (2011) research needs to look at current buyer-seller collaborative relationships as an important future research topic. Collaborative relationships will serve as the independent variable in this study.

Organizations develop collaborative relationships as they aim to improve their operations and gain advantage over other organizations working alone. Dyer and Singh (1998) propose that competitive advantage can be gained if firms combine resources that are beyond the firm's inherent resources in unique ways. The relational view suggests that "asset interconnectedness across organizational boundaries" has the potential to create an advantage over competitors (Dyer & Singh, 1998, p. 672). Advantages can be created from relation-specific assets, knowledge sharing, combination of resources and effective governance. Beneficial relationships that produce differential operational performance compared to competitors should result in competitive advantage. Research has shown that collaborative enterprises bring operational advantages due to partners being more effective and actively managing processes (Wilding & Humphries, 2006). For example in collaborative forecasting and planning by Japanese

manufacturers, a superior logistics and production performance was found achievable by combining resources, collaborative process operations and collaborative process improvement (Nakano, 2009).

Research has shown that collaborative relationships can help firms to minimize conflict, increase commitment to mutual goals and realize expected performance improvements (Nyaga, Lynch, Marshall, & Ambrose, 2013); and to combine resources and capabilities to develop a stronger basis for strategic advantage (Paulraj, et al., 2008). Moreover, information visibility and supply chain flexibility can be gained from strong collaborative relationships and are valuable capabilities in creating competitive advantage (Wang & Wei, 2007). Collaborative relationships appear to have great potential, but further investigation is needed to identify the inherent value (Daugherty, 2011).

According to the relational view complementing firms' internal capabilities with other capabilities, by building strong relationships with the supply chain partners who own the capabilities, are an important source of competitive advantage (Dyer & Singh, 1998). The relational view of the firm has traditionally focused on strategic alliances and long term relationships, a logical extension is the application of relational view to collaboration (Zacharia, et al., 2011). Higher levels of collaboration has shown to lead to improvements in operational and relational outcomes (Zacharia, et al., 2009b). Building upon the relational view of the firm, the following hypotheses addressing the impact of collaborative relationships in the context of ongoing inter-firms relationships are presented.

**$H_1$:** Strong collaborative relationships lead to increased collaborative advantage.

**$H_2$:** Strong collaborative relationships lead to increased relational outcomes.

Moreover, the desire to achieve advanced organizational objectives such as improved forecasts reduced inventory and/or improved customer value may encourage organizations to invest time and resources in collaborative programs (Barratt & Oliveira, 2001). For example, the implementation of Efficient Consumer Response (ECR), a cooperative value creation strategy whereby retailers and suppliers jointly implemented collaborative business practices, showed a positive impact on supplier economic performance and capability development (Corsten & Kumar, 2005).

Information technologies can contribute to collaborative advantage through leveraging "relational competencies" referred as collaborative managerial mindset for building strategic advantage such as inter-organizational communication (Paulraj, et al., 2008, p. 46). IT can also integrate data for the development, exchange and use of strategically valuable knowledge between supply chain partners (Paulraj, et al., 2008). This research is based on the premise that organizations adopting cloud computing, a new technology believed to substantially change the way IT is delivered and made accessible to organizations, will be able to augment the relational outcomes and collaborative advantage. Relational outcomes are the result of customer relationship, cooperation and financial performance of the organization. Collaborative advantages are strategic benefits gained over competitors; these should be advantageous to any firm not acting alone.

High levels of collaboration have been developed by bringing together the resources of diverse members in creative and innovative ways assuring enduring success (Lavie, 2006). For buyers, reducing uncertainty and increasing cooperation in relational exchanges to improve forecasting demand has allowed them to improve logistics performance (Morris & Carter, 2005).

The use of IT systems allow organizations to achieve greater speed and precision of the information within the supply chain (Thun, 2010). The ability to make connections with the right partners is critical (Nyaga & Whipple, 2011). The choice of inter-organizational systems allows firms to manage their resource dependence and select functionalities consistent with their desired supply chain design (Saeed, Malhotra, & Grover, 2005). Transaction cost economics theory associates collaboration through investment in appropriate systems and resources for reduction of information search and related costs leading to altered costs (Byrd, et al., 2008). Williamson (1975) argued that transaction-specific assets (i.e. transactions supported by specific investments in resources to preserve the relationship) are unique to a task. Asset specificity (i.e. asset not redeployable for alternative uses) predicts how external transactions are coordinated and facilitate value creation from the relationship (Nesheim, 2001). Additionally, according to a relational view, transaction costs do not necessarily increase with an increase in relation specific investments; transaction costs differ depending on factors such as commitment, scale and scope of exchanges, information sharing and governance (Dyer, 1997).

Despite the benefits of suitable asset investment, the following issues sometimes limit organizational relational-initiatives. Internet applications have not been implemented to a great extent due to the cost of implementation, organizational problems, acceptance of particular applications or technical problems of new IT applications (Thun, 2010). Also, maintaining close, intense relationships can be very expensive in management effort (Cavinato, 1992; Langley & Holcomb, 1992). Although, the IT revolution has changed the way companies conduct businesses, having the technology is not sufficient to improve performance and relationships. Instead, how the company uses the technology is what may generate distinctive value (Fawcett, et al., 2011).

Cloud computing basically allows organizations to invest in IT in order to increase or add capabilities as needed without spending in new infrastructure, training new personnel, or licensing new software. Given that there are many types of IT offered through cloud computing a better understanding of how IT brings value to the organizations is important. Beyond minimizing up front transaction costs the level of specialized assets may be a source of competitive advantage due to the new ways of enhancing performance through relation-specific investments. This is supported by the key premise of Task-Technology Fit theory that performance outcomes are dependent upon the level of fit that exist between the information system and the tasks to be performed (Goodhue & Thompson, 1995). This study proposes that cloud computing offers an environment with great flexibility, ease of use, availability of data and services that promote collaborative relationships and augment relational outcomes and collaborative advantage. The following hypotheses are presented in the context of inter-organizational collaborative relationships.

**$H_{3a}$:** Cloud computing positively moderates the association between collaborative relationship and relational outcomes.

**$H_{3b}$:** Cloud computing positively moderates the association between collaborative relationship and collaborative advantage.

Collaborative relationships with large and powerful retailers have not been achieved in spite of the new relationship paradigm (Corsten & Kumar, 2005). Studies have shown that firm size may have a significant moderating effect in supply chain relationships. Power advantage may appropriate more value from the relationship (Shervani, Frazier, & Challagalla, 2007). In today's competitive environment companies, big or small, need to improve effectiveness and

efficiency to achieve competitive advantage (McLaughlin, et al., 2003). Cloud computing allow organizations to start small and increase hardware resources when there is an increase in their needs (Armbrust, et al., 2010), which otherwise would be difficult to acquire (Low, et al., 2011). The following hypotheses are proposed based on the previous discussion of the literature.

**$H_{4a}$:** For small firms the impact of cloud computing on the association between collaborative relationship and relational outcomes will be stronger than for large firms.

**$H_{4b}$:** For small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms.

## Research Model

The research model addressing the issues presented previously is shown in Figure 3. The model suggests that inter-firm relationships generate collaborative advantage and collaborative relational outcomes. In addition, it proposes that the use of cloud computing positively impacts the collaborative advantage and collaborative relational outcomes that inter-firm relationships generate without the use of cloud. As firms interact within a broad network, the reliance on one another to deliver value, increases (Barney, 1999).

Past studies have demonstrated that collaborative relationships show high levels of satisfaction and performance (Whipple, et al., 2010). This study would like to measure the impact of collaborative relationships on relational outcomes and evaluate collaborative advantage achieved from those relationships. Moreover, collaborative relationships often required greater resource commitment and investments, making difficult for firms to collaborate with every customer or supplier (Lambert, Emmelhainz, & Gardner, 1996a; Whipple, et al.,

2010). This study explores if cloud computing use impact the expected outcomes of collaborative relationships. The implementation of cloud computing does not require a high resource commitment or investment, making more accessible to all firms.

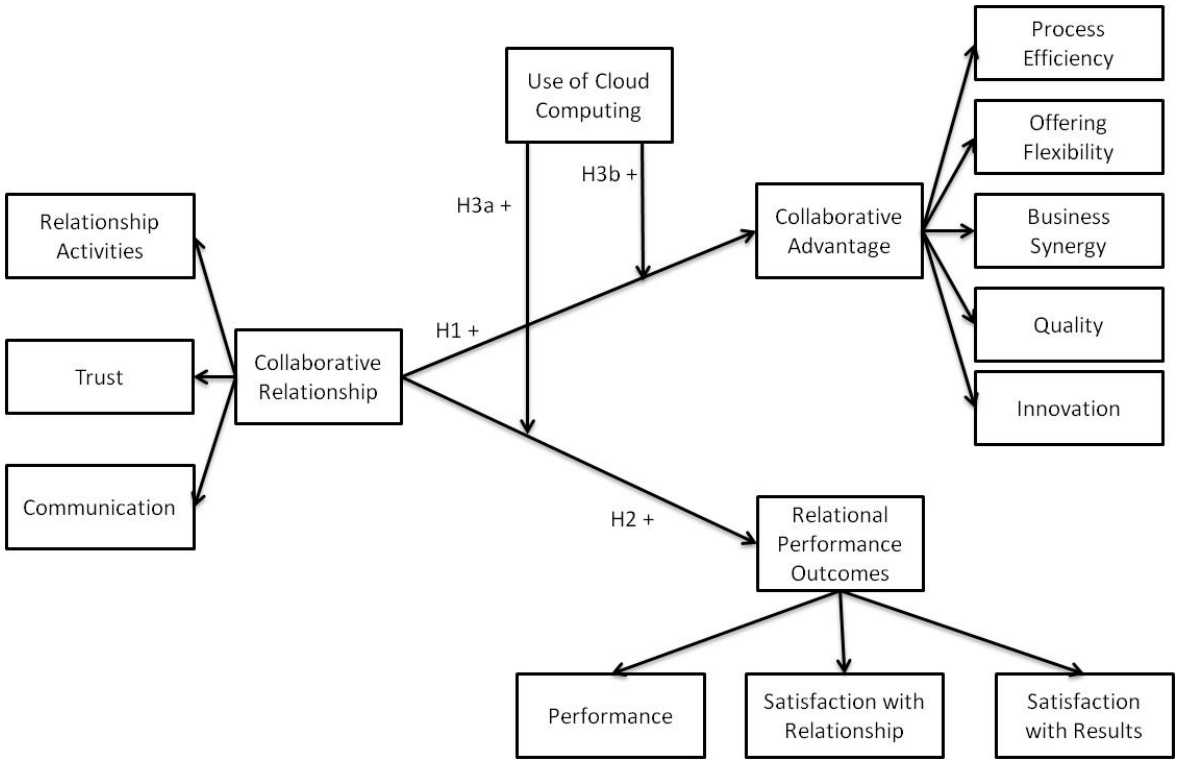


**Figure 3. Collaborative Relationships Framework**

*Summary*

This chapter presented the research model and hypothesis that build upon the literature review based on synthesis of research in multiple domains. This approach facilitates the investigation of a set of variables including collaborative relationships, collaborative advantage, relational outcomes and cloud computing that provide insights into the phenomena of interest.

# CHAPTER 3

# RESEARCH METHODOLOGY

This study explores the logistics managers' perception of the association of collaborative relationships and collaborative advantage and relational outcomes. It also investigates the moderating effect that cloud computing may have on collaborative advantage and relational outcomes. This chapter outlines the methodology that will be followed in order to examine those questions.

This chapter starts with an introduction that contains an overview of the research methodology requirements and a justification for performing survey methodology on this study. Then, this section uses the" General guide for survey method design" Creswell's (2003) describe the purpose of the survey, the reasoning for the selected methodology, the population, the development of the survey instrument and the description of the data collection and analysis. This chapter concludes by providing an overview of the methodology selected to evaluate the hypothesized associations between collaborative relationships, collaborative advantage, relational outcomes, and cloud computing use.

## Introduction

The main objectives of a research methodology are to assure that the study has good internal and external validity, including: quality of the research design, suitability of the approach to assess the research model , accuracy of data, generalizability and replication (Straub, 1989). After identifying the research questions, variables of interest and specification of the research model, the next step consists of the selection of the appropriate approach towards

empirical assessment of the research model. Robey (1996) emphasized that the theoretical foundations for research and s research methods should be justified by the research purpose (see Figure 4). Good research must be grounded in existing theories and practice, but should also contribute something new.

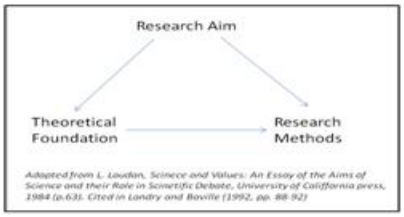


**Figure 4. Triad for the Justification of Research**

The research should also have sufficient justification, based on clear definitions, consistent measures and consistent relationships among the constructs, to pick the right methods to test the hypothesis (Mentzer, 2008). Methodological research strategies may fall into four classes: 1) settings in natural systems, 2) contrived and created settings, 3) behavior non setting dependent and 4) no observation of behavior required (see Figure 5), depending on one of three research goals: 1) maximize generalizability, 2) maximize precision/control, 3) maximize realism of context (McGrath, 1982).

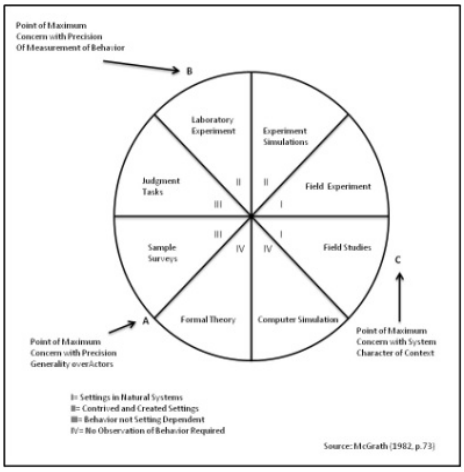


**Figure 5. Methodological Research Strategies**

An extensive review of the literature has provided the foundation for this research. This study aims to evaluate the moderating effect of cloud computing use in the relationship between collaborative relationships and collaborative advantage. It also evaluates the impact of cloud computing use in the association between collaborative relationships and relational outcomes. This study has identified specific hypothesis (See Table 5) that shape the focus of the research. In quantitative studies, researchers use research questions and hypothesis to test and draw inferences about the population from a study sample (Creswell, 2003). According to McGrath's "three horn criteria" (McGrath, 1982, p. 291) every research method is flawed and there is no way to maximize generalizability, realism and control at the same time. This research examines the association among collaborative relationships, collaborative advantage, relational outcomes and cloud computing through survey quantitative approach to gain generalizable results from an appropriate sample about populations. The findings can then be generalized and applied to other organizations independent of their context.

**Table 5. Research Hypothesis**

| Hypothesis | |
|---|---|
| $H_1$ | Strong collaborative relationships lead to increased collaborative advantage. |
| $H_2$ | Strong collaborative relationships lead to increased relational outcomes. |
| $H_{3a}$ | Cloud computing positively moderates the association between collaborative relationship and relational outcomes. |
| $H_{3b}$ | Cloud computing positively moderates the association between collaborative relationship and collaborative advantage. |
| $H_{4a}$ | For small firms the impact of cloud computing on the association between collaborative relationship and relational outcomes will be stronger than for large firms. |
| $H_{4b}$ | For small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms. |

Survey research is a well-known method for studying organizational problems in the logistics and supply chain field (Liao-Troth, Thomas, & Fawcett, 2012). Although, survey

research is a very useful method, researchers should carefully apply it to meet the purpose of their research. According to Creswell (2003), the design of a survey method section should follow a standard format. The author provided a checklist of questions, as a general guide, for designing a survey method. The methodology section of this study followed Creswell's (2003) general guide for survey method design (See Table 6).

**Table 6. Creswell's (2003) Checklist of Questions for Designing a Survey**

| Checklist of Questions for Designing a Survey Method |
|---|
| 1. Is the purpose of a survey design stated? |
| 2. Are the reasons for the design mentioned? Is the survey cross-sectional or longitudinal? |
| 3. Are the population and size of the population mentioned? Will the population be stratified? If so, how? How many people be on the sample? On what basis was this size chosen? What will be the procedure for sampling this individuals (e.g. random, non-random)? |
| 4. What instrument will be used in the survey? Who developed it? What are the content areas? The scales? Pilot the survey? What is the timeline for administering the survey? What are the variables? How do this variables cross-reference with the research questions? |
| 5. How is the data analyzed: analyze returns? response bias? descriptive analysis? scale items? reliability of scales? inferential statistics to answer the research questions? |

*1. Purpose of survey*

A quantitative approach was taken for the investigation, in or order to document how logistics managers perceive the association between collaborative relationships, collaborative advantage, relational outcomes and cloud computing use. An empirical study utilizing survey methodology was used to examine the proposed model and test the hypothesis. "Survey design provides quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population and generalizes or make claims about the population" (Creswell, 2003, p. 153). This survey evaluated the logistics managers' perceptions of the impact of cloud computing use in the relationship between collaborative relationships and collaborative

advantage. It also evaluated the logistics managers' perception of the impact of cloud computing use in the association between collaborative relationships and relational outcomes.

An understanding of the relationship between constructs of interest in this research can be gained by gathering data from organizational settings (Bruns & Kaplan, 1987). The focus of this study is on collaborative relationships between supply chain partners and how can it generate collaborative advantage and impact relational outcomes. The relational view suggests that firms working together can accomplish more benefits than firms working alone (Dyer, 1997). Supply chain partners as companies are responsible for establishing for creating the means to foster and manage collaborative relationships. This study uses the relational view of the firm at the firm-to-firm level as the unit of analysis and evaluates the value created based on the firm's actions to gain relational benefits.

*2. Reasoning for Selected Methodology*

A survey is an appropriate methodology for this quantitative study. It attempts to develop knowledge from testing the hypotheses developed using well established theories and measures to collect data on predetermined instruments, yield statistical data and maximize generalizability among the population (McGrath, Martin, & Kukla, 1982; Sudman & Blair, 1999). Surveys have been recognized as the most frequently used data collection method in organizational research for assessing phenomena not directly observable (Schneider, Ashworth, Higgs, & Carr, 1996; Smith & Paul, 1991) such as perception of employees. The survey is cross-sectional with the data collected at one point in time. A cross-sectional survey study will help support the inferences of cause and effect of the previously hypothesized relationships

Moreover, a survey methodology provided advantages such as lower design costs and faster turnaround in data collection (Creswell, 2003). Research has shown that web-based surveys are preferred to mail surveys because they have higher response numbers, faster responses and allow for modifications of the survey structure upon responses (Griffis, Goldsby, & Cooper, 2003). Bachmann, Elfrink and Vazzana. (1999) found that electronic surveys provided low cost, quick response time, and good response rate advantages compared to mail surveys. Online quantitative research deliver results that are not dissimilar to traditional methods. (Barnham, 2012). Therefore, a web-based survey was utilized in this research using the total design method consistent with the guidelines suggested by Dillman (2007). An adapted schematic overview of Dillman's Tailored Design perspective is shown on Table 7.

**Table 7. Adapted Dillman's Tailored Design**

| | | |
|---|---|---|
| **A. Tailored Design** is the development of survey procedures that create respondent trust and perceptions of increased rewards and reduced costs for being respondents, which consider features of the survey situation and a goal of reduction of survey error. | | |
| **Social exchange and respondent behavior:** actions are motivated by the return they bring from others. The likelihood of responding a questionnaire accurately is greater when the respondent trust that the expected fixed rewards of responding will outweigh the anticipated costs. | | |
| Many aspects of questionnaire and implementation process can be shaped to create trust and influence the respondent's expectations for rewards and costs. | | |
| To Establish Trust | To Increase rewards | To Reduce Social Costs |
| Provide token of appreciation in advance<br>Sponsorship by legitimate authority<br>Make task appear important<br>Invoke other exchange relationships | Show positive regard<br>Say thank you<br>Ask for advise<br>Support group values<br>Give tangible rewards<br>Make questionnaire interesting<br>Give social validation<br>Communicate scarcity of response opportunities | Avoid subordination language<br>Avoid embarrassment<br>Avoid inconvenience<br>Make questionnaire short and easy<br>Minimize requests to obtain personal information<br>Emphasize similarity to other requests |
| **Exchange concepts** must be communicated visually (instead of verbally) through the use of visual designs principles for development of questionnaire and implementation materials. | | |
| **Knowledge** of survey population, sponsorship, and survey content must be considered in order to develop the most effective means for increasing rewards, reducing costs and building trust. | | |
| Successful Tailored Design seeks to reduce survey errors from coverage, sampling, measurement , and nonresponse. | | |

*3. Population*

For this study, a single stage sampling (i.e. researcher has access to names in the population and will sample the people directly) procedure will be performed. Data will be collected by randomly selecting a representative sample from the population from the Council of Supply Chain Management Professionals (CSCMP). This preeminent worldwide professional logistics and supply chain organization has been considered an adequate sample for research and knowledge on supply chain management (Fugate, Mentzer, & Stank, 2010). CSCMP members will be pre-screened to determine if they met the criteria for this study's target population and sent a notification that they will shortly be invited to participate; pre-notification is believed to

raise response rates (Wagner & Kemmerling, 2010). The target respondents are firm's mid- and top-level logistics professionals, as they are considered to have a higher degree of knowledge of most of the logistics areas within the organization (Fugate, et al., 2010; Griffis, Cooper, Goldsby, & Closs, 2004). This research will collect a random sample of the population, where each individual is chosen entirely by chance and each member of the population has a equal chance of being included in the sample in order to avoid bias. There is no precise consensus on the adequate sample size for Structural Equation Modeling (SEM), Kline (1998) indicated that 10 to 20 participants per estimated parameter would result in a sufficient sample. Assuming no missing data or non-normal distributions a minimum sample size of 200 is recommended (Weston & Gore, 2006). SEM requires a large sample technique (usually N > 200) and the sample size is dependent on the model complexity (Kline, 2005).

*4. Survey instrument*

For the assessment of all the focal model constructs, this study adopted a variety of multi-item scales. All scales were obtained from the literature review and adapted to fit the research purpose and context. Appendix A contains a complete description of the scales and their sources. Table 8 below provides an overview of the variables in the study in relation to the specific questions on the instrument to easily determine how we will use the questionnaire items.

**Table 8. Hypothesis Testing Measures**

| | Collaborative Relationships (Whipple et al. 2010) | Collaborative Advantage (Cao and Zhang 2010) | Relational Outcomes (Whipple et al. 2010) | Use of Cloud Computing |
|---|---|---|---|---|
| **$H_1$** Strong collaborative relationships lead to increased collaborative advantage. | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | Process Efficiency<br>Offering Flexibility<br>Business synergy<br>Quality<br>Innovation | | |
| **$H_2$** Strong collaborative relationships lead to increased relational outcomes. | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | . | Satisfaction with the relationship (Kauser & Shaw, 2004)<br>Satisfaction with the results (Kauser & Shaw, 2004)<br>Performance (Dahistrom et al. 1996; Knemeyer et al. 2003) | |
| **$H_{3a}$** Cloud computing positively moderates the association between collaborative relationship and relational outcomes. | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | . | Satisfaction with the relationship (Kauser & Shaw, 2004)<br>Satisfaction with the results (Kauser & Shaw, 2004)<br>Performance (Dahistrom et al. 1996; Knemeyer et al. 2003) | System on the cloud<br>Use of cloud computing<br>Sanders (2007)<br>Diffusion of cloud computing applications<br>Zhang and Dhaliwal (2009) |
| **$H_{3b}$** Cloud computing positively moderates the association between collaborative relationship and collaborative advantage | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | Process Efficiency<br>Offering Flexibility<br>Business synergy<br>Quality<br>Innovation | | System on the cloud<br>Use of cloud computing<br>Sanders (2007)<br>Cloud computing diffusion<br>Zhang and Dhaliwal (2009) |
| **$H_{4a}$** For small firms the impact of cloud computing on the association between collaborative relationship and relational outcomes will be stronger than for large firms. | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | Characteristics of the company such as approximate company sales/gross revenue, number of employees, industry group. | Satisfaction with the relationship (Kauser & Shaw, 2004)<br>Satisfaction with the results (Kauser & Shaw, 2004)<br>Performance (Dahistrom et al. 1996; Knemeyer et al. 2003) | System on the cloud<br>Use of cloud computing<br>Sanders (2007)<br>Cloud computing diffusion<br>Zhang and Dhaliwal (2009) |
| **$H_{4b}$** For small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms. | Relationship activities (Ellinger et al. 2000)<br>Trust (Gibson et al.2002)<br>Communication (Jonsson and Zineldin 2003) | Characteristics of the company such as approximate company sales/gross revenue, number of employees, industry group. | | System on the cloud<br>Use of cloud computing<br>Sanders (2007)<br>Cloud computing diffusion<br>Zhang and Dhaliwal (2009) |

## Collaborative Relationships Scale

Survey respondents were first asked to think about their collaborative relationship with their principal supply chain partner. The Council Of Supply Chain Management Professionals includes suppliers, intermediaries, third-party service providers and customers within the definition of supply chain partners. Then, those collaborative relationships are measured using an adapted scale from Whipple et al. (2010). The factors: trust, relationship activities and communication (see Table 9) are used to measure collaborative relationships. Participants were asked to indicate their level of agreement with the questions on a seven-point Likert scale (where 1 equals strongly disagree and 7 equals strongly agree). Trust' measures were adopted from Gibson, Rutner and Keller's (2002) scale, relationship activities' measures were adopted from Ellinger, Daugherty and Keller's (2000) scale; and communication' measures were adopted from Jonsson and Zineldin's (2003) scale.

**Table 9. Item Measures for Collaborative Relationships**

| Collaborative Relationships (Whipple, et al., 2010) |
|---|
| Relationship activities (Ellinger, et al., 2000)<br>My firm and this supplier<br>...interact on a real time basis.<br>...achieve goals collectively.<br>...develop mutual understanding of responsibilities.<br>...informally work together.<br>...share ideas, information, and/or resources.<br>...have joint teams.<br>...conduct joint planning to anticipate and resolve operational problems.<br>...make joint decisions about ways to improve overall cost efficiency.<br>...share cost information. |
| Trust (Gibson, et al., 2002)<br>This supplier keeps the promises it makes.<br>We believe the information this supplier provide us.<br>This supplier is genuinely concerned that we succeed.<br>We trust this supplier keeps our best interests in mind.<br>This supplier considers our welfare as well as its own.<br>This supplier is trustworthy. |
| Communication (Jonsson & Zineldin, 2003)<br>This supplier keeps us informed of new developments.<br>This supplier's sales personnel frequently visit our place of business.<br>This supplier devotes a lot of time in getting to know our staff.<br>This supplier gives us opportunities to participate in goal setting to enhance performance. |

## Collaborative Advantage Scale

Cao and Zhang (2010) provided theoretical insights, instrument development and empirical support of supply chain collaborative advantage. The authors extended the understanding of the nature and attributes of supply chain collaborative advantage as five dimensions of process efficiency, offering flexibility, business synergy, quality and innovation. Cao and Zhang (2010) developed a reliable and valid instrument composed of 20 items for the five dimensions of collaborative advantage (see Table 10). Participants will be asked to indicate the extent to which they agree or disagree to each statement on a 7-point Likert-type scale (where 1 equals strongly disagree and 7 equals strongly agree).

**Table 10. Item Measures of Supply Chain Collaborative Advantage**

| Collaborative Advantage (Cao & Zhang, 2010) |
|---|
| Process Efficiency<br>Our firm with supply chain partners meets agreed upon unit costs in comparison with industry norms.<br>Our firm with supply chain partners meets productivity standards in comparison with industry norms.<br>Our firm with supply chain partners meets on-time delivery requirements in comparison with industry norms.<br>Our firm with supply chain partners meets inventory requirements (finished goods) in comparison with industry norms. |
| Offering Flexibility<br>Our firm with supply chain partners offers a variety of product and services efficiently in comparison with industry norms.<br>Our firm with supply chain partners offers customized products and services with different features quickly in comparison with industry norms.<br>Our firm with supply chain partners meets different customer volume requirements efficiently in comparison with industry norms.<br>Our firm with supply chain partners has good customer responsiveness in comparison with industry norms. |
| Business synergy<br>Our firm and supply chain partners have integrated IT infrastructure and IT resources.<br>Our firm and supply chain partners have integrated knowledge bases and know-how.<br>Our firm and supply chain partners have integrated marketing efforts.<br>Our firm and supply chain partners have integrated production systems. |
| Quality<br>Our firm with supply chain partners offers products that are highly reliable.<br>Our firm with supply chain partners offers products that are highly durable.<br>Our firm with supply chain partners offers high quality products to our customers.<br>Our firm with supply chain partners have helped each other to improve product quality. |
| Innovation<br>Our firm with supply chain partners introduces new products and services to market quickly.<br>Our firm with supply chain partners has rapid new product development.<br>Our firm with supply chain partners has time-to-market lower than industry average.<br>Our firm with supply chain partners innovates frequently. |

## Relational Outcomes Scale

In terms of relational outcomes, collaborative relationships must generate demonstrable value to its participants (Cannon & Homburg, 2001). Nyaga et al. (2010) and Whipple et al (2010) examined three outcomes measures, satisfaction with the relationship, satisfaction with the results and performance (see Table 11). The authors adopted measurement items from past studies based on relevant literature and where appropriate adapted the items to specific context (see Table 11). Satisfaction with relationships and with results was adapted from Kauser and

Shaw (2004) and performance was adapted from Knemeyer, Corsi and Murphy (2003)and Dahistrom , McNeilly and Speh (1996). All measures used a 7 point Likert scale (where 1 equals strongly disagree and 7 equals strongly agree). Performance examined the respondent firm's resulting performance. Perceptual measures of performance have been shown to correspond closely with objective performance data obtained from internal and external sources (Venkatraman and Ramanujam 1986; Narasimhan and Das 2001).

**Table 11. Item Measures of Relational Outcomes**

| Relational Outcomes (Nyaga, et al., 2010; Whipple, et al., 2010) |
|---|
| Satisfaction with the relationship (Kauser & Shaw, 2004)<br>My firm is satisfied with this relationship in terms of:<br>Coordination of activities.<br>Participation in decision making.<br>Level of commitment.<br>Level of information sharing.<br>Management of activities. |
| Satisfaction with the results (Kauser & Shaw, 2004)<br>My firm is satisfied with this relationship in terms of:<br>Profitability.<br>Market share.<br>Sales growth. |
| Performance (Dahistrom, et al., 1996; Knemeyer, et al., 2003)<br>This relationship has:<br>Reduced our cycle times.<br>Improved our order processing accuracy.<br>Improved our on-time delivery.<br>Increased our forecast accuracy. |

Use of Cloud Computing Scale

In order to measure the use of cloud computing we will first ask respondents what Logistics Information Systems (LIS) they are using in their company. Then, we ask if any of those LIS are cloud computing applications. If organizations are not using cloud computing applications, the respondents would provide their opinion based on their understanding of cloud computing if they think it would be beneficial to achieve their organizational outcomes.

If LIS cloud computing applications are used in the organization the scale from Zhang and Dhaliwal (2009) measuring external diffusion to deal with breath and volume of web-based transactions with suppliers (see Table 12). All measures used a seven point Likert scale (where 1= "strongly disagree" and 7= "strongly agree").

**Table 12. Item Measures of Diffusion of EB Use**

| Use of Cloud Computing (Zhang & Dhaliwal, 2009) |
|---|
| Proportion of total suppliers with whom you interact through EB applications |
| Proportion of total supplier transactions done through EB applications |
| Proportion of overall interactions with suppliers through EB applications |

An scale from Sanders (2007) that evaluated the use of e-business technologies will be adapted to measure the use of cloud computing. Sanders (2007) adapted this scale from Kent and Mentzer (2003) to better fit the purpose of her research focusing only on the extent of use of e-business technologies as the Internet, intranets, extranets, and web based applications in conducting business processes. Sanders (2007) scale was composed of four scale items used to evaluate the firm's use of e-business technologies: relative to industry standards, relative to key competitors, relative to key customers, and the extent of reliance of e-business operations. The

scale items were measured using a five point Likert scale ranging from "significantly below standard", "comparable to standard" and "significantly above standard". This study will adapt the use of e-business scale items from Sanders (2007) in order to understand if the use cloud computing has an effect on collaborative advantage and relational outcomes (see Table 13).

**Table 13.Item Measures of E-Business Technologies Use**

| Use of Cloud Computing (Sanders, 2007) |
|---|
| Use of e-business technologies relative to industry standard |
| Use of e-business technologies relative to key competitors |
| Use of e-business technologies relative to key customers |
| Reliance on e-business technologies in conducting business processes |

The survey instrument will be pretested with individuals from academia and industry familiar with buyer–supplier relationships. The survey will be first reviewed by four academic experts for clarity, readability, specificity, representativeness, content validity and face validity. Some items might need to be rewritten after receiving the experts' feedback. The survey should then be reviewed by experienced managers from logistics companies in the Georgia area for further suggestions regarding survey improvement. Some questions might need to be added and others removed based on the managers' feedback. The pretest will be used to ensure the questions are clear and provide face validity (i.e. effective in terms of its stated aims) for the constructs being tested. Minor changes will need to be made to the survey based on the pretest to improve clarity and parsimony.

In addition, demographic questions related to the respondent such as position and average number of years worked in the company, and characteristics of the company such as approximate company sales/gross revenue, number of employees, industry group will be collected in order to

check for representativeness of the sample (Mentzer & Flint, 1997). A pilot study with a small sample of respondents will be performed to pretest, validate and revise the measures and determine if the measures used are reliable (Dillman, 2000; Zacharia, Nix, & Lusch, 2009a). After the pilot test, the scales might need to be modified and/or adjusted to improve validity (Autry, Griffis, Goldsby, & Bobbitt, 2005; Griffis, et al., 2003). If the scales are not modified the pretest data and the final data may be combined for the analysis because no changes are made to the survey after pre-test. Incomplete surveys will be removed from the sample. Thus, the survey instrument will be developed using valid scales from the supply chain collaborative relationships, collaborative advantage, relational outcomes and cloud computing literature and modified to the context of this study.

The survey will then be programmed into an online survey instrument. There are indications that response rates in survey-based studies are declining and will continue to decrease (Larson & Poist, 2004; Melnyk, Page, Wu, & Burns, 2012). The response rates observed in supply chain management research from 1990 to 2008 shows and average of 32,87% (Melnyk, et al., 2012). In logistics research the response rates between 1989 and 2003 averaged 31% (Larson, 2005). Unfortunately, there are indications that the response rates have decreased at least 1% each year (Larson, 2005; Melnyk, et al., 2012). Response rates in a leading logistics journal, the Journal of Business Logistics recently are about 10.6% for survey studies (Bellingkrodt & Wallenburg, 2013). Getting an acceptable and reliable response rate is an important objective of this study methodology. In a recent study, Melnyk et al (2012) identified several practices that have emerged from the concern of researchers to improve response rates (see Table 14) and this study applies them to achieve higher response rates.

**Table 14. Adapted Survey Practices to Improve Response Rates (Melnyk, et al., 2012)**

| Practice | Background |
|---|---|
| Pre-notification/pre-qualification | Potential sample respondents, appropriate for the study, aware of goals and interested in participating |
| Incentives | Range from promises of study findings to monetary contributions. Incentives are highly effective for increased response rates. |
| Support | Endorsement by another credible group (i.e. professional societies, government, firm management) enhances response rates |
| Number of questions | Survey length impact response rates, longer surveys equal lower response rates. Not well defined what is considered "too long" or "too short" |
| Follow-up | Multiple waves of mailings/reminders are critical encouraging responses |
| Method of survey delivery | May be delivered through: mail, fax, telephone, personal interview and internet. Effectiveness and efficiency of online surveys versus other methods is still investigated. How surveys are distributed can significantly impact response rates |
| Survey format | Presentation is critical to enhance response rates |
| Types of questions used | Existing, reliable scales and questions means fewer questions to measure constructs and higher response rate is expected |
| Sampling strategy | Numerous sampling strategies each with requirements and challenges that influence response rates |
| Integrated method | Dillman (2000) developed and integrative approach to survey design and administration "Tailored Design Method" to encourage participation by incorporating multiple survey tactics in the study |

Besides considering Melnyk et al (2012) practices to improve response rates in this study, the most current version of Dillman's (2000) tailored design method is followed to achieve higher response rates in this study (Dillman, 2007):

1. A respondent-friendly questionnaire: clear and easy to comprehend, question order and layout appropriates.

2. Up to five contacts with the questionnaire recipient (see Appendix B): a brief pre-notice letter sent a few days prior to questionnaire, a questionnaire that includes a detailed cover letter explaining why the response is important, a thank you note a few days to a week after the

questionnaire, replacement questionnaire sent to non-respondents 2-4 weeks after the previous questionnaire, a final contact that may be made by telephone a week or so after the fourth contact.

3. Personalized correspondence; real names instead of preprinted salutation.

4. An incentive that is sent with the survey request (offer to provide report of results and entrance in a drawing to win an Apple Ipad)

*5. Data Collection and Analysis*

The principal concern in developing the data collection is to ensure that a generalizable sample was gathered (Shadish et al. 2002). For this study, a single stage sampling (i.e. researcher has access to names in the population and sample the people directly) procedure will be performed. Data will be collected by randomly selecting a representative sample from the population from the Council of Supply Chain Management Professionals (CSCMP). The CSCMP early called Council of Logistics Management (CLM) was the association that most often provided survey support in logistics research during 1989-2003 (Larson, 2005). CSCMP members will be pre-screened and pre-notified to determine if they met the criteria for this study's target population; pre-notification is believed to raise response rates (Wagner & Kemmerling, 2010). Pre-screening and qualification of survey recipients, monetary incentives and follow-up mailings are some of techniques used to help get better response rates (Dillman, 2007; Larson, 2005). The data collected from the survey will be analyzed using structural equation model (SEM) through partial least squares (PLS). SEM has become a popular multivariate approach express a theory in terms of relationships among measured variables and latent constructs to assess how well the theory fits reality as presented by data (Hair, Black,

Babin, & Anderson, 2010). "PLS-SEM is a causal modeling approach aimed at maximizing the explained variance of the dependent latent constructs." (Hair, Ringle, & Sarstedt, 2011, p. 139).

As per Fornell and Larcker (1981), the data should be checked for normality, skewness and kurtosis on SPSS and structural equation modeling (SEM). The outputs, such as standardized regression weights, squared multiple correlations, standardized residuals, modification indices, and goodness of fit indicators, should be used to confirm the scales' validity including: reliability, construct validity, convergent validity, and discriminant validity. The hypothesis should be evaluated based on significance and direction of each path. Fit criteria should be used to test for unidimensionality and reduce biases of the individual measures. Lack of unidimensionality will be shown if the measured variables do not load on only one construct (Hair, et al., 2010).

*Validity*

Rigorous logistics research requires an evaluation of the new instrument to ensure that the conclusions from the research study are valid. According to Mentzer and Flint (1997) validity of logistics research in composed of four components:

1. Statistical conclusion validity; is there a relationship among the constructs?
2. Internal validity; is the relationship plausibly causal?
3. Construct validity; given causal probability, what are the constructs in the relationship?
4. External validity; given causal probability between constructs, how generalizable is it across persons, settings, and times?

Statistical Conclusion Validity

"Statistical conclusion validity refers to whether there is a statistical relationship between two phenomena."(Mentzer & Flint, 1997, p. 202). For this study is necessary to determine the level of confidence we have that the variables in this study vary together (covary). For example, we hypothesized that there is a positive relationship between collaborative relationships and collaborative advantage, we must demonstrate that a rise in collaborative relationships is usually accompanied by a rise in collaborative advantage. Statistical conclusion validity is important for large sample size survey research (Mentzer & Flint, 1997).

Internal Validity

Internal validity provides evidence of causal relationships; history (i.e. changes in the environment), maturation, instrumentation and selection might change the causal relationships. As a result, it is important to complete the study in a reasonable time, compare results for frequently surveyed respondents to those not so frequently surveyed, do not include leading questions, test for non-response bias to assure that nonrespondents do not feel differently about the relationships explored.

Nonresponse bias examines the correlation between waves of survey responses;

test that compares early and late respondents *(Armstrong & Overton, 1977).*

All respondents should be subject to a wave analysis using multivariate analysis of variance. During data collection, three waves of respondents should be identified relative to early, middle, and late responses. These cuts will be developed based on the timing of the two

follow-up emails. All measures should be tested via multiple regression versus multiple outcome variables. Indications of nonresponse bias will be evaluated based on the wave analysis (Armstrong and Overton 1977). There should not be a statistically significant differences between the answers of early respondents and late respondents.

To mitigate the potential for common method bias, the questionnaire is designed with several subsections so that respondents have to pause and read instructions for each sub-section (Podsakoff et al. 2003). In addition, two tests may be performed to determine the extent of common method bias. First, Harmon's single-factor test (Podsakoff and Organ 1986) to determine if all construct items load onto one factor and, via principal component factor analysis, the results should be examined to determine whether a single factor would emerge and⁄or if one general factor would account for most of the covariance in the variables (Hult et al. 2007). The results of this test should indicate if common method bias is a major problem in the data. Second, the first-order factors will be allowed to load on their theoretical constructs as well as on an unmeasured latent common methods variance factor (Podsakoff et al. 2003). The results of this test should show model fit and any changes in the structural paths estimates with the introduction of the latent common method factor and further confirm if common method bias is a major problem in the study.

Construct Validity

Construct validity assessed whether the theoretical phenomena in this study was correctly defined and measured. To evaluate the appropriateness of measures for the theoretical construct the study must address the components of construct validity nomological validity, face/content

validity, and trait validity ( i.e. convergent validity, discriminant validity and tangentially reliability) (Mentzer & Flint, 1997).

1. No statistical test exist to evaluate nomological validity, it is a qualitative assessment of its logical consistency and definition of its constructs.
2. Face/content validity evaluates how well the questions asked for the purpose of tapping a certain construct ask about all aspects of the construct. Content validity depends on how well the researchers create measurement items to cover the domain of the variable being measured (Nunnally, 1978) and is not subject to statistical evaluation but judgment based on the review of the literature.
3. Trait validity issues in developing construct validity need convergent validity, discriminant validity and reliability.

Convergent Validity

Convergent validity states that different measures of same construct should be related to one another. Convergent validity looks at each item in the scale as a different approach to measure the construct and determine if they are convergent. Confirmatory factor analysis confirmed that all the questions related to the construct converge on the same factor. It should be assessed using the Bentler-Bonett coefficient (Bentler & Bonett, 1980), which is the ratio difference between the chi-square of the null measurement model and the chi-square value of the specified measurement model to the chi square value of the null model. Convergent validity should be confirmed with a value of 0.90 or higher (Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005). If needed, the purifying measures process (i.e. eliminating and/or rewriting questions) is detailed in Churchill and Gerbing and Anderson.

## Discriminant Validity

Discriminant validity states that measures of different constructs should load on separate factors. Confirmatory factor analysis confirms that all the questions related to a construct loaded on one factor and all the questions of a separate construct loaded on a different factor. Discriminant validity represents the independence of the measures. It should be tested using confirmatory factor analysis (CFA) in order to demonstrate that the measures do not correlate very high with other measures from which it should differ (Campbell & Fiske, 1959). The average variance extracted by each construct with its shared variance with the other constructs (square of correlations between the constructs) as suggested by Fornell and Larcker (1981) can also be used to assess discriminant validity. The values should be greater than the squared intercorrelations for each construct in all subsamples. Also, a pair-wise comparison, by comparing the model with correlation constrained to equal one with an unconstrained model, should show to be significant ($p<0.001$) in order to supported discriminant validity (Joreskog, 1971).

## Reliability

Reliability establishes how consistently the measures yield the same results from multiple applications. The split half reliability test may be used to evaluate the correlation among two groups randomly selected from the total number of respondents. High correlation demonstrated reliability. The most common statistic measure of reliability is called Cronbach's α. Cronbach's α compares how well each question correlates with the combination of all other questions. A Cronbach α coefficient greater than 0.7 is used to evaluate reliability of the scale (Nunnally, 1978). Cronbach α is calculated from principal factor analysis and reliability checks. If all

measures have a Cronbach's α of over 0.70 indicates that the set of measures work consistently (i.e. reliably).

External Validity

External validity is defined as "the degree to which the research findings can be generalized to the broader population″ (Mentzer & Flint, 1997, p. 211). Achieving external validity requires a random sampling, appropriate sample size, and adequate response rates. According to Mentzer and Flint (1997) no single study can ensure external validity; only generalizability with new sample from the population, replication of the same study, and the realism of the settings may demonstrate external validity.

*Institutional Review Board (IRB)*

All research that involved humans must be approved by a federally mandated committee the IRB prior to initiating recruitment of subjects and data collection. The proposed research study was sent to the IRB and approved on February 10, 2014, approval notice number H14302.

*Conclusion*

This chapter has outlined the proposed methodology adopted for the study. The overall intent was to follow approaches and procedures prescribed in literature that if implemented would ascertain that the study should have accurate study results. In this chapter the reasoning for adopting survey methodology was presented, the constructs were operationalized and the data collection procedure to test the proposed research model outlined.

# CHAPTER 4

# RESEARCH RESULTS AND FINDINGS

This chapter describes the empirical examination of the research model and the hypotheses. As discussed in Chapter 4, items for measurement of the constructs were adapted from previously validated scales. This chapter starts with examining the sample characteristics and demonstrating non-response bias. Then, analyzing the data to evaluate construct validity which requires an assessment of unidimensionality, convergent validity, discriminant validity and reliability. After establishing that the constructs meet established literature guidelines, we proceed with model testing using SmartPLS 3. This chapter concludes by reviewing the level of support for each hypothesis and discussing the implication of the results.

## Sample Characteristics

### *Pilot test*

After developing the survey instrument, a pilot test was conducted by distributing thirty paper copies of the instrument with a self addressed envelope to logistics managers attending the Logistics Summit in Atlanta Georgia. Subjects were asked to fill out the instrument and mail back to us when completed. The pilot instrument had two additional questions that provided information on the understandability of the questionnaire and the best method to motivate logistics managers to respond. Seven responses were received from the pilot test. The only comment to the questionnaire was to have it available online instead of paper. All of the respondents to the pilot test agreed that receiving a survey report would motivate them to fill out the survey.

*Survey*

The results of the pilot study showed that the questionnaire was well understood by the respondents and did not need modifications to proceed with data collection. Following the suggestion of the pilot respondents this research utilized a web version of the questionnaire to collect responses and offered to provide a survey report of the results. The target population for this survey was logistics professionals in the US. An email was sent to 4676 Members of the Council of Supply Chain Management Professionals (CSCMP) requesting their participation in the survey. A total of 2269 CSCMP members opened the email (48.52%). From the members that opened and read the email 357 started the survey (15.73%), 182 left the survey incomplete (8%), 71 responded they were not interested in participating (3.13%) and 104 completed the survey (4.58%). This response rate is lower than response rates of recent survey studies in leading supply chain journals, even though, this study implemented best practices to achieve higher response rates(Melnyk, et al., 2012).

*Profile of Respondents*

A total of one hundred and four surveys were used for data analysis. The respondents were logistics professionals, members of the CSCMP, from companies located in the United States. Table 15 shows respondents distribution by industry type. The respondents were from the Manufacture and Textiles (10%), Pharmaceuticals, Chemicals and Electronics (9%), Retailer, Consumer goods and Food and beverage (23%), Service industry (24%), and Other (34%).

**Table 15 Industry Type**

| Industry | Number of respondents | Percent of respondents |
|---|---|---|
| Manufacture and Textiles | 10 | 10% |
| Pharmaceuticals, Chemicals and Electronics | 9 | 9% |
| Retailer, Consumer goods and Food and beverage | 24 | 23% |
| Service industry | 25 | 24% |
| Other | 35 | 34% |

Eighty eight percent of these firms had over a million dollars gross revenue and all respondent firms earned more than fifty thousand dollars (see Table 16).

**Table 16 Firm's Gross Income**

| Gross income | Number of respondents | Percent of respondents |
|---|---|---|
| $50,000 - 250,000 | 3 | 3% |
| $251,000 - 500,000 | 5 | 5% |
| $500,000 - 1,000,000 | 5 | 5% |
| Over $1,000,000 | 91 | 88% |

Fifty four percent of the respondents were from organizations with 1001 or more employees; the other 46% of respondents are part of organizations of less than 1001 employees (See Table 17). The United States Small Business Authority (SBA) establishes small business size standards and gives a numerical representation for Federal Government programs (SBA, 2014). Size standards have been established for types of economic activity or industry. The SBA size standards, expressed in number of employees, considers 1000 or less employees small business for the industries participating in this study.

**Table 17. Number of Employees**

| Number of employees | Number of respondents | Percent of respondents |
|---|---|---|
| 1-1000 employees | 48 | 46% |
| 1001+ employees | 56 | 54% |

Table 18 shows the logistics professionals who responded to the survey occupied positions in their organizations as director (38%), manager (31%), supervisor (3), other positions (see Table 18) such as vice president (16%), president (6%), owner (1%), founder (1%), chairman (1%), logistics specialist (1%), CEO (1%), sourcing specialist (1%), and executive (1%). On average the respondents had nine years working in the firm and twenty four years of experience in the industry (see Table 19). Therefore, this group represented a diversified sample mix of experienced logistics professionals whose responses are presumably typical of average business individuals in the United States.

**Table 18. Respondent Position in the Firm**

| Position in the firm | Percent of respondents |
|---|---|
| Director | 38% |
| Manager | 31% |
| Supervisor | 3% |
| Other, Vice-president, President, Owner, Founder, Chairman, Logistics specialist, CEO, Sourcing specialist, and Executive | 29% |

**Table 19. Number of respondents by years worked in the firm and years of industry experience**

| Years | Working in the firm | Experience in the industry |
|---|---|---|
| 0 to 5 years | 44 | 2 |
| 5-9 years | 18 | 6 |
| 10-20 years | 30 | 31 |
| More than 20 years | 9 | 61 |

The collecting time was a two-month period. In order to evaluate non-response bias a two-sample mean difference test between early respondents and late respondents was conducted (Armstrong & Overton, 1977). The test compared the means on each measurement item between early responders and late responders. It found no statistical significant differences between the first and second wave of respondents in terms of their organizations' size and gross revenue. Equal variances assumed the *t* value for size is 1.068 and gross revenue .000; the two-tailed *p* value for size is.288 and for gross revenue is 1. A *t* test failed to reveal a statistically reliable difference between the mean number of early respondents and late respondents of this survey by size and gross revenue.

## Data Analysis

As discussed in Chapter Three, all survey items were adopted from previously validated scales in published literature. All items were assessed using a seven-point Likert scale. The collaborative relationship indicator measured the relationships activities, trust and communication among firms. The collaborative advantage indicator measured the process efficiency, flexibility offers, business synergy, quality and innovation of firms working together.

The relational outcomes indicator measure the satisfaction with the relationship, satisfaction with the results and performance. As described in Chapter Three, the SEM multivariate approach, help researchers to express theory in terms of relationships among measured variables and latent constructs to assess how well theory fits reality as presented by data (Hair, et al., 2010).

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

PLS-SEM methodology has been successfully applied in research that aims to predict the structural relationships, explore and extend the structural theory in a complex model with many constructs, indicators and empirical research challenges such as smaller sample sizes (Hair, et al., 2011). PLS-SEM is suitable to use in our complex structural model with multi-dimensions (Hair, et al., 2011) such as for the collaborative relationships, collaborative advantage and relational outcomes multi-dimensional constructs. More importantly, PLS-SEM provides flexibility on the assumptions for model specification and data, and high statistical power to examine moderating effects (Wetzels, Odekerken-Schroder, & Van Oppen, 2009). This research applied the partial least squares (PLS) technique of structural equation modeling (SEM) to establish measurement models and investigate the structural model, and a subgroup analysis for investigating the moderating effect of cloud computing use on the association between collaborative relationships and both collaborative advantage and relational outcomes though comparing the path coefficients between groups.

The PLS-SEM rule of thumb for minimum sample size is ten times the larger number of formative indicators used to measure a single construct (Hair, Hult, Ringle, & Sarstedt, 2013). As the larger number of formative indicators was 9, according to the rule of thumb this study required a minimum sample size of ninety. Moreover, according to Hair et al. (2013) the PLS-

SEM sample size recommendations are built on the properties of ordinary least squares (OLS) regression and applying Cohen's statistical power analysis. Per Cohen (1992), power analysis for multiple regression models using G*Power program suggests a minimum of eighty eight responses should be collected assuming a commonly used level of statistical power of 80%. and the specific level of complexity of this PLS path model (nine indicators pointing at a construct). Thus, after collecting the survey responses the sample size was 104. This number of responses is considered large enough to test utilizing PLS-SEM modeling based on the sample size requirements in the literature (Hair, et al., 2013; Hair, et al., 2011)

This research proceeded with a systematic evaluation of PLS-SEM results recommended by Hair et al (2013) consisting of two stages:

1. Evaluation of measurement model
    a. Internal consistency (composite reliability)
    b. Indicator reliability
    c. Convergent validity (average variance extracted)
    d. Discriminant validity
2. Evaluation of structural model
    a. Coefficients of determination ($R^2$)
    b. Predictive relevance ($Q^2$)
    c. Size and significant path coefficients
    d. $f^2$ effect sizes
    e. $q^2$ effect sizes

## Evaluation of Measurement Model

Initially, the measurement model assessed internal consistency; indicator reliability, convergent validity and discriminant validity. The examination of the PLS-SEM estimates enables the researcher to evaluate reliability and validity of the construct measures. In order to establish strong reliability the factor loadings the indicators of latent constructs must be greater than 0.7 (Fornell & Larcker, 1981). The first criterion to be evaluated is internal consistency reliability. Cronbachs' α is the traditional criterion for internal consistency because it provides an estimate of reliability based on the intercorrelations of the observed indicator variables assuming that all indicators are equally reliable (Hair, et al., 2013). Cronbach' α of 0.7 is considered acceptable for existing constructs and 0.6 for new constructs (Nunnally, 1978). Cronbach' α values greater than 0.95 are not desired because they may show that the indicator variables are measuring the same phenomena (Hair, et al., 2013). This exist when there are semantically redundant items that might be slightly paraphrasing the same question.

Because Cronbach' α assumes that all indicators have equal outer loadings on the construct, composite reliability criterion, which take into account the different outer loadings of the indicators is also used to demonstrate internal consistency. Composite reliability varies between 0, and 1 with higher values also indicating higher levels of reliability. Composite reliability values below 0.6 indicate lack of internal consistency reliability (Hair, et al., 2013). Table 20 summarizes the results of the measurement model assessment using SmartPLS 3 , (Ringle, Wende, & Becker, 2014). As can be seen, all model evaluation criteria have met, providing support for the measures' reliability and validity. All the constructs in the study meet the requirements for internal consistency reliability and composite reliability.

**Table 20. Reliability and Validity Analysis (n=104)**

| | Results from original scales | | | Results removing Business Synergy and Quality constructs from the scale | | |
|---|---|---|---|---|---|---|
| | Cronbach's α, min >=0.70 | Composite Reliability, min >=0.70 | Average Variance Extracted (AVE), min >=0.50 | Cronbach's α, min >=0.70 | Composite Reliability, min >=0.70 | Average Variance Extracted (AVE), min >=0.50 |
| **Collaborative Relationships** | **0.942** | **0.949** | **0.506** | **0.942** | **0.949** | **0.506** |
| Trust | 0.938 | 0.951 | 0.762 | 0.938 | 0.951 | 0.762 |
| Relational Activities | 0.892 | 0.914 | 0.549 | 0.892 | 0.914 | 0.549 |
| Communication | 0.799 | 0.867 | 0.623 | 0.799 | 0.867 | 0.623 |
| **Collaborative Advantage** | **0.913** | **0.925** | **0.391** | **0.910** | **0.924** | **0.506** |
| Innovation | 0.870 | 0.911 | 0.720 | 0.870 | 0.911 | 0.719 |
| Offering Flexibility | 0.870 | 0.911 | 0.719 | 0.870 | 0.911 | 0.719 |
| Process Efficiency | 0.856 | 0.903 | 0.700 | 0.856 | 0.903 | 0.700 |
| *Business Synergy* | *0.848* | *0.896* | *0.683* | | | |
| *Quality* | *0.829* | *0.886* | *0.661* | | | |
| **Relational Outcomes** | **0.934** | **0.942** | **0.510** | **0.934** | **0.942** | **0.510** |
| Satisfaction with the Relationship | 0.935 | 0.951 | 0.795 | 0.935 | 0.951 | 0.795 |
| Satisfaction with the Results | 0.867 | 0.918 | 0.790 | 0.867 | 0.918 | 0.790 |
| Performance | 0.892 | 0.914 | 0.573 | 0.892 | 0.914 | 0.573 |

Moreover, Table 21 shows the average variance extracted (AVE) results which represent the proportion of average variance between constructs and indicator variable. AVE is a common measure used to assess convergent validity (Hair, et al., 2013). It is recommended that AVE is at least 0.5 to suggest good convergent validity, as it indicates that 50% or more of the variance is explained by the indicators of the latent variables (Chin, 1998). Based on this criteria, the results demonstrate the variables of the measurement model show the minimum acceptable values for the constructs on each of the measures with the exception of AVE for Collaborative Advantage. While Cronbach's α and composite reliability are high (above .90) and previous research found

that the Collaborative Advantage scale showed sufficient reliability and validity, we will keep this construct in the model. Business synergy and quality constructs showed low individual loadings for the collaborative advantage scale. Removing business synergy and quality constructs from the Collaborative Advantage scale improves the overall AVE from 0.391 to 0.506 while maintaining good Cronbach's α and composite reliability values on the other scale items. With this scale modification, all the constructs in the study demonstrated acceptable internal consistency reliability and convergent validity.

Second, construct validity examines the degree to which a scale measures what it intends to measure, including content validity, convergent validity and discriminant validity. Content validity does not have a formal statistical test, but this study provides content validity by a detailed review of the literature, linkage to theory and pilot of the survey. Convergent validity evaluates the ability of the scale items to load on a single construct by examining the individual loadings for each scale item onto its latent variable (Hair, et al., 2013). The standardized loadings should be greater than 0.70, meaning that each indicator share more variance with the component than with the error variance. A lower bound of 0.50 or 0.60 may be sufficient for newly developed scales (Chin, 1998). In this model all items except CRRA_4 =0.481 exhibited such value. Then, we removed item CRRA_4 and noticed a mild improvement on Cronbach's α, composite reliability and AVE of collaborative relationships and relational activities. The remaining indicators still sufficiently capture the construct's content from a theoretical perspective and composite reliability (or AVE) is above the suggested threshold. Table 21 provides a list of outer loadings for each construct demonstrating that they are all above the minimum requirements (Chin, 1998) with the exception of Collaborative Relationships Relational Activities item 4 which was removed.

**Table 21 Convergent Validity**

| | | Outer Loadings (range) with indicator CRRA_4 | Outer Loadings (range) without indicator CRRA_4 |
|---|---|---|---|
| Collaborative Relationships | Relational Activities | 0.481-0.837 | 0.573-0.837 |
| | CRRA_1 | 0.571 | 0.573 |
| | CRRA_2 | 0.837 | 0.829 |
| | CRRA_3 | 0.740 | 0.746 |
| | CRRA_4 | 0.481 | |
| | CRRA_5 | 0.804 | 0.800 |
| | CRRA_6 | 0.804 | 0.812 |
| | CRRA_7 | 0.832 | 0.837 |
| | CRRA_8 | 0.837 | 0.845 |
| | CRRA_9 | 0.675 | 0.677 |
| | Trust | 0.860-0.899 | 0.848-0.899 |
| | CRT_1 | 0.860 | 0.859 |
| | CRT_2 | 0.884 | 0.885 |
| | CRT_3 | 0.848 | 0.848 |
| | CRT_4 | 0.886 | 0.886 |
| | CRT_5 | 0.860 | 0.860 |
| | CRT_6 | 0.899 | 0.899 |
| | Communication | 0.622-0.858 | 0.620-0.858 |
| | CRC_1 | 0.829 | 0.829 |
| | CRC_2 | 0.622 | 0.620 |
| | CRC_3 | 0.826 | 0.826 |
| | CRC_4 | 0.858 | 0.858 |
| Collaborative Advantage | Process Efficiency | 0.7998-0.897 | 0.799-0.897 |
| | CAPE_1 | 0.799 | 0.799 |
| | CAPE_2 | 0.897 | 0.897 |
| | CAPE_3 | 0.822 | 0.821 |
| | CAPE_4 | 0.826 | 0.826 |
| | Offering Flexibility | 0.834-0.855 | 0.836-0.855 |
| | CAOF_1 | 0.852 | 0.852 |
| | CAOF_2 | 0.855 | 0.855 |
| | CAOF_3 | 0.848 | 0.848 |

| | | | |
|---|---|---|---|
| | CAOF_4 | 0.836 | 0.836 |
| | Innovation | 0.788-0.894 | 0.782-0.897 |
| | CAI_1 | 0.897 | 0.897 |
| | CAI_2 | 0.878 | 0.878 |
| | CAI_3 | 0.728 | 0.782 |
| | CAI_4 | 0.831 | 0.831 |
| Relational Outcomes | Satisfaction with the Relationship | 0.864-0.918 | 0.864-0.918 |
| | ROREL_1 | 0.865 | 0.865 |
| | ROREL_2 | 0.894 | 0.894 |
| | ROREL_3 | 0.918 | 0.918 |
| | ROREL_4 | 0.864 | 0.864 |
| | ROREL_5 | 0.915 | 0.915 |
| | Satisfaction with the Results | 0.855-0.905 | 0.855-0.905 |
| | RORES_1 | 0.855 | 0.855 |
| | RORES_2 | 0.905 | 0.905 |
| | RORES_3 | 0.905 | 0.905 |
| | Performance | 0.654-0.806 | 0.654-0.806 |
| | ROP_1 | 0.792 | 0.792 |
| | ROP_2 | 0.821 | 0.821 |
| | ROP_3 | 0.806 | 0.806 |
| | ROP_4 | 0.703 | 0.703 |
| | ROP_5 | 0.710 | 0.710 |
| | ROP_6 | 0.654 | 0.654 |
| | ROP_7 | 0.845 | 0.845 |
| | ROP_8 | 0.703 | 0.703 |

Discriminant validity is the extent to which the construct is distinct from the other constructs. One method for assessing discriminant validity is that the square root of each of the construct's AVE should be greater than its highest correlations of other variables, and the value of the diagonal element should be greater than those of off-diagonal elements (Fornell & Larcker, 1981). Table 22 shows that the square root of all AVEs is much is much larger than all other cross correlations which demonstrate adequate discriminant validity.

| | Communication | Innovation | Offering Flexibility | Performance | Process Efficiency | Relational Activities | Satisfaction with the Relationship | Satisfaction with the Results | Trust |
|---|---|---|---|---|---|---|---|---|---|
| Communication | **0.789** | | | | | | | | |
| Innovation | 0.516 | **0.848** | | | | | | | |
| Offering Flexibility | 0.527 | 0.508 | **0.848** | | | | | | |
| Performance | 0.500 | 0.477 | 0.461 | **0.757** | | | | | |
| Process Efficiency | 0.607 | 0.500 | 0.692 | 0.509 | **0.837** | | | | |
| Relational Activities | 0.713 | 0.479 | 0.639 | 0.562 | 0.647 | **0.770** | | | |
| Satisfaction with the Relationship | 0.688 | 0.485 | 0.589 | 0.609 | 0.606 | 0.702 | **0.892** | | |
| Satisfaction with the Results | 0.412 | 0.542 | 0.453 | 0.520 | 0.345 | 0.459 | 0.683 | **0.889** | |
| Trust | 0.670 | 0.477 | 0.540 | 0.519 | 0.635 | 0.673 | 0.732 | 0.558 | **0.873** |

**Table 22.Fornell-Larcker Discriminant Criterion**

Another method for assessing discriminant validity is by examining the cross loadings of the indicators of the scales employed in testing our research model (Chin, 1998). A cross loading exceeding an indicators' outer loadings suggest it is not completely distinct from other constructs, a problem with discriminant validity. Appendix D reports the loading and cross-loading of all measures in the model. The values in the columns show that the item loadings in their corresponding columns are all higher than the loadings of the items used to measure the other constructs. The values across the rows show item loadings higher for their corresponding constructs than for others. As a result, the measurement demonstrate discriminant validity according to Chin (1998).

To summarize the assessment of the measurement model (indicator reliability, composite reliability, convergent validity and discriminant validity) demonstrates the reliability and validity of the construct measures and provide support for the suitability of their inclusion in the path model. Table 23 summarizes the results of the measurement model assessment such as variables, survey items used, loadings, indicator reliability and path coefficients between first and second order constructs. As can be seen, all model evaluation criteria has been met providing support for the measures reliability and validity.

**Table 23. Measurement Indicators of Collaborative Relationships**

| Variables | Indicators/Survey Questions | Loadings | Cronbach's α | Composite Reliability | AVE | Discriminant Validity |
|---|---|---|---|---|---|---|
| Collaborative Relationships | | | 0.938 | 0.946 | 0.516 | |
| Relational Activities | My firm and this supplier interact on a real time basis (CRRA_1) | 0.574 | 0.899 | 0.920 | 0.593 | Yes |
| | My firm and this supplier achieve goals collectively (CRRA_2). | 0.829 | | | | |
| | My firm and this supplier develop mutual understanding of responsibilities (CRRA_3). | 0.746 | | | | |
| | My firm and this supplier share ideas, information, and/or resources (CRRA_5). | 0.800 | | | | |
| | My firm and this supplier have joint teams (CRRA_6). | 0.813 | | | | |
| | My firm and this supplier conduct joint planning to anticipate and resolve operational problems (CRRA_7). | 0.838 | | | | |
| | My firm and this supplier make joint decisions about ways to improve overall cost efficiency (CRRA_8). | 0.844 | | | | |
| | My firm and this supplier share cost information (CRRA_9). | 0.677 | | | | |
| Trust | This supplier keeps the promises it makes (CRT_1). | 0.876 | 0.922 | 0.941 | 0.763 | Yes |
| | This supplier is genuinely concerned that we succeed (CRT_2). | 0.900 | | | | |
| | This supplier considers our welfare as well as its own. (CRT_3). | 0.836 | | | | |
| | We believe the information this supplier provide us (CRT_4). | 0.898 | | | | |
| | We trust this supplier keeps our best interests in mind (CRT_5). | 0.854 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Communication | This supplier keeps us informed of new developments (CRC_1). | 0.828 | 0.799 | 0.867 | 0.623 | Yes |
| | This supplier's sales personnel frequently visit our place of business (CRC_2). | 0.620 | | | | |
| | This supplier devotes a lot of time in getting to know our staff (CRC_3). | 0.827 | | | | |
| | This supplier gives us opportunities to participate in goal setting to enhance performance (CRC_4). | 0.858 | | | | |
| Collaborative Advantage | | | 0.910 | 0.924 | 0.506 | |
| Performance Efficiency | My firm with SC partners meet agreed upon unit costs in comparison with industry norms (CAPE_1) | 0.799 | 0.856 | 0.903 | 0.700 | Yes |
| | My firm with SC partners meet productivity standards in comparison with industry norms (CAPE_2) | 0.897 | | | | |
| | My firm with SC partners meet on-time delivery requirements in comparison with industry norms (CAPE_3) | 0.822 | | | | |
| | My firm with SC partners t inventory requirements (finished goods) in comparison with industry (CAPE_4) | 0.826 | | | | |
| Offering Flexibility | My firm with SC partners offer a variety of product and services efficiently in comparison with industry norms (CAOF_1) | 0.852 | 0.870 | 0.911 | 0.719 | Yes |
| | My firm with SC partners offer customized products and services with different features quickly in comparison with industry norms (CAOF_2) | 0.855 | | | | |
| | My firm with SC partners meet different customer volume requirements efficiently in comparison with industry norms (CAOF_3) | 0.848 | | | | |
| | My firm with SC partners have good responsiveness in comparison with industry norms (CAOF_4) | 0.846 | | | | |
| Innovation | My firm and SC partners introduce new products and services to market quickly (CAI_1) | 0.897 | 0.870 | 0.911 | 0.719 | Yes |
| | My firm and SC partners have rapid new product development (CAI_2) | 0.878 | | | | |
| | My firm and SC partners have time-to-market lower than industry average (CAI_3) | 0.782 | | | | |
| | My firm and SC partners innovate frequently (CAI_4) | 0.831 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Relational outcomes | | | 0.927 | 0.937 | 0.500 | |
| Satisfied with the Relationship | My firm is satisfied with this relationship in terms of: Coordination of activities (ROREL_1) | 0.883 | 0.914 | 0.940 | 0.796 | Yes |
| | My firm is satisfied with this relationship in terms of: Participation in decision making (ROREL_2) | 0.900 | | | | |
| | My firm is satisfied with this relationship in terms of: Level of commitment (ROREL_3) | 0.919 | | | | |
| | My firm is satisfied with this relationship in terms of Level of information sharing (ROREL_4) | 0.866 | | | | |
| Satisfaction with the Results | My firm is satisfied with this relationship in terms of: Profitability (RORES_1) | 0.856 | 0.867 | 0.918 | 0.790 | Yes |
| | My firm is satisfied with this relationship in terms of: Market share (RORES_2) | 0.904 | | | | |
| | My firm is satisfied with this relationship in terms of: Sales growth (RORES_3) | 0.905 | | | | |
| Performance | This relationship has Reduced our order cycle times (ROP_1) | 0.792 | 0.892 | 0.914 | 0.573 | Yes |
| | This relationship has Improved our order processing accuracy (ROP_2) | 0.821 | | | | |
| | This relationship has Improved our on-time delivery (ROP_3) | 0.806 | | | | |
| | This relationship has Increased our forecast accuracy (ROP_4) | 0.703 | | | | |
| | This relationship has Reduced our inventory (ROP_5) | 0.710 | | | | |
| | This relationship has Achieved cost reductions (ROP_6) | 0.654 | | | | |
| | This relationship has Improved our fill rate (ROP_7) | 0.844 | | | | |
| | This relationship has Increased our profitability (ROP_8) | 0.704 | | | | |

## Evaluation of Structural Model

After confirming the reliability and validity of the construct measures, the next step addresses the assessment of the structural model results. This involves examining the predictive capabilities and the relationships between the constructs by assessing the structural model for collinearity issues, significance and relevance of path coefficients, level of R squared values, effect sizes f squared and predictive relevance Q squared and the q squared effect sizes (Hair, et al., 2013).

Tolerance, "the amount of variance of one indicator not explained by the other indicators in the same block"(Hair, et al., 2013, p. 124), assesses the level of collinearity. To address this, this research uses the variance inflation factor (VIF), a related measure of collinearity defined as the reciprocal of tolerance (Hair, et al., 2013; Hair, et al., 2011). Appendix E exhibit VIF results. Collaborative relationships trust (CRT_6=6.289) and satisfaction with the relationship (ROREL_3=5.461 and ROREL_5= 5.043) items, have a VIF of 5 or higher respectively which may indicate a collinearity problem (Hair, et al., 2013; Hair, et al., 2011). In looking at how to address this concern, solely removing CRT_6 indicator from trust showed a minimum impact on Cronbach's α, composite reliability and AVE, but did not improve all VIF values. Then, we considered removing ROREL_3 from satisfaction with the relationship, but that decreased the AVE of relational outcomes below the 0.5 threshold. On the other hand, removing CRT_6 and ROREL_5 decreased all VIF values below 5 and maintained the relational outcomes' AVE to exactly 0.5. Thus, by removing CRT_6 and ROREL_5, we did not affect construct content, but controlled collinearity according to VIF recommendations (Hair, et al., 2013; Hair, et al., 2011).

*Structural Model Path Coefficients*

After running the PLS-SEM algorithm, estimates are obtained for the structural model relationships that represent the hypothesized relationships among the constructs. Instead of applying goodness of fit, the structural model in PLS-SEM is assessed in terms of how well it predicts the endogenous variables/constructs (Hair, Sarstedt, Pieper, & Ringle, 2012; Rigdon, 2012). The criteria for assessing the structural model in PLS-SEM includes check for collinearity issues (VIF), significance and relevance of the relationships, level of $R^2$, effect sizes $f^2$, and predictive relevance $Q^2$ and the $q^2$ effect sizes. Since collinearity was indicated (VIF above 5.00) according to VIF recommendation the indicators CRT_6 and ROREL_5 were removed without affecting construct content and reliability of the measures.

After running the PLS-SEM algorithm, path coefficients are calculated and assigned standardized values between -1 and +1 representing strong positive relationship (and vice versa for negative values); the closer the coefficients to 0 the weaker the relationship. The standard error is calculated to obtain the empirical *t* value and compare it to the critical value to determine the significance of the coefficient at a certain error probability. Commonly used critical values are 1.65 for 10% significance level, 1.96 for 5% significance level and 2.57 for 1% significance level .

## Test of Hypothesis

**Hypothesis 1** examined the direct relationship between collaborative relationships and collaborative advantage. The results of the research confirm previous finding on the literature

demonstrating that collaborative relationship produce positive outcomes for organizations. This research shows that collaborative advantage is significantly affected by collaborative relationships. The path coefficient (P) .759 and t-score of 13.781 at a 0.05 level of confidence. This leads to the acceptance of the first hypothesis, which states that collaborative advantage is directly related to collaborative relationships. The results of this study add to the collaboration literature by showing a positive association between collaborative relationships and collaborative advantage not previously examined in the collaboration literature.

**Hypothesis 2** looked at a direct relationship between collaborative relationship and relational outcomes. The path coefficient of 0.758 and t-score of 14.911 indicated a statistically positive relationship. This research shows that relational outcomes are significantly affected by collaborative relationships. The results of this study confirm the result found on the collaboration literature that collaborative relationships offer worthwhile benefits to both buyers and suppliers (Nyaga, et al., 2010). This relationship has significant p values (the probability of erroneously rejecting the null hypothesis) indicating that the path relationships from collaborative relationship to relational outcomes with their corresponding values are significant. In other words, this research demonstrated a positive association between collaborative relationships and relational outcomes.

The most commonly used measure to evaluate the structural model is the coefficient of determination. The coefficient of determination ($R^2$ value) measures the model's predictive accuracy and it is calculated as the squared correlation between the specific endogenous construct's actual and predicted values (Hair, et al., 2013). $R^2$ in collaborative advantage for the structural model was 57.6% and for relational outcomes $R^2$ of 57.5%. Higher $R^2$ represents

higher predictive accuracy. The $R^2$ on this research can be considered moderate (Hair, et al., 2011; Henseler, Ringle, & Sinkovics, 2009).

Figure 6 shows a summary of hypothesis 1 and 2 testing results, including: path coefficients, *t* values higher than theoretical *t* value of 1.96 for a 5% probability of error, and coefficient of determination ($R^2$ value) (Hair, et al., 2013). Significant *p* values indicate that the path relationships (original sample) are significant at a 5% probability error. All the path coefficients from the relationships in this model are significant. "$R^2$ values of 0.75, 0.50, or 0.25 for endogenous latent variables can be respectively described as substantial, moderate, or weak (Hair, et al., 2011; Henseler, et al., 2009). The $R^2$ results in this study for all the first and second order factors displayed in the model represent both moderate and substantial predictive accuracy.

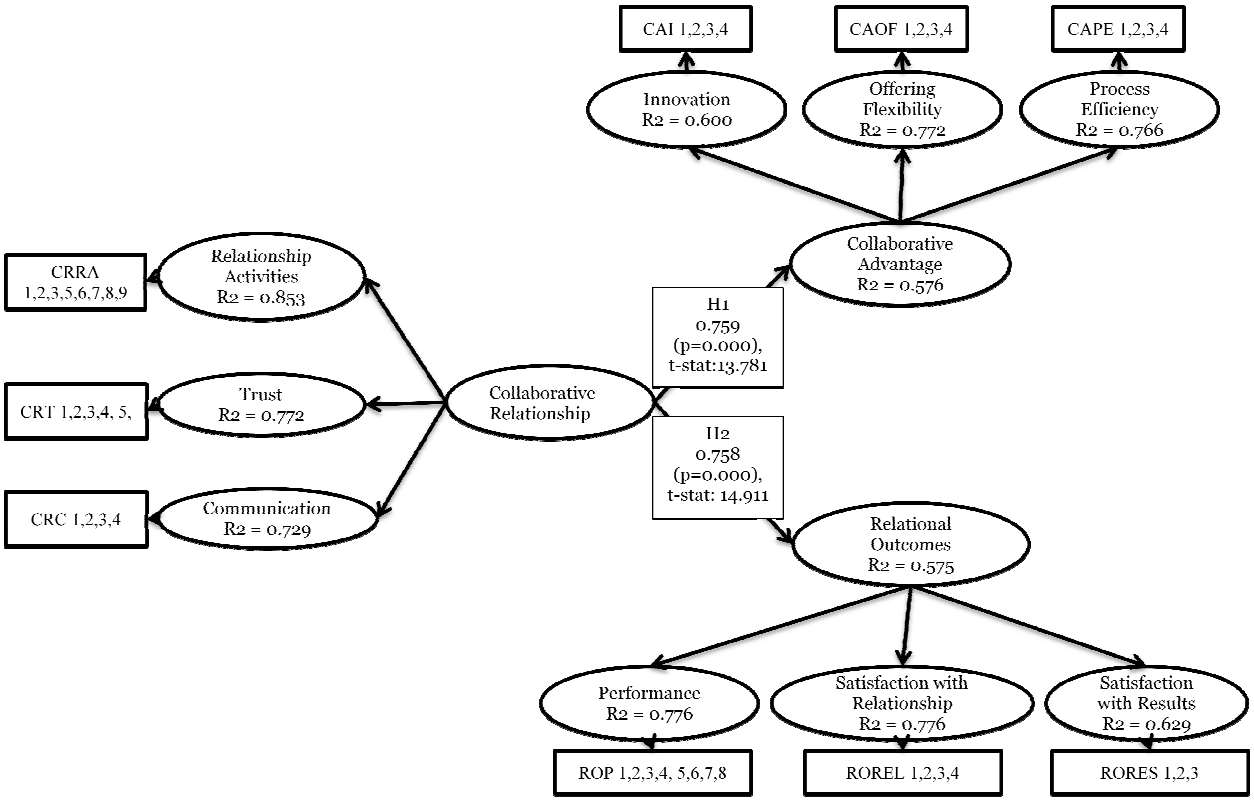


**Figure 6. Structural Model Results**

In addition to evaluating the $R^2$ values of the endogenous constructs, the research used the Stone-Geisser's $Q^2$ value (Geisser, 1974; Stone, 1974) to measure the model's predictive relevance. The research used blindfolding procedure for the reflective endogenous latent variables to indicate the path model's predictive relevance for each construct. The $Q^2$ values estimated by blindfolding procedure represent how well the path model can predict the originally observed values. The model showed $Q^2$ values of 0.284 for collaborative advantage and 0.275 for relational outcomes suggesting that the model has predictive relevance (Hair, et al., 2013).

Predictive accuracy (*f* squared effect size) and predictive relevance (q squared effect size) cannot be computed in this research as there are no predecessor constructs (Hair, et al., 2013). There is no $R^2$ value change because there is no additional constructs preceding collaborative advantage and/or relational outcomes.

*The Moderating Effect of Cloud Computing*

This research investigates if the use of cloud computing enhances collaboration across the supply chain. The cloud benefits of enhanced information processing, increased information sharing and greater utilization of computer resources may impact collaboration (Benlian & Hess, 2011; Iyer & Henderson, 2010; Marston, et al., 2011; Parmigiani, et al., 2011). The moderating effect of cloud computing was examined as part of the research hypothesis.

Partial Least Squares-Multiple Group Analysis: Hypotheses 3a and 3b

**Hypothesis 3a** examines the degree to which cloud computing moderates the association between collaborative relationships and relational outcomes. This hypothesis was tested through multi-group analysis (Hair et al. 2013) to examine whether the effects of collaborative relationships are moderated by the use of cloud computing. The parameter of interest (path coefficients) was used to compare the results between the organizations that use cloud computing versus the ones that does not use cloud. Keil et al (2000) proposed a modified version of a two-independent-samples test (Mooi &Sarsterdt. 2011) to compare path coefficients across two groups of data. Using the parametric approach PLS-MGA provided by Hair et al.(2013) to calculate *t* values and *p* values using path coefficients and standard errors of cloud computing users and cloud computing non- users for each of the relationships. The computing on

collaborative relationships and relational outcomes from the test for equality of standard error 0.000 is lower than 0.05 which implies that the sample assumes unequal standard errors. The resulting *t* value is 1.485 which yields a *p* value of 0.143, thus indicating no significant difference in the effect of collaborative relationships and relational outcomes between cloud computing users and non-users. Thus, hypothesis 3a is not supported.

**Hypothesis 3b** examines the degree to which cloud computing moderates the association between collaborative relationships and collaborative advantage. In the association collaborative relationships and collaborative advantage the resulting test from the test for equality of standard error 0.914 is higher than 0.05 and lower than 0.95,which implies that the sample assumes equal standard errors. The resulting *t* value is 0.297 which yields a *p* value of 0.767, thus indicating that there is no significant difference in the effect of collaborative relationships and collaborative advantage between cloud computing users and non-users. Hypothesis 3b is not supported.

Table 24 show s the results of the parametric approach PLS-MGA provided by Hair et al.(2013) to calculate t values and p values using path coefficients and standard errors of cloud computing users and cloud computing non- users for each of the relationships.

**Table 24. Cloud Computing Moderation Using PLS-MGA**

| Hypothesis 3a &3b | Used cloud computing n=41 | | | Do not use cloud computing n=50 | | | *t*-test | *p*-value |
|---|---|---|---|---|---|---|---|---|
| | Path coefficient | S.E. | T stat | Path coefficient | S.E. | T stat | | |
| **H3a** CR-RO | 0.666 | 0.102 | 6.536 | 0.832 | 0.049 | 17.109 | 1.485 | 0.143 |
| **H3b** CR-CA | 0.756 | 0.078 | 9.694 | 0.791 | 0.087 | 9.121 | 0.297 | 0.767 |

Regression Analysis: Hypotheses 3a and 3b

Moderation implied an interaction effect, where introducing the moderating variable cloud computing use, causes magnitude change of the relationship between collaborative relationships and collaborative advantage, as well as, collaborative relationships and relational outcomes should occur. Because, the parametric approach PLS-MGA did not find significant differences in the effect of the predictor, the moderating effects were also tested through regression. The second order latent variable scores generated by Smart PLS were averaged to obtain an approximate score for each of the latent variables: collaborative relationships (MCR), collaborative advantage (MCA) and relationship outcome (MRO). The cloud computing use (CCU) categorical variable was dummy coded 1=cloud computing users and 0=non-cloud computing users and manually created product terms for the predictor, collaborative relationships, and the moderator variable cloud computing use MCRCCU.

In this study, a regression analysis was done first to predict relational outcomes(MRO) from cloud computing use (CCU) and the interaction between collaborative relationships and cloud computing use (MCRCCU). The overall regression was statistically significant and explained a moderate portion of the variance in collaborative advantage, R=.587, adjusted $R^2$=.572, F(3,86)=40.705, p<.001. The raw score regression coefficient for this product term was $b$ = .049, with $t$=.349, $p$=.728. There was not a statistically significant interaction in these relationships. Again, this result is similar to the outcome obtained through PLS-MGA analysis confirming that cloud computing does not strengthen the association between collaborative relationships and relational outcomes. Consequently, Hypothesis 3a was not supported.

The regression analysis procedure was then repeated to predict collaborative advantage (MCA) from cloud computing use (CCU) and the interaction between collaborative relationships and cloud computing use (MCRCCU). The inclusion of MCRCCU product term makes it possible to assess whether MCA from MCR differ significantly between the users and non-users of cloud computing. The overall regression was statistically significant and explained a moderate portion of the variance in collaborative advantage, R=.567, adjusted $R^2$=.552, F(3,86)=37.546, p<.001. The raw score regression coefficient for this product term was *b* = .143, with *t*=.967, *p*=.336.There was not a statistically significant interaction in these relationships. This result confirms the PLS-MGA analysis previously completed and confirms that cloud computing does not strengthen the association between collaborative relationships and collaborative advantage. Consequently, Hypothesis 3b was not supported.

Independent Sample *t* Test Analysis for Hypotheses 3a and 3b

This inferential statistic is calculated on SPSS to identify statistically significant differences between two categories of respondents: cloud computing users and nonusers. This test found significant differences between cloud computing users and nonusers in the collaborative relationships (MCR) p =.031. Other variables that showed significant differences include collaborative relationships trust (MCRT) p=.035, collaborative relationships communication (MCRC) p=.022 (See Appendix E). Consequently, this results show that collaborative relationships may be stronger for users of cloud computing when compared to nonusers.

Table 25 shows the mean of the perceived scores for collaborative relationships, collaborative advantage and relational outcomes (where 7 is the highest and 1 the lowest value).

The results show higher mean scores for firms using cloud computing. The product terms collaborative relationships and collaborative advantage (MCRMCA) was also significant p=.061, as well as the product term collaborative relationships and relational outcomes (MCRMRO) p=.099. The independent t test results show important differences among users and nonusers of cloud computing. Considering that cloud computing technology in logistics is still at an early stage of implementation and according to other studies early implementation stages might cause the differences in significant test results (Chan, et al., 2012), this result show a that logistics managers perceive cloud computing may benefits overall collaborative relationships among organizations.

**Table 255. Mean Scores by Firm**

| Variables | Cloud computing | Number of firms | Mean scores |
|---|---|---|---|
| Collaborative relationships | Using | 41 | 5.5423 |
| | Not using | 49 | 5.1026 |
| Collaborative Advantage | Using | 41 | 5.2439 |
| | Not using | 49 | 4.9983 |
| Relational Outcomes | Using | 41 | 5.1663 |
| | Not using | 49 | 4.9909 |

<u>Partial Least Squares-Multiple Group Analysis: Hypotheses 4a and 4b</u>

In Chapter 2, the review of the literature suggested that firm size may have a significant moderating effect. Because cloud computing allow organizations to start small and increase hardware resources when there is an increase in their needs (Armbrust, et al., 2010), or acquire resources that otherwise would be difficult to acquire (Low, et al., 2011). This research investigates the effect that firm size has in the outcomes (i.e., collaborative advantage and

relational outcomes) of collaborative relationships between organizations using cloud computing and not using cloud computing.

This study classified small and large organizations by firm size, expressed in number of employees, according to the United States Small Business Authority (SBA) size standards(SBA, 2014). Table 26 shows a comparison of larger (1001+ employees) and smaller (1000- employees), of organizations using and not using cloud computing. The table shows that 54% of small organizations is using cloud computing an 47% of small organizations is not using cloud computing. Also, 46% of large organization is using cloud computing and 53% is not using cloud computing .

**Table 266. Cloud Use by Firm Size**

| Firm size | Use Cloud Computing | Not Use Cloud Computing |
|---|---|---|
| 1-1000 employees | 22 | 23 |
| 1001+ employees | 19 | 26 |
| Total | 41 | 49 |
| Percent large org | 46% | 53% |
| Percent small org | 54% | 47% |

**Hypothesis 4a** investigates if for small firms the impact of cloud computing on the association between collaborative relationship and relational outcomes is be stronger than for large firms. Using the parametric approach PLS-MGA provided by Hair et al. (2013) to calculate *t* values and *p* values using path coefficients and standard errors of cloud computing users and cloud computing non- users for each of the relationships. In small organizations, investigating the association between collaborative relationships and relational outcomes, the test for equality of standard error 0.981 is higher than 0.95 which implies that the sample assumes

unequal standard errors. The resulting *t* value is 0.327 which yields a *p* value of 0.745, thus indicating that there is no significant difference in the effect of collaborative relationships and relational outcomes between cloud computing users and non-users in small organizations. For large organizations, the association: collaborative relationships and relational outcomes using the test for equality of standard error 0.000 is lower than 0.05 which implies that the sample assumes unequal standard errors. The resulting *t* value is 2.493 which yields a *p* value of 0.022, thus indicating that there is a significant difference in the effect of collaborative relationships and relational outcomes between cloud computing users and non-users in large organizations (Hair et al. 2013 PLS-MGA). Consequently, hypothesis 4a is not supported. The use of cloud computing in large organizations shows significant differences in the association between collaborative relationships and relational outcomes between users and non users of cloud computing technology.

**Hypothesis 4b** estimated that for small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms. PLS-MGA (Hair, et al., 2013) evaluated the association of collaborative relationships and collaborative advantage. For small organizations, the resulting *t* value was 0.164 which yield a *p* value of 0.871, thus indicating that there is no significant difference in the effect of collaborative relationships and collaborative advantage between cloud computing users and non-users in small organizations. For large organizations, the association: collaborative relationships and collaborative advantage using PLS-MGA resulted a *t* value of 0.110 which yields a *p* value of 0.913, thus indicating that there no significant difference in the effect of collaborative relationships and collaborative advantage between cloud computing users and non-users of large organizations. As a result, hypothesis 4b is not supported. The use of cloud

computing does not shows differences in the association between collaborative relationships and collaborative advantage for either small or large organizations using and not using cloud computing. Table 27 summarizes hypothesis 4a and 4b PLS-MGA test results.

**Table 27. PLS-MGA Results for Small and Large Firms**

| Hypothesis 4a | Used cloud computing<br>Small n=19 -- Large n=22 | | | Do not use cloud computing<br>Small n=26 -- Large n=23 | | | *t*-test | *p* value |
|---|---|---|---|---|---|---|---|---|
| | Path coefficient | S.E. | T stat | Path coefficient | S.E. | T stat | | |
| Small CR-RO | 0.872 | 0.121 | 7.222 | 0.806 | 0.167 | 4.820 | 0.327 | 0.745 |
| Large CR-RO | 0.543 | 0.146 | 3.723 | 0.906 | 0.030 | 30.577 | 2.493 | 0.022 |
| Hypothesis 4b | Used cloud computing<br>Small n=19 -- Large n=22 | | | Do not use cloud computing<br>Small n=26 -- Large n=23 | | | *t*-test | *p* value |
| | Path coefficient | S.E. | T stat | Path coefficient | S.E. | T stat | | |
| Small CR-CA | 0.780 | 0.082 | 9.500 | 0.741 | 0.229 | 3.238 | 0.164 | 0.871 |
| Large CR-CA | 0.704 | 1.124 | 5.670 | 0.826 | 0.117 | 7.070 | 0.110 | 0.913 |

Regression Analysis: Hypotheses 4a and 4b

Introducing the moderating variable firm size, a magnitude change of the relationship between collaborative relationships and collaborative advantage, as well as, collaborative relationships and relational outcomes should occur for firms using and not using cloud computing. Because, the parametric approach PLS-MGA confounding results in the effect of the predictor, the moderating effects were also tested through regression. The samples was divided

in small and large firms. The categorical variable cloud computing use before dummy coded 1=small firms and 0=large firms and manually created product terms for the predictor, collaborative relationships (MCR), and the moderator variable cloud computing use (CC_USE).

For small firms, first, regression used to predict relational outcomes(MRO) by cloud computing use (CC_USE) and the interaction between collaborative use cloud computing (MCRCCU). The results explain a moderate portion of the variance in relational outcomes R=.663, adjusted $R^2$=.638, F(3,41)=26.887, p<.001. Collaborative relationship had a significant effect on relational outcomes, with b=.699, t=5.604, p<.001. The effect of cloud computing use was somewhat statistically significant b=-1.842, t=-1.784 p=.082. The interaction between collaborative relationships and cloud computing use was not statistically significant, with b=.305, t=1.599, p=.117. The results shows that for small firms in terms of collaborative relationships the use of cloud computing does not have a significant effect on relational outcomes, as a result hypothesis 4a is not supported.

Then, the regression analysis repeated to predict differences in collaborative advantage (MCA) by cloud computing use (CC_USE) and the interaction between collaborative relationships and cloud computing use (MCRCCU) in small firms. The overall regression was statistically significant and explained a moderate portion of the variance in collaborative advantage, R=.566, adjusted $R^2$=.535, F(3,41)=17.859, p<.001. Collaborative relationship had a significant effect on collaborative advantage, with an unstandardized slope b=.623, t=4.076, p<.001. Cloud computing use had a significant effect on collaborative advantage, with b=-2.714, t=-2.147 p=.038. The interaction between collaborative relationships and cloud computing use was somewhat statistically significant, with b=.450, t=1.927, p=.061. The results show that

small firms using cloud computing had significant effect on collaborative advantage for organizations using cloud computing, somewhat supporting hypothesis 4b.

Then, the procedure previously described was repeated to evaluate differences in large organizations using and not using cloud computing. First, in order to predict relational outcomes(MRO) by cloud computing use (CC_USE) and the interaction between collaborative relationships and cloud computing use (MCRCCU) for large organizations. The overall regression was statistically significant and explained a moderate portion of the variance in relational outcomes, R=.548, adjusted $R^2$=.515, F(3,41)=16.576, p<.001. Only collaborative relationships had a significant effect on relational outcomes, with b=.782, t=5.783, p=.001. The effect of cloud computing use was not statistically significant b=.764, t=.671 p=.506. The interaction between collaborative relationships and cloud computing use was not statistically significant, with b=-.163, t=.783, p=.438. The results shows that for large firms in terms of collaborative relationships the use of cloud computing does not have a significant effect on relational outcomes. These results partially support hypothesis 4a.

Then, the regression analysis repeated to predict differences in collaborative advantage (MCA) by cloud computing use (CC_USE) and the interaction between collaborative relationships and cloud computing use (MCRCCU) in large firms. The overall regression was statistically significant and explained a moderate portion of the variance in collaborative advantage, R=.631, adjusted $R^2$=.604, F(3,41)=23.395, p<.001. Collaborative relationship had a significant effect on collaborative advantage, with an unstandardized slope b=.771, t=6.484, p<.001. Cloud computing use did not have a significant effect on collaborative advantage, with b=.749, t=-.748 p=.458. The interaction between collaborative relationships and cloud

computing use was not statistically significant, with b=-.117, t=-.638, p=.527. The results show that cloud computing use among large organizations does not have a significant effect on collaborative advantage. The results support hypothesis 4b.

In summary, the regression analyses of small and large organizations show that collaborative relationships have a strong impact on both collaborative advantage and relational outcomes. Cloud computing use only shows significant differences for small organizations in collaborative advantage results. This result somewhat supports hypothesis 4b that states that for small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms.

Independent Sample *t* Test Analysis for Hypotheses 4a and 4b

In order to corroborate the results of the PLS-MGA analysis this research used independent samples t-test. This inferential statistic is calculated on SPSS to identify statistically significant differences between two categories of respondents: cloud computing users and nonusers for large and small organizations. For large organizations only collaborative relationships trust (MCRT) shows a significant difference (p =.051) among cloud computer user and non users. No other relationship showed significant differences (See Appendix F). For small organizations the independent samples t-test only shows a significant difference (p =.012) for firms using cloud computing and firms not using cloud computing on their collaborative relationships communication (MCC). The other relationships do not show significant differences (See Appendix G). Consequently, we corroborate the results obtained through PLS-MGA analysis, hypothesis 4a and 4b are not supported.

To summarize, this chapter reported the characteristics of the sample population used in the study and presented the data collected in the survey. The empirical examination of the research model reflected the impact of collaborative relationships in collaborative advantage, relational outcomes, cloud computing use, and size. The goal was to determine whether this variable produce advantages and positive outcomes from working relationships among organizations. Five research questions represented the possible interactions of those variables, culminating in six hypotheses. Upon testing the model SmartPLS 3 and examining the data collected via online survey the research model lacked discriminant validity until the indicators CRRA_4, CRT_6 and ROREL_3 as well as business synergy and quality subcomponents of collaborative advantage were removed to meet the required validity and reliability conditions of the constructs without affecting its content. Three of the six hypotheses were supported as recapped in Table 28.

**Table 28. Summary of Hypotheses Results**

| **Hypothesis** | | **Results of Testing** |
|---|---|---|
| $H_1$ | Strong collaborative relationships lead to increased collaborative advantage. | Supported |
| $H_2$ | Strong collaborative relationships lead to increased relational outcomes. | Supported |
| $H_{3a}$ | Cloud computing positively moderates the association between collaborative relationship and relational outcomes. | Not supported |
| $H_{3b}$ | Cloud computing positively moderates the association between collaborative relationship and collaborative advantage. | Not supported |
| $H_{4a}$ | For small firms the impact of cloud computing on the association between collaborative relationship and relational outcomes will be stronger than for large firms. | Not supported |
| $H_{4b}$ | For small firms the impact of cloud computing on the association between collaborative relationship and collaborative advantage will be stronger than for large firms. | Partially Supported |

Testing the model, indicates that collaborative relationships is positively associated to collaborative advantage and relational outcomes. First, the association between collaborative

relationships and collaborative advantage has not been previously tested in the literature. This result extends the collaboration literature to show that strengthening the collaborative relationships with other firms results in stronger collaborative advantages for firms that otherwise wouldn't achieve acting alone. Second, the association between collaborative relationships and relational outcomes evaluates a latent construct collaborative relationships and shows economic, non economic, and operational results from the investment in collaborative relationships. The results confirm that collaborative relationships have strong impact in both collaborative advantage and relational outcomes. Third, the use of cloud computing technology did not strengthen the relationships between collaborative relationships and relational outcomes (H3a), and collaborative relationships and collaborative advantage (H3b); hypothesis 3a and 3b were not supported. Fourth, the PLS-MGA, regression and independent t test results of the impact of cloud computing by firm size differ. Regression analysis shows some significant results in the association of collaborative relationships and collaborative advantage for small organizations using cloud computing; the other tests do not show significant values. According to the regression analysis results, small organizations using cloud computing may have stronger association between collaborative relationships and collaborative advantage, partially supporting H4b. Moreover, hypothesis, 4a was not supported and showed a conflicting result in the association between collaborative relationships and relational outcomes. Only, the PLS-MGA analysis showed that large firms may have significant differences when compared to small firms using cloud computing.

Logistics managers of organizations using cloud computing may have perceived a positive impact of cloud computing technology on the relationships investigated. Logistics managers from organizations using cloud computing provided higher scores to the collaborative

advantage and relational outcomes indicators compared to the scores that logistics managers of organizations not using cloud gave to the same indicators. Cloud computing technology in logistics is still at an early stage of implementation, further study of its collaborative capabilities should be sought-after. A more extensive discussion of the meaning of these findings will be discussed in the Chapter Five.

# CHAPTER 5

# DISCUSSION, CONCLUSION AND RECOMMENDATIONS

Chapter Five starts with an introduction that summarizes Chapters 1 to 3 including the motivation for this research, the research purpose addressing the gaps in the literature, the theoretical lenses used in this study, and the research methodology applied. This is followed by a discussion of the key findings presented in Chapter Four, tied back to the research questions. It also identifies the research's contribution to the field of knowledge, the theoretical and practical implications of findings. The chapter concludes by outlining the limitations of the study and proposes several areas for future research.

## Introduction

At present, businesses do not compete alone; entities develop multiple relations with organizations - these constitute a supply chain. The changing competitive environment requires more effective collaboration to improve value and reduce costs. The literature to date has identified collaboration as a way to promote distinctive relational advantage, superior productivity and satisfaction(Whipple, et al., 2010). High-level collaboration is valuable but not often viable, as it requires developing collaborative improvements that allow entities to achieve sustained advantage and performance (Allred, et al., 2011). Collaborative investments and behaviors across the supply chain provide support for organizations to achieve goals and objectives. This study illustrates the outcomes that organizations obtain from their investment in collaborative relationships and their investment in cloud computing technology.

Developing collaborative relationships have been identified as an important element for business operations as coordinated buyers- suppliers' operations can provide operational and strategic benefits (Sanders, 2008). Literature found that buyer- supplier relationship improvement was a major contributor of buyer competitive advantage (Li, Humphreys, Yeung, & Cheng, 2012a). This study examined the collaborative advantages that investing in collaborative relationships provide and what relational outcomes are enhanced by collaborative relationships. While much investigation has been done in supply chain collaboration there is still more to examine and understand within the topic (Daugherty, 2011). This study was designed to address the need for quantitative research linking collaborative relationships to collaborative advantage and/or relational outcomes.

This research also investigate the collaborative advantage and relational outcomes that the investment in cloud computing technology provides to organizations, and compared those not using cloud computing with those that are. Investments in information technologies make their greatest contribution when they enable collaboration (Fawcett, et al., 2011). Cloud computing research has increased in the past few years providing a better understanding of the design and research directions of this area. According to McCrea (2012) cloud computing will lead to new forms of collaboration that couldn't be developed with traditional solutions in traditional architectures. This study extends current cloud computing research, relating those technologies to collaborative relationships. Specifically, this research examines the logistics managers' perception of cloud computing use enhancing the collaborative advantage and relational outcomes perceived from collaborative relationships. It also evaluates the outcomes among small and large organizations using and not using cloud computing.

This study is grounded in three theories particularly relevant to underpinning a study of inter-organizational relationships in a technical environment. As such it builds on the relational view (Dyer & Singh, 1998), that states that firms working together may produce rare, valuable, inimitable and/or non-substitutable resources. By asking logistics managers about their perception of suppliers or customers behaviors and relational ties, the researcher investigated whether inter-firm relationships generate collaborative advantage and relational outcomes. The Transaction Cost Economics (Williamson, 1981, 1989) proposes that organizations need to consider the cost of transactions and investment in specific assets for exchange. The investment in cloud computing technology lowers the cost of accessing computer-intense business analytics enabling organizations to collaborate, share information and work across organizational boundaries. Finally, the Task-Technology Fit theory (Goodhue & Thompson, 1995) suggests that technology use and performance benefits results when the characteristics of the technology complement the tasks that should be performed. The implementation of cloud computing provides a competitive advantage if organizations have their business goals and expectations aligned.

This study was operationalized through an online survey quantitative approach to gain generalizable results from a sample of logistics professionals members of the Council of Supply Chain Management Professionals (CSCMP). The respondents were asked about collaborative relationships, collaborative advantage, relational outcomes and the use of cloud computing for supply chain operations. The web survey was developed from previously validated scales and the data was collected over a two month period. A total of 104 responses were received from small and large organizations expressed in number of employees. Gross income for the majority of firms in the survey was over a million dollars. These respondents represented a diversified

sample mix of experienced logistics professional s (i.e., directors, managers, supervisors) whose responses are most likely typical of average business individuals in the United States. The data did not show a non-response bias from the two sample mean difference test performed between early respondents and late respondents (Armstrong & Overton, 1977). The study applied PLS-SEM methodology in order to evaluate the hypothesized relationships. PLS-SEM was the appropriate multivariate approach for this study with a complex structural model with multi-dimensions (Hair, et al., 2011). The systemic evaluation of the PLS-SEM results demonstrated acceptable reliability and validity measures. Regression analysis and independent t test were also utilized to evaluate the hypothesized. moderating effects. Regression is used to determine whether the relationship between two variables depend on a third variable. Independent t tests is used to examine differences between two groups of respondents. Key findings from the structural model evaluation are discussed next.

## Discussion of the findings

After confirming the reliability and validity of the construct measures, the structural model examined the predictive capabilities and the relationships between the constructs. The empirical examination of the research model reflected the impact of collaborative relationships in collaborative advantage and relational outcomes. The goal was to determine the advantages and positive outcomes from working relationships among organizations and the impact of cloud computing technology on the strength of the outcomes. Five research questions represented the possible interactions of collaborative relationships, collaborative advantage, relational outcomes, cloud computing use and size:

**RQ 1.** What is the perception of logistics managers of the impact of collaborative relationships on collaborative advantage?

**RQ 2.** What is the perception of logistics managers of impact of collaborative relationships on relational outcomes?

**RQ 3.** Do logistics managers perceive that the use of cloud computing moderates the relationship between a collaborative relationship and collaborative advantage?

**RQ 4.** Do logistics managers perceive that the use of cloud computing moderates the relationship between collaborative relationship and relational outcomes?

**RQ 5.** Do logistics managers perceive that the impact of cloud computing is different for small enterprises and large organizations?

These research questions culminated in six hypotheses that are explained below.

Hypothesis 1

Organizations develop collaborative relationships as they aim to improve their operations and gain advantage over other organizations working alone. The first hypothesis examined the effect of collaborative relationships on collaborative advantage. The relational view of the firm states that advantages can be created from relation-specific assets, knowledge sharing, combination of resources and effective governance (Dyer & Singh, 1998). A collaborative relationship is defined as "a relationship where participants cooperate, share information and work together to plan and modify their business practices to improve joint performance" (Whipple, et al., 2010, p. 507). Collaborative advantages are seen because parties in the supply chain cooperate. The literature affirmed that firms cannot compete successfully in isolation, they need to collaborate with other firms in the supply chain (Min, et al., 2005).

The research results supported hypothesis 1: collaborative relationships enhances collaborative advantage. The study showed that good relational activities, trust and communication with their partners allowed organizations to improve their process efficiency, innovation and flexibility of their offerings. Firms that have strong collaborative relationships work together to introduce new processes, products and services, are cost competitive among their primary competitors, and are able to support changes in product or service offerings when they face environmental changes. Closer collaborative relationships with suppliers may strengthen competitive advantages(Li, Humphreys, Yeung, & Cheng, 2012b). This research shows that closer collaborative relationships strengthen collaborative advantage that focuses on joint value creation from partners working toward common goals and benefits that cannot be achieved acting alone. This is in contrast to competitive advantage that focuses more on appropriate common benefits and private benefits (Lavie, 2006). This research make a contribution to the field by empirically supporting the suggestions in the earlier literature that maintaining good collaborative relationships lead to increased collaborative advantage. Having strong collaborative relationships between supply chain partners generates mutual gains.

Hypothesis 2

Higher levels of collaboration has shown to lead to improvements in operational and relational outcomes (Zacharia, et al., 2009b). Hypothesis 2 investigated the effect of collaborative relationships on relational outcomes. Promoting both parties' cooperative behavior that increases their efficiency and creativity of their actions result in differential performance from the relationship (Sanders, 2008). This research measured relational outcomes in three dimensions: satisfaction with the relationship, satisfaction with the results and performance. The

research supported hypothesis 2: strong collaborative relationships lead to increased relational outcomes. In other words, this study shows that collaborative relationships allow organizations to increase relational outcomes measured by their satisfaction with the relationships, satisfaction with the results of those relationships and the positive operational outcomes resulting from strong collaborative relationships. Collaborative relationships generate demonstrable value to its participants (Cannon & Homburg, 2001), in terms of satisfaction with improved coordination of activities, decision making, commitment, information sharing, management, profitability, market share, sales growth, reduced cycle times, order processing accuracy, on-time delivery, and forecast accuracy. Collaborative relationships have been demonstrated to be effective in enabling firms to interact very closely, develop joint objectives, and gain benefits that could not be achieved by any firm acting alone. This study make a contribution to the field by being one of the first to support the positive association between collaborative relationships and relational outcomes by measure the an intangible variable "collaborative relationships" in tangible outcomes such as performance, satisfaction with the results and satisfaction with the relationship.

Hypothesis 3a and 3b

The effect of cloud computing technology on the association of collaborative relationships, collaborative advantage and relational outcomes had no impact on the corresponding relationships. The research results neither supported hypothesis 3a nor hypothesis 3b. Hypothesis 3a suggested that cloud computing use positively moderates the association between collaborative relationship and relational outcomes. Hypothesis 3b investigated if cloud computing use positively moderates the association between collaborative relationship and collaborative advantage. Although this research did not supported hypothesis 3a or 3b, the

independent sample t-test show significant differences between firms using cloud computing and the ones not using cloud computing in terms of collaborative relationships. Overall, organizations using cloud computing showed important differences in their collaborative relationships, trust and communication. The literature has shown multiple benefits of cloud computing technology, this study demonstrate the positive effect of cloud computing in collaborative relationships. Enterprises that fail to integrate the capabilities of business partners and exploit the new functionalities and favorable economies of cloud services risk competitive disadvantage (Stamas, 2013). The review of the literature also revealed that the notion of cloud is a nascent and emerging topic. As a result, perhaps it is not time yet to evaluate the outcomes of cloud computing use. Researchers believe that cloud use will evolve from operational platforms to business models based on partnerships and collaboration (Stamas, 2013).

Hypothesis 4a and 4b

The use of cloud computing was also evaluated by firm size. First, hypothesis 4a suggested that for small firms the impact of cloud computing use on the association between collaborative relationship and relational outcomes will be stronger than for large firms. This hypothesis was not supported. The results showed a significant result for large organizations using cloud computing in the association between collaborative relationships and relational outcomes. According to this result, logistics managers from large organizations perceived that organizations using cloud computing were generating higher relational outcomes. The relational outcomes included measures of their satisfaction with the relationship with partners, satisfaction with the results from the relationships developed and also economical performance outcomes for their firms. The reason for this opposite result might be that large organizations are reassembling

in partnerships with smaller firms to establish opportunities for value creation (Cherbakov, Galambos, Harishankar, Kalyana, & Rackham, 2005; Iansiti & Clark, 1994; Tapscott, Lowy, & Ticoll, 2000).

Hypothesis 4b proposed that for small firms the impact of cloud computing use on the association between collaborative relationship and collaborative advantage will be stronger than for large firms. This hypothesis was supported. Small and large organizations are starting to see the benefits of using cloud computing. The positive effect in the association between collaborative relationships and collaborative advantage in small organizations, as well as, the positive effect in the association between collaborative relationships and relational outcomes for large firms reveals the benefits of the technology implementation. The newness of the technology and the firms' unwillingness to implement other technologies have been reported previous studies and may impact the results of this study. For example, "the high penetration levels needed for successful use of electronic data interchange (EDI) was held back by the reluctance of small companies to adopt it." (Larson, Carr, & Dhariwal, 2005, p. 20). Small suppliers are concerned that the new technologies means benefits for large organizations and cost for small firms (Morgan, 2000, 2003), because large organizations often force small entities to adopt innovations in information technology without sharing the resultant results (Grossman, 2004).

Cloud computing technology lend itself easier to small firms, because it lowers the cost for smaller firms to access compute-intensive business analytics most of the times obtainable only by large corporations (Belalem, et al., 2011; Marston, et al., 2011). Cloud computing adoption, like any other technology, may have barriers and challenges for small organizations

that need to be able to effectively integrate and manage externally sourced services form different providers and incorporate the services into their IT infrastructure (Feuerlicht & Govardhan, 2009; Huang, Li, Yin, & Zhao, 2013). Currently, cloud offerings have its own way on how users interact, prohibiting users to choose from an alternative vendors simultaneously and integrating cloud services with the organizations' legacy system. Prior research suggests that collaboration with a business partner can help small organizations in sharing complementary resources to improve their operations, but small organizations may have not formally adopted the service-oriented architecture that would make them more flexible, extensible, scalable, and reusable (Dillon, Wu, & Chang, 2010; Zhang & Zhou, 2009).

## Significance and Impact of Research

### *Theoretical Implications*

The previous review of the literature showed that collaborative relationships may provide satisfaction and performance (Whipple, et al., 2010). The purpose of this study was to actually measure the impact of collaborative relationships on relational outcomes and evaluate collaborative advantage achieved from those relationships. The research adopted and explored a cross-disciplinary theoretical perspective, which combined the relational view of the firm, the transaction cost and task-technology theories by evaluating inter-firm relationships and the perceived benefits organizations are developing into their collaborative capabilities. Because the research evaluated logistics managers' perception of collaborative relationships, collaborative advantage, relational outcomes and cloud computing use, the combination of the relational view of the firm, the transaction cost economics and the task-technology theories contributed to the

understanding of multiple relationships in a technical environment. The findings of this study extend our understanding of collaborative relationships and highlighted the collective action and economic dynamics within the logistics discipline. Specifically, focusing on collaboration between organizations that logistics managers perceived are creators of positive relational outcomes and collaborative advantages.

This study also explored whether the use of cloud computing impacts the outcomes of collaborative relationships. In the information systems, management, marketing, and supply chain management literature, there is extensive literature about relationships, collaboration and IT; however, to date supply chain management (SCM) literature has not generally addressed the emerging technology of cloud computing. Little research has focused on understanding the overall collaborative advantage, the strategic benefits gained over competitors as well as the relational outcomes from their association using cloud computing. The task technology fit theory explains why the performance benefits from the use of cloud computing technology are now seen (Goodhue, 2006), the adoption of cloud computing is strengthening the existing collaborative relationships among partners and increasing the collaborative advantages of small firms. This study supports the task technology fit theory as characteristics of cloud computing technology may be complementing the tasks that partnering organizations are performing.

Previous research recommended examination of current buyer-seller collaborative relationships as an important future research topic (Daugherty 2011). Also, there is an extensive current interest in cloud computing research (Ross, 2010). This research provides an insight to the vision of the future enterprise that offers value propositions through a dynamic network of

partners that provide complementary capabilities to enhance firm's process effectiveness, flexibility, innovation, and performance.

*Practical Implications*

Understanding how collaboration impacts firm performance, even if the results of performance are indirect, may lead firms to appreciate collaboration for their outcomes (Fawcett, et al., 2008; Lambert, et al., 1996a). This research allows business practitioners to clearly identify what benefits exists from the collaboration of all parties involved and understand what to expect from successful collaborative relationships. This information aids firms to measure the success of their joint operations with other organizations in terms of collaborative advantages and relational outcomes. Business practitioners may be motivated to provide the proper resources to ensure collaborative relationships that succeed. Firms that developed strong collaborative relationships, brought the resources of diverse members in creative ways that allowed them to obtain benefits over competitors that could not be achieved by any firm acting alone.

Complementary to measuring the outcomes of collaborative relationships, this study showed that when using cloud computing large organizations enhanced their relational outcomes more than small organizations did. Also, demonstrated that small organizations using cloud computing enhance their collaborative advantages. The characteristics of cloud computing seem to be more attractive to small firms due to the low cost and fast deployment of technology. It is important that firms consider how incorporating the technology fits the organizational the structure and goals. It is also important that cloud providers clearly promote the benefits of cloud computer to smaller firms. More research is needed to fully understand the results of this

research. For example, determining the reasons for large organizations using cloud computing to show higher relational outcomes. It may be the case that large organizations using cloud are developing new working relationships with small firms and increasing their relational outcomes.

Successfully managing relationships and collaborating with members enables value creation for organizations (Bowersox, et al., 2000). Collaborative relationships often required greater resource commitment and investments, making difficult for firms to collaborate with every customer or supplier (Lambert et al. 1996a; Whipple et al. 2010). This study illustrates the positive impact of cloud computing has in the firms' collaborative relationships. Because of its characteristics, cloud computing, does not represent a high resource commitment or investment, making it more accessible to all firms. This study contributes information for decision makers to e in making decisions about employing cloud computing to enhance their collaborating efforts. The chapter concludes presenting its limitations and suggestions for future research.

## Study Limitations and Future Research

All research has limitations usually associated with the research method employed. Survey research has been criticized for the lack of precision, control and realism of context (McGrath, 1982). Generalization of the study findings is potentially limited to the study population. Although the researcher approached a convenience sample of logistics professionals based on the entire CSCMP email list, there is always the challenge of "contacting the right person with the right information at the right time in order to ask the right questions using the right instrument for the collection of the right data at the right cost are ongoing concerns"(Larson, 2005, p. 221). Moreover, limited access to informal interactions and personal

correspondence between members does not allow the researchers to perceive the intricacies of the participants' opinions provided to this investigation. Perhaps a multi-method study provides researchers with potential areas of further analysis to better understand the collaborative relationships and its positive benefits. Cloud computing is a fairly new topic, as a result, it could benefit from a grounded theory study, where the relationships emerge from a series of conversations with firms using cloud computing and their collaborative relationships with other firms. In 2013, applications such as customer relationship management CRM has been implemented about 45% in the cloud, compared to warehouse management systems (WMS) were only 8% has been cloud-based WMS sales (Michel, 2014). Cloud adoption in Logistics is pretty nascent today, as a result, it is important to revisit this topic at a later time when cloud computing technology is not so new so we can evaluate its impact on small organizations' performance would be addressed in the multi-method study.

This research also has limitations associated with the collection of its quantitative data; including the low response rate. Although this research followed Dillman 's (2007) survey design recommendations to help maximize response rates. Low response rates is an ongoing concern in conducting surveys (Hager, Wilson, Pollak, & Rooney, 2003; Larson, 2005; Rutner & Gibson, 2001). Although, the number of respondents in this study was low, it was considered appropriate sample size to use PLS-SEM to evaluate the relationships. The relationships may have lost statistical power when the sample was divided into groups of users and non-users of cloud computing and small and large organizations for moderation analysis. Collecting more data could help researchers uncover (if any) differences in the results.

This research is limited by the perception of logistics managers included among the survey participants. All the respondents were people involved in logistics operations. Due to the nature of the industry, necessity of partnership, geography or regulations, the results may differ. In our modern global economy, businesses interact in multiple locations, future research could expand the scope of this research to include other geographical areas to evaluate factors such as culture or diffusion of technology in other countries affect the results. Other geographic areas may have different organizational situations or cultures that may change the way collaborative relationships are perceived.

This study is a one-sided view of these relationships. An interesting extension to the current research would be to collect data from matched dyadic members of supply chain. Identifying any differences between intermediaries, third party service providers, customers, or suppliers working relationships or the type of application/system used may help identify differences in the collaborative advantage and relational outcomes obtained under those circumstances.

## Contribution of this Dissertation

The previous review of literature highlighted the important but difficult task of collaborating in the supply chain, because collaboration has shown to promote unique relational advantages and more productivity and satisfaction. Nowadays, supply chains are looking for strategic ways of doing business that differentiate them from their competitors. This study measured the value of maintaining strong collaborative relationships with organizations in the supply chain. Organizations that have good relational activities, trust and communication in

place, generate high satisfaction and improved performance outcomes. Also, maintaining excellent collaborative relationships, and improves the collaborative advantages from those relationships in terms of process efficiencies, flexibility offering and innovation.

Moreover, literature to date has shown that the use of technology has helped firms differentiate from competitors by enhancing their relationships with suppliers and customers (Closs & Savitskie, 2003). This study is one of the firsts to address the impact of cloud computing in Supply Chain, and shows the positive effect that cloud computing use has on collaborative advantage for Small organizations. Moreover, this study demonstrates that the use of cloud computing positively affects the relational outcomes from collaborative relationship for Large firms. This topic is pretty nascent in regards to logistics implementation, as time passes reliability and usage of technology may continue to increase and cloud solutions may become functionally rich. Table 29 shows a summary of the issues identified in the review of literature, the purpose of this study and its contribution.

**Table 29. Research Contribution**

| Issues | Why needed | This study | Contribution of the study |
|---|---|---|---|
| Why is high-level collaboration valuable but rare? (Allred, et al., 2011) | Collaboration promotes distinctive relational advantage, superior productivity and satisfaction. | Examines the collaborative advantage that collaborative relationships provide. Also, describes what relational outcomes are enhanced by collaborative relationships. | This study found that collaborative relationships generates collaborative advantages such as process efficiency, flexibility of the offerings and Innovation.<br>Also, this research shows the relational outcomes obtained from strong collaborative relationships including satisfaction with the relationship, satisfaction with the results and performance. |
| Why is combining and configuring technology across boundaries hard work and rarely occur? (Stalk et al., 1992) | Internet based collaboration technology enhance connectivity and coordination of complex supply chains. | Evaluates the characteristics of cloud computing that improve the relational outcomes of the extended supply chain. | This is the first study to address the emerging technology of cloud computing in logistics collaboration context.<br>This study found that organizations using cloud computing develop stronger collaborative relationships, trust and communication. |
| Why is IT implementation different for small and large organizations? (Chan et al., 2012) | Low IT implementation in small organizations. | Determines whether cloud computing enables small organizations to share the same services as larger companies. | Small firms using cloud computing generate stronger collaborative advantages.<br>Large organizations using cloud computing generate higher relational outcomes for their firms. |

# REFERENCES

Allred, C. R., Fawcett, S. E., Wallin, C., & Magnan, G. M. (2011). A dynamic collaboration capability as a source of competitive advantage. *Decision Sciences, 42*(1), 129-161.

Anderson, J. C., & Narus, J. A. (1990). A model of distributor firm and manufacturer firm working partnerships. *Journal of Marketing, 54*(1), 42-58.

Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., . . . Zaharia, M. (2010). A View of Cloud Computing. *Communications of the ACM, 53*(4), 50-58.

Armstrong, J. S., & Overton, T. S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research, 14*(3), 396-402.

Autry, C. W., Grawe, S. J., Daugherty, P. J., & Richey, R. G. (2010). The effects of technological turbulence and breadth on supply chain technology acceptance and adoption. *Journal of Operations Management, 28*(6), 522-536.

Autry, C. W., Griffis, S. E., Goldsby, T. J., & Bobbitt, L. M. (2005). Warehouse management systems: resource, commitment, capabilitites, and organizational performance. *Journal of Business Logistics, 26*(2), 165-181.

Autry, C. W., Skinner, L. R., & Lamb, C. W. (2008). Interorganizational Citizenship Behaviors: An Empirical Study. *Journal of Business Logistics, 29*(2), 53-74.

Bachmann, D. P., Elfrink, J., & Vazzana, G. E.-M. (1999). E-mail and snail mail face off in rematch. *Marketing Research, 11*(4), 10-15.

Badaracco, J. (1991). *The knowledge link: How firms compete throught strategic alliances*: Harvard Business Press.

Bagchi, P. K., Ha, B. C., Skjoett-Larsen, T., & Soerensen, L. B. (2005). Supply chain integration: a European survey. *International Journal of Logistics Management, The, 16*(2), 275-294.

Baljko, J. (2013). A Manufacturing Revolution Starts in the Cloud Retrieved October 9, 2013, from http://www.ebnonline.com/author.asp?section_id=1061&doc_id=264150&

Banker, R. D., Bardhan, I., & Asdemir, O. (2006). Understanding the impact of collaboration software on product design and development. *Information Systems Research, 17*(4), 352-373.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Barnham, C. (2012). Separating methodologies? : Market Research Soc 15 Northburgh St, London EC1VOJR, England.

Barratt, M. (2003). Positioning the role of collaborative planning in grocery supply chains. *International Journal of Logistics Management, 14*(2), 53-66.

Barratt, M. (2004a). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal, 9*(1), 30-42.

Barratt, M. (2004b). Unveiling enablers and inhibitors of collaborative planning. *International Journal of Logistics Management, 15*(1), 73-90.

Barratt, M., & Oliveira, A. (2001). Exploring the experiences of collaborative planning initiatives. *International Journal of Physical Distribution and Logistics Management, 31*(4), 266-289.

Barringer, B. R., & Harrison, J. S. (2000). Walking a tightrope: creating value through interorganizational relationships. *Journal of Management, 26*(3), 367-403.

Bechtel, C., & Jayaram, J. (1997). Supply chain management: a strategic perspective. *International Journal of Logistics Management, 8*(1), 15-34.

Belalem, G., Bouamama, S., & Sekhri, L. (2011). An effective economic management of resources in cloud computing. *Journal of Computers, 6*(3), 404-411.

Bellingkrodt, S., & Wallenburg, C. M. (2013). The Role of External Relationships for LSP Innovativeness: A Contingency Approach. *Journal of Business Logistics, 34*(3), 209-221.

Benlian, A., & Hess, T. (2011). Opportunities and risks of software-as-a-service: Findings from a survey of IT executives. *Decision Support Systems, 52*(1), 232-246.

Bentler, P. M., & Bonett, D. G. (1980). Significant test and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588-606.

Bercovitz, J., Jap, S. D., & Nickerson, J. A. (2006). The antecedents and performance implications of cooperative exchange norms. *Organization Science, 17*(6), 724-740.

Bienstock, C. C., Royne, M. B., Sherrell, D., & Stafford, T. F. (2008). An expanded model of logistics service quality: Incorporating logistics information technology. *International Journal of Production Economics, 113*(1), 205-222.

Bowersox, D. J., Closs, D. J., & Stank, T. P. (2000). Ten-mega trends that will revolutionize supply chain logistics. *Journal of Business Logistics, 21*(2), 1-15.

Bowersox, D. J., Closs, D. J., & Stank, T. P. (2003). How to master cross-enterprise collaboration. *Supply Chain Management Review, 7*(4 (July/Aug. 2003)), 18-27.

Brender, N., & Markov, I. (2013). Risk perception and risk management in cloud computing: Results from a case study of Swiss companies. *International Journal of Information Management, 33*(5), 726-733.

Brewer, P. C., & Speh, T. W. (2000). Using the balanced scorecard to measure supply chain performance. *Journal of Business Logistics, 21*(1), 75-94.

Bruns, W. J., & Kaplan, R. (1987). *Accounting and Management Review: Field Study Perspectives*. Boston, MA.

Buyya, R., Yeo, C. S., & Venugopal, S. (2008). *Market-oriented cloud computing: Vision, hype, and reality for delivering it services as computing utilities.* Paper presented at the High Performance Computing and Communications, HPCC'08. 10th IEEE International Conference.

Byrd, T. A., Pitts, J. P., Adrian, A. M., & Davidson, N. W. (2008). Examination Of A Path Model Relating Information Technology Infrastructure With Firm Performance. *Journal of Business Logistics, 29*(2), 161-187.

Cai, S., & Yang, Z. (2008). Development Of Cooperative Norms In The Buyer-Supplier Relationship: The Chinese Experience. *Journal of Supply Chain Management, 44*(1), 55-70.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and Discriminat validation by the Multitrait-Multimethod matrix. *Psychological Bulletin, 56*(2), 81-105.

Cannon, J. P., & Homburg, C. (2001). Buyer-supplier relationships and customer firm costs. *Journal of Marketing, 65*(1), 29-43.

Cao, M., & Zhang, Q. (2010). Supply chain collaborative advantage: A firm's perspective. *International Journal of Production Economics, 128*(1), 358-367. doi: http://dx.doi.org/10.1016/j.ijpe.2010.07.037

Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management, 29*(3), 163-180. doi: http://dx.doi.org/10.1016/j.jom.2010.12.008

Carr, A. S., & Smeltzer, L. R. (2002). The relationship between information technology use and buyer-supplier relationships: an exploratory analysis of the buying firm's perspective. *Engineering Management, IEEE Transactions on, 49*(3), 293-304. doi: 10.1109/tem.2002.803389

Cassivi, L., Lefebvre, É., Lefebvre, L. A., & Léger, P.-M. (2004). The impact of e-collaboration tools on firms' performance. *International Journal of Logistics Management, 15*(1), 91-110.

Cavinato, J. L. (1992). A total cost/value model for supply chain competitiveness. *Journal of Business Logistics, 13*, 285-285.

Cegielski, C. G., Jones-Farmer, L. A., Wu, Y., & Hazen, B. T. (2012). Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach. *International Journal of Logistics Management, 23*(2), 184-211.

Chan, F. T. S., Yee-Loong Chong, A., & Zhou, L. (2012). An empirical investigation of factors affecting e-collaboration diffusion in SMEs. *International Journal of Production Economics, 138*(2), 329-344. doi: http://dx.doi.org/10.1016/j.ijpe.2012.04.004

Chen, C. C., Chen, X.-P., & Meindl, J. R. (1998). How can cooperation be fostered? The cultural effects of individualism-collectivism. *Academy of Management Review, 23*(2), 285-304.

Chen, H., Daugherty, P. J., & Landry, T. D. (2009). Supply chain process integration: a theoretical framework. *Journal of Business Logistics, 30*(2), 27-46.

Chen, H., Tian, Y., Ellinger, A. E., & Daugherty, P. J. (2010). Managing logistics outsourcing relationships: an empirical investigation in China. *Journal of Business Logistics, 31*(2), 279-299.

Chen, M., Zhang, D., & Zhou, L. (2007). Empowering collaborative commerce with Web services enabled business process management systems. *Decision Support Systems, 43*(2), 530-546.

Cherbakov, L., Galambos, G., Harishankar, R., Kalyana, S., & Rackham, G. (2005). Impact of service orientation at the business level. *IBM Systems Journal, 44*(4), 653-668. doi: 10.1147/sj.444.0653

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research, 295*(2), 295-336.

Chu, Z., & Wang, Q. (2012). Drivers of Relationship Quality in Logistics Outsourcing in China. *Journal of Supply Chain Management, 48*(3), 78-96. doi: 10.1111/j.1745-493X.2011.03259.x

Closs, D. J., & Savitskie, K. (2003). Internal and external logistics information technology integration. *International Journal of Logistics Management, The, 14*(1), 63-76.

Coase, R. H. (1937). The nature of the firm. *Economica, 4*(16), 386-405.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159.

Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: more than a new name for logistics. *International Journal of Logistics Management, 8*(1), 1-14.

Corsten, D., & Kumar, N. (2005). Do suppliers benefit from collaborative relationships with large retailers? An empirical investigation of efficient consumer response adoption. *Journal of marketing*, 80-94.

Courion. (2012). American Red Cross chooses Courion's access risk management suite as part of transition to cloud computing platform Retrieved October 9, 2013, from http://www.courion.com/company/press_room.html?id=1035

Covalentworks. (2013). Web-Based EDI Solutions For Suppliers Retrieved October 9, 2013, from http://www.covalentworks.com/web-based-edi.asp

Creswell, J. W. (2003). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches* (Vol. 2nd ed). Thousand Oaks, CA: Sage Publications, Inc.

Dahistrom, R., McNeilly, K. M., & Speh, T. W. (1996). Buyer-seller relationships in the procurement of logistical services. *Journal of the Academy of Marketing Science, 24*(2), 110-124.

Daugherty, P. J. (2011). Review of logistics and supply chain relationship literature and suggested research agenda. *International Journal of Physical Distribution and Logistics Management, 41*(1), 16-31.

Daugherty, P. J., Richey, R. G., Roath, A. S., Min, S., Chen, H., Arndt, A. D., & Genchev, S. E. (2006). Is collaboration paying off for firms? *Business Horizons, 49*(1), 61-70.

Davies, G. (1996). Supply-chain relationships. *Relationship Marketing: Theory and Practice*, 17-28.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: the quest for the dependent variable. *Information Systems Research, 3*(1), 60-95.

Derocher, R. P., & Kilpatrick, J. (2000). Six Supply Chain Lessons For The Millennium. *Supply Chain Management Review, 3*(4 (Winter 2000)), 34-40.

Devaraj, S., Vaidyanathan, G., & Misra, A. N. (2012). Effect of purchase volume flexibility and purchase mix flexibility on e-procurement performance: An analysis of two perspectives. *Journal of Operations Management, 30*(7), 509-520.

Dillman, D. A. (2000). *Mail and Internet Surveys: The Total Design Method*. New York: John Wiley & Sons.

Dillman, D. A. (2007). *Mail and Internet Surveys: The Tailored Design Method* (Vol. Second ed.). New Jersey: John Wiley & Sons, Inc.

Dillon, T., Wu, C., & Chang, E. (2010). *Cloud computing: issues and challenges.* Paper presented at the Advanced Information Networking and Applications (AINA), 24th IEEE International Conference.

Dwyer, F. R., Schurr, P. H., & Oh, S. (1987). Developing buyer-seller relationships. *Journal of Marketing, 51*(2), 11-27.

Dyer, J. (1997). Effective interfirm collaboration: how firms minimize transaction costs and maximize transaction value. *Strategic Management Journal, 18*(7), 553-556.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660-679.

Ellinger, A. E., Daugherty, P. J., & Keller, S. B. (2000). The relationship between marketing/logistics interdepartmental integration and performance in US manufacturing firms: an empirical study. *Journal of Business Logistics, 21*(1), 1-22.

Ellram, L. M. (1992). Partners In International Alliances. *Journal of Business Logistics, 13*(1), 1-25.

Ellram, L. M., & Hendrick, T. E. (1995). Partnering characteristics: a dyadic perspective. *Journal of Business Logistics, 16*, 41-41.

Emberson, C., & Storey, J. (2006). Buyer–supplier collaborative relationships: Beyond the normative accounts. *Journal of Purchasing and Supply Management, 12*(5), 236-245.

Etro, F. (2011). The economics of cloud computing. *The IUP Journal of Managerial Economics, 9*(2), 7-22.

Fawcett, S. E., Fawcett, A. M., Watson, B. J., & Magnan, G. M. (2012). Peeking inside the black box: toward an understanding of supply chain collaboration dynamics. *Journal of Supply Chain Management, 48*(1), 44-72.

Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution and Logistics Management, 32*(5), 339-361.

Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). A Three-Stage Implementation Model For Supply Chain Collaboration. *Journal of Business Logistics, 29*(1), 93-112.

Fawcett, S. E., Wallin, C., Allred, C., Fawcett, A. M., & Magnan, G. M. (2011). Information Technology as an Enabler of Supply Chain Collaboration: a Dynamic-Capabilities Perspective. *Journal of Supply Chain Management, 47*(1), 38-59.

Feuerlicht, G., & Govardhan, S. (2009). SOA: Trends and directions. *Systems Integration, 149*, 149-155.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research, 18*(1), 39-50.

Forza, C. (1996). Achieving superior operating performance from integrated pipeline management: an empirical study. *International Journal of Physical Distribution & Logistics Management, 26*(9), 36-63.

Frazier, G. L. (1983). Interorganizational exchange behavior in marketing channels: a broadened perspective. *Journal of Marketing*, 68-78.

Fuerst, C. (2013). Guest Commentary: Three Reasons We're all Moving to the Cloud Retrieved September 22, 2013, from http://logisticsviewpoints.com/2013/09/19/guest-commentary-three-reasons-moving-cloud/

Fugate, B. S., Mentzer, J. T., & Stank, T. P. (2010). Logistics performance: efficiency, effectiveness, and differentiation. *Journal of Business Logistics, 31*(1), 43-62.

Fuller, R. M., & Dennis, A. R. (2009). Does fit matter? The impact of task-technology fit and appropriation on team performance in repeated tasks. *Information Systems Research, 20*(1), 2-17.

Furneaux, B. (2012). Task-Technology Fit Theory: A Survey and Synopsis of the Literature *Information Systems Theory* (pp. 87-106): Springer.

Galbraith, J. R. (1973). *Designing complex organizations*: Addison-Wesley Longman Publishing Co., Inc.

Ganesan, S. (1994). Determinants of long-term orientation in buyer-seller relationships. *Journal of Marketing, 58*(2), 1-19.

Geisser, S. (1974). A predictive approach to the random effect model. *Biometrika, 61*(1), 101-107.

Gentry, J. J. (1996). The role of carriers in buyer-supplier strategic partnerships: A supply chain management approach. *Journal of Business Logistics, 17*(2), 35-55.

Gibson, B. J., Rutner, S. M., & Keller, S. B. (2002). Shipper-carrier partnership issues, rankings and satisfaction. *International Journal of Physical Distribution and Logistics Management, 32*(8), 669-681.

Golicic, S. L., & Mentzer, J. T. (2005). Exploring the drivers of interorganizational relationship magnitude. *Journal of Business Logistics, 26*(2), 47-71.

Golicic, S. L., & Mentzer, J. T. (2006). An empirical examination of relationship magnitude. *Journal of Business Logistics, 27*(1), 81-108.

Goodhue, D. L. (2006). Task-technology fit. *Human-computer interaction and management information systems: applications. New York: Sharpe*, 184-204.

Goodhue, D. L., Klein, B. D., & March, S. T. (2000). User evaluations of IS as surrogates for objective performance. *Information and Management, 38*(2), 87-101.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS quarterly*, 213-236.

Gray, J. L., & Harvey, T. W. (1992). *Quality value banking: Effective management systems that increase earnings, lower costs, and provide competitive customer service*: J. Wiley.

Griffis, S. E., Cooper, M., Goldsby, T. J., & Closs, D. J. (2004). Performance Measurement: Measure Selection Based upon Firm Goals and Information Reporting Needs. *Journal of Business Logistics, 25*(2), 95-118.

Griffis, S. E., Goldsby, T., & Cooper, M. L. (2003). Web-Based and Mail Surveys: A comparison of response, data, and cost. *Journal of Business Logistics, 24*(2), 237-258.

Grossman, M. (2004). The role of Trust and Collaboration in the Internet-Enabled Supply Chain. *Journal of American Academy of Business, 5*(1/2), 391-396.

Grover, V., & Malhotra, M. K. (1997). Business process reengineering: a tutorial on the concept, evolution, method, technology and application. *Journal of Operations Management, 15*(3), 193-213.

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal, 38*(1), 85-112.

Gunasekaran, A., & Ngai, E. W. (2008). Adoption of e-procurement in Hong Kong: an empirical research. *International Journal of Production Economics, 113*(1), 159-175.

Hager, M. A., Wilson, S., Pollak, T. H., & Rooney, P. M. (2003). Response rates for mail surveys of nonprofit organizations: A review and empirical test. *Nonprofit and Voluntary Sector Quarterly, 32*(2), 252-267.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (Vol. Seventh Edition). Englewood Cliffs, NJ: Prentice Hall.

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2013). *A primer on partial least squares structural equation modeling (PLS-SEM)*: SAGE Publications, Incorporated.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152.

Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. *Long Range Planning, 45*(5), 320-340.

Handfield, R. B., & Nichols, E. L. (1999). *Introduction to supply chain management* (Vol. 183): Prentice Hall New-Jersey.

Hartley, J. L., Greer, B. M., & Park, S. (2002). Chrysler leverages its suppliers' improvement suggestions. *Interfaces, 32*(4), 20-27.

Hazen, B. T., & Byrd, T. A. (2012). Toward creating competitive advantage with logistics information technology. *International Journal of Physical Distribution & Logistics Management, 42*(1), 8-35.

Heiser, J., & Nicolett, M. (2008). Assessing the security risks of cloud computing. *Gartner Report*.

Hendricks, K. B., & Singhal, V. R. (2003). The effect of supply chain glitches on shareholder wealth. *Journal of Operations Management, 21*(5), 501-522.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing, 20*, 277-319.

Highjump. (2013). Warehouse Management Software (WMS) In The Cloud from HighJump Software Retrieved October 9, 2013, from http://www.highjump.com/solutions/distribution-logistics/warehouse-management-cloud

Hoyt, J., & Huq, F. (2000). From arms-length to collaborative relationships in the supply chain: an evolutionary process. *International Journal of Physical Distribution and Logistics Management, 30*(9), 750-764.

Huang, B., Li, C., Yin, C., & Zhao, X. (2013). Cloud manufacturing service platform for small- and medium-sized enterprises. *The International Journal of Advanced Manufacturing Technology, 65*(9-12), 1261-1272. doi: 10.1007/s00170-012-4255-4

Iansiti, M., & Clark, K. B. (1994). Integration and dynamic capability: evidence from product development in automobiles and mainframe computers. *Industrial and Corporate Change, 3*(3), 557-605.

Iyer, B., & Henderson, J. C. (2010). Preparing for the future: understanding the seven capabilities of cloud computing. *MIS Quarterly Executive, 9*(2), 117-131.

Jap, S. D. (1999). Pie-expansion efforts: collaboration processes in buyer-supplier relationships. *Journal of Marketing Research, 36*(4), 461-475.

Jap, S. D. (2001). Perspectives on joint competitive advantages in buyer–supplier relationships. *International Journal of Research in Marketing, 18*(1), 19-35.

Johnston, H. R., & Vitale, M. A. (1988). Creating Competitive Advantage With Interorganizational Information Systems. *MIS quarterly, 12*(2), 153-165.

Jonsson, P., & Zineldin, M. (2003). Achieving high satisfaction in supplier-dealer working relationships. *Supply Chain Management: an international journal, 8*(3), 224-240.

Joreskog, K. G. (1971). Simultaneous Factor analysis in several populations. *Psychometrika, 36*(4), 409-426.

Joshi, A. W., & Stump, R. L. (1999). The contingent effect of specific asset investments on joint action in manufacturer-supplier relationships: an empirical test of the moderating role of

reciprocal asset investments, uncertainty, and trust. *Journal of the Academy of Marketing Science, 27*(3), 291-305.

Joskow, P. L. (1988). Asset specificity and the structure of vertical relationships: empirical evidence. *Journal of Law, Economics and Organization, 4*(1), 95-117.

Kaipia, R., & Hartiala, H. (2006). Information-sharing in supply chains: five proposals on how to proceed. *International Journal of Logistics Management, 17*(3), 377-393.

Kanter, R. M. (1994). Collaborative advantage: the art of alliances. *Harvard Business Review, 72*(4), 96-108.

Karimi, J., Somers, T. M., & Gupta, Y. P. (2001). Impact of information technology management practices on customer service. *Journal of Management Information Systems, 17*(4), 125-158.

Kauser, S., & Shaw, V. (2004). The influence of behavioural and organisational characteristics on the success of international strategic alliances. *International Marketing Review, 21*(1), 17-52.

Kent, J. L., & Mentzer, J. T. (2003). The effect of investment in interorganizational information technology in a retail supply chain. *Journal of Business Logistics, 24*(2), 155-175.

Klein, R. (2007). Customization and real time information access in integrated eBusiness supply chain relationships. *Journal of Operations Management, 25*(6), 1366-1381.

Klein, R., & Rai, A. (2009). Interfirm Strategic Information Flows In Logistics Supply Chain Relationships. *MIS quarterly, 33*(4), 735-762.

Kline, R. B. (1998). *Principles and Practice of Structural Equation Model*. New York, NY: The Guilford Press.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Model* (Vol. Second Edition). New York, NY: The Guilford Press.

Knemeyer, A. M., Corsi, T. M., & Murphy, P. R. (2003). Logistics outsourcing relationships: customer perspectives. *Journal of Business Logistics, 24*(1), 77-109.

Koh, S., Gunasekaran, A., & Rajkumar, D. (2008). ERP II: The involvement, benefits and impediments of collaborative information sharing. *International Journal of Production Economics, 113*(1), 245-268.

Kontoravdis, G. (2011). The New Breed of Cloud-Based TMS Retrieved October 9, 2013, from http://www.inboundlogistics.com/cms/article/the-new-breed-of-cloud-based-tms/

Koploy, M. (2011). 2011 Market Trends Report: Procurement Retrieved October 9, 2013, from http://blog.softwareadvice.com/articles/scm/2011-market-trends-report-procurement-systems-1030711/

Koufteros, X. A., Vonderembse, M. A., & Doll, W. J. (2002). Integrated product development practices and competitive capabilities: the effects of uncertainty, equivocality, and platform strategy. *Journal of Operations Management, 20*(4), 331-355.

Kumar, K., & van Dissel, H. G. (1996). Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems. *MIS quarterly, 20*(3), 279-300.

Kumar, N. (1996). The power of trust in manufacturer-retailer relationships. *Harvard Business Review, 74*(6), 92-106.

Kwon, I.-W. G., & Suh, T. (2004). Factors Affecting the Level of Trust and Commitment in Supply Chain Relationships. *Journal of Supply Chain Management, 40*(2), 4-14. doi: 10.1111/j.1745-493X.2004.tb00165.x

Laframboise, K., & Reyes, F. (2005). Gaining Competitive Advantage From Integrating Enterprise Resource Planning and Total Quality Management. *Journal of Supply Chain Management, 41*(3), 49-64. doi: 10.1111/j.1055-6001.2005.04103005.x

Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management, 29*(1), 65-83.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: implementation issues and research opportunities. *International Journal of Logistics Management, 9*(2), 1-20.

Lambert, D. M., Emmelhainz, M. A., & Gardner, J. T. (1996a). Classifying Relationships. *Marketing Management, 5*(2), 28-41.

Lambert, D. M., Emmelhainz, M. A., & Gardner, J. T. (1996b). Developing and implementing supply chain partnerships. *International Journal of Logistics Management, 7*(2), 1-18.

Langley, C., & Holcomb, M. C. (1992). Creating logistics customer value. *Journal of Business Logistics, 13*, 1-1.

Larson, P. D. (2005). A note on mail surveys and response rates in logistics research. *Journal of Business Logistics, 26*(2), 211-222.

Larson, P. D., Carr, P., & Dhariwal, K. S. (2005). SCM Involving Small Versus Large Suppliers: Relational Exchange and Electronic Communication Media. *Journal of Supply Chain Management, 41*(1), 18-29. doi: 10.1111/j.1745-493X.2005.tb00181.x

Larson, P. D., & Poist, R. F. (2004). Improving response rates to mail surveys: a research note. *Transportation Journal*, 67-74.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of Management Review, 31*(3), 638-658.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T., & Subba Rao, S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega, 34*(2), 107-124.

Li, S., Rao, S. S., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management, 23*(6), 618-641.

Li, W., Humphreys, P. K., Yeung, A. C., & Cheng, T. (2012a). The impact of supplier development on buyer competitive advantage: A path analytic model. *International Journal of Production Economics, 135*(1), 353-366.

Li, W., Humphreys, P. K., Yeung, A. C. L., & Cheng, T. C. E. (2012b). The impact of supplier development on buyer competitive advantage: A path analytic model. *International Journal of Production Economics, 135*(1), 353-366. doi: http://dx.doi.org/10.1016/j.ijpe.2011.06.019

Liao-Troth, S., Thomas, S., & Fawcett, S. E. (2012). Twenty years of< IT> IJLM</IT>: evolution in research. *International Journal of Logistics Management, 23*(1), 4-30.

Liu, H., Ke, W., Wei, K. K., Gu, J., & Chen, H. (2010). The role of institutional pressures and organizational culture in the firm's intention to adopt internet-enabled supply chain management systems. *Journal of Operations Management, 28*(5), 372-384.

Logan, M. S. (2000). Using agency theory to design successful outsourcing relationships. *International Journal of Logistics Management, 11*(2), 21-32.

Lorenzoni, G., & Lipparini, A. (1999). The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Management Journal, 20*(4), 317-338.

Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems, 111*(7), 1006-1023.

Madhok, A., & Tallman, S. B. (1998). Resources, transactions and rents: managing value through interfirm collaborative relationships. *Organization Science, 9*(3), 326-339.

Maitland, I., Bryson, J., & Van de Ven, A. (1985). Sociologists, economists, and opportunism. *Academy of Management Review, 10*(1), 59-65.

Manthou, V., Vlachopoulou, M., & Folinas, D. (2004). Virtual e-Chain (VeC) model for supply chain collaboration. *International Journal of Production Economics, 87*(3), 241-250. doi: http://dx.doi.org/10.1016/S0925-5273(03)00218-4

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing — The business perspective. *Decision Support Systems, 51*(1), 176-189. doi: http://dx.doi.org/10.1016/j.dss.2010.12.006

McCrea, B. (2012). Supply chain technology:Cloud computing breakthough Retrieved July 22, 2013, from http://www.logisticsmgmt.com/article/supply_chain_technology_cloud_breakthrough

McGrath, J., Martin, J., & Kukla, R. (1982). *Judgement calls in research*. Beverly Hills, CA: Sage.

McGrath, J. E. (1982). *Dilemmatics: The Study if Reseach Choices and Dilemmas*. Beverly Hills, CA: Sage Publications Inc.

McLaughlin, J., Motwani, J., Madan, M. S., & Gunasekaran, A. (2003). Using information technology to improve downstream supply chain operations: a case study. *Business Process Management Journal, 9*(1), 69-80.

Mell, P., & Grace, T. (2011). A NIST Definition of Cloud Computing. *Special Publication 800-145* Retrieved November 1, 2011, from http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf

Mell, P., & Grance, T. (2010). The NIST Definition of Cloud Computing. *Communications of the ACM, 53*(6), 50.

Melnyk, S. A., Page, T. J., Wu, S. J., & Burns, L. A. (2012). Would you mind completing this survey: Assessing the state of survey research in supply chain management. *Journal of Purchasing and Supply Management, 18*(1), 35-45.

Mentzer, J. T. (1999). *Supplier partnering*. Thousand Oaks, CA: Sage.

Mentzer, J. T. (2008). RIGOR VERSUS RELEVANCE: WHY WOULD WE CHOOSE ONLY ONE?*. *Journal of Supply Chain Management, 44*(2), 72-77.

Mentzer, J. T., & Flint, D. J. (1997). Validity in Logistics Research. *Journal of Business Logistics, 18*(1), 199-216.

Mentzer, J. T., Foggin, J. H., & Golicic, S. L. (2000). Collaboration: the enablers, impediments, and benefits. *Supply chain Management Review, 4*(4), 52-58.

Mentzer, J. T., & Konrad, B. P. (1991). An efficiency effectiveness approach to logistics performance analysis. *Journal of Business Logistics, 12*(1), 33-62.

Mentzer, J. T., Stank, T. P., & Esper, T. L. (2008). Supply chain management and its relationship to logistics, marketing, production, and operations management. *Journal of Business Logistics, 29*(1), 31-46.

Michel, R. (2014). Development of Cloud Computing for the Warehouse Retrieved February,21, 2015

Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Richey, R. G. (2005). Supply chain collaboration: what's happening? *International Journal of Logistics Management, 16*(2), 237-256.

Moberg, C. R., & Speh, T. W. (2003). Evaluating the relationship between questionable business practices and the strength of supply chain relationships. *Journal of Business Logistics, 24*(2), 1-19.

Mohr, J. J., Fisher, R. J., & Nevin, J. R. (1996). Collaborative communication in interfirm relationships: moderating effects of integration and control. *Journal of Marketing, 60*(3), 103-115.

Monkmeyer, J. (2011, May 9, 2011). SaaS, "The Cloud" & 3PLs. *Supply & Demand Chain Executive*, from http://www.sdcexec.com/article/10263628/saas-the-cloud-and-3pls

Moorman, C., & Rust, R. T. (1999). The role of Marketing. *Journal of Marketing, 63*(4), 180-197.

Moorman, C., Zaltman, G., & Deshpande, R. (1992). Relationships Between Providers and Users of Market Research: The Dynamics of Trust. *Journal of Marketing Research, 29*(3), 314-328.

Morgan, J. P. (2000). New Solutions to Making EDI Really Work in Purchasing. *Purchasing, 129*(6), 42.

Morgan, J. P. (2003). R. Gene Richter: The man who made supply chain strategies work. *Purchasing, November 6, 2003*, 45-50.

Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing, 58*(3), 20-38.

Morris, M., & Carter, C. R. (2005). Relationship Marketing and Supplier Logistics Performance: An Extension of the Key Mediating Variables Model. *Journal of Supply Chain Management, 41*(4), 32-43. doi: 10.1111/j.1745-493X.2005.04104004.x

Mowery, D. C. (1988). *International collaborative ventures in US manufacturing*: Ballinger Pub Co.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review, 23*(2), 242-266.

Nakano, M. (2009). Collaborative forecasting and planning in supply chains: The impact on performance in Japanese manufacturers. *International Journal of Physical Distribution & Logistics Management, 39*(2), 84-105.

Namjoshi, J., & Gupte, A. (2009). *Service oriented architecture for cloud based travel reservation software as a service.* Paper presented at the Cloud Computing. CLOUD'09. IEEE International Conference.

Nesheim, T. (2001). Externalization of the core: antecedents of collaborative relationships with suppliers. *European Journal of Purchasing and Supply Management, 7*(4), 217-225.

Nunnally, J. C. (1978). *Psychometric theory (2nd ed.)*. New York: McGraw-Hill.

Nyaga, G. N., Lynch, D. F., Marshall, D., & Ambrose, E. (2013). Power Asymmetry, Adaptation and Collaboration in Dyadic Relationships Involving a Powerful Partner. *Journal of Supply Chain Management, 49*(3), 42-65. doi: 10.1111/jscm.12011

Nyaga, G. N., & Whipple, J. M. (2011). Relationship Quality and Performance Outcomes: Achieving a Sustainable Competitive Advantage. *Journal of Business Logistics, 32*(4), 345-360. doi: 10.1111/j.0000-0000.2011.01030.x

Nyaga, G. N., Whipple, J. M., & Lynch, D. F. (2010). Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management, 28*(2), 101-114.

Ojala, A., & Tyrväinen, P. (2011). Value networks in cloud computing. *Journal of Business Strategy, 32*(6), 40-49.

Oliver, C. (1990). Determinants of interorganizational relationships: Integration and future directions. *Academy of Management Review, 15*(2), 241-265.

Oracle. (2013). Oracle ERP Cloud Service Retrieved October 9, 2013, from http://www.oracle.com/us/solutions/cloud/erp/overview/index.html

Ouf, S., & Nasr, M. (2011). *Business intelligence in the cloud.* Paper presented at the Communication Software and Networks (ICCSN), 2011 IEEE 3rd International Conference on.

Palmatier, R. W., Dant, R. P., Grewal, D., & Evans, K. R. (2006). Factors influencing the effectiveness of relationship marketing: a meta-analysis. *Journal of Marketing, 70*(4), 136-153.

Pappu, M., Mundy, R., & Paswan, A. (2001). *New channel dynamics: an investigation of transport services.* Paper presented at the Anais do International Annual IPSERA Conference.

Parmigiani, A., Klassen, R. D., & Russo, M. V. (2011). Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. *Journal of Operations Management, 29*(3), 212-223.

Paul, D. L., & McDaniel Jr, R. R. (2004). A Field Study Of The Effect Of Interpersonal Trust On Virtual Collaborative Relationship Performance. *MIS quarterly, 28*(2), 183-227.

Paulraj, A., & Chen, I. J. (2007). Strategic Buyer-Supplier Relationships, Information Technology and External Logistics Integration. *Journal of Supply Chain Management, 43*(2), 2-14. doi: 10.1111/j.1745-493X.2007.00027.x

Paulraj, A., Lado, A. A., & Chen, I. J. (2008). Inter-organizational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer–supplier relationships. *Journal of Operations Management, 26*(1), 45-64. doi: http://dx.doi.org/10.1016/j.jom.2007.04.001

Petersen, K. J., Ragatz, G. L., & Monczka, R. M. (2005). An examination of collaborative planning effectiveness and supply chain performance. *Journal of Supply Chain Management, 41*(2), 14-25.

Pimentel Claro, D., & Oliveira Claro, P. B. (2010). Collaborative buyer–supplier relationships and downstream information in marketing channels. *Industrial Marketing Management, 39*(2), 221-228.

Power, D., & Singh, P. (2007). The e-integration dilemma: the linkages between internet technology application, trading partner relationships and structural change. *Journal of Operations Management, 25*(6), 1292-1310.

Prahinski, C., & Benton, W. C. (2004). Supplier evaluations: communication strategies to improve supplier performance. *Journal of Operations Management, 22*(1), 39-62. doi: http://dx.doi.org/10.1016/j.jom.2003.12.005

Prockl, G., Pflaum, A., & Kotzab, H. (2012). 3PL factories or lernstatts? Value-creation models for 3PL service providers. *International Journal of Physical Distribution and Logistics Management, 42*(6), 544-561.

Rayport, J. F., & Jaworski, B. J. (2004). Best face forward. *Harvard Business Review, 82*(12), 47-59.

Richey, R. G., Adams, F. G., & Dalela, V. (2012). Technology and Flexibility: Enablers of Collaboration and Time-Based Logistics Quality. *Journal of Business Logistics, 33*(1), 34-49.

Riedel, E. (2012). *An Examination of Small Business' Propensity to Adopt Cloud-Computing Innovation*. Dissertation. Walden Unversity.

Rigdon, E. E. (2012). Rethinking partial least squares path modeling: in praise of simple methods. *Long Range Planning, 45*(5), 341-358.

Rinehart, L. M., Eckert, J. A., Handfield, R. B., Page, T. J., & Atkin, T. (2004). An assessment of supplier—customer relationships. *Journal of Business Logistics, 25*(1), 25-62.

Ringle, C., Wende, S., & Becker, J.-M. (2014). Smartpls 3, from http://www.smartpls.com

Riordan, M. H., & Williamson, O. E. (1985). Asset specificity and economic organization. *International Journal of Industrial Organization, 3*(4), 365-378.

Robey, D. (1996). Research commentary: diversity in information systems research: threat, promise, and responsibility. *Information Systems Research, 7*(4), 400-408.

Rodero-Merino, L., Vaquero, L. M., Gil, V., Galán, F., Fontán, J., Montero, R. S., & Llorente, I. M. (2010). From infrastructure delivery to service management in clouds. *Future Generation Computer Systems, 26*(8), 1226-1240.

Ross, V. W. (2010). *Factors influencing the adoption of cloud computing by decision making managers.* Capella University.

Ruan, K., Baggili, I., Carthy, J., & Kechadi, T. (2011). *Survey on cloud forensics and critical criteria for cloud forensic capability: A preliminary analysis.* Paper presented at the Proceedings of the 2011 ADFSL Conference on Digital Forensics, Security and Law.

Rutner, S. M., & Gibson, B. J. (2001). *The effects of survey collection methods on reliability, response rate and costs.* Paper presented at the Proceedings of the 2001 Council of Logistics Management Educators Conference, Kansas City, MO.

Saeed, K. A., Malhotra, M. K., & Grover, V. (2005). Examining the impact of interorganizational systems on process efficiency and sourcing leverage in buyer–supplier dyads. *Decision Sciences, 36*(3), 365-396.

Sahay, B., & Mohan, R. (2006). 3PL practices: an Indian perspective. *International Journal of Physical Distribution and Logistics Management, 36*(9), 666-689.

Sanders, N. R. (2005). IT Alignment in Supply Chain Relationships: A Study of Supplier Benefits. *Journal of Supply Chain Management, 41*(2), 4-13. doi: 10.1111/j.1055-6001.2005.04102001.x

Sanders, N. R. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management, 25*(6), 1332-1347.

Sanders, N. R. (2008). Pattern of information technology use: The impact on buyer–suppler coordination and performance. *Journal of Operations Management, 26*(3), 349-367.

Sanders, N. R., & Premus, R. (2005). Modeling The Relationship Between Firm It Capability, Collaboration, And Performance. *Journal of Business Logistics, 26*(1), 1-23.

SBA. (2014). U.S. Small Business Administration. *Small Business Size Standards* Retrieved February 12, 2014, from http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=7780ee089107f59ef3f78b938e2282b7&r=PART&n=13y1.0.1.1.17#se13.1.121_1201

Schakett, T., Flaschner, A., Gao, T., & El-Ansary, A. (2011). Effects of Social Bonding in Business-to-Business Relationships. *Journal of Relationship Marketing, 10*(4), 264-280.

Schneider, B., Ashworth, S. D., Higgs, A. C., & Carr, L. (1996). Design, validity, and use of strategically focused employee attitude surveys. *Personnel Psychology, 49*(3), 695-705.

Schniederjans, D., & Özpolat, K. (2013). *An Empirical Examination of Cloud Computing in Humanitarian Logistics*. Retrieved from http://www.cba.uri.edu/research/brownbag/spring2013/documents/DaraS2013329paper.pdf

Shervani, T. A., Frazier, G., & Challagalla, G. (2007). The moderating influence of firm market power on the transaction cost economics model: an empirical test in a forward channel integration context. *Strategic Management Journal, 28*(6), 635-652.

Shin, H., Collier, D. A., & Wilson, D. D. (2000). Supply management orientation and supplier/buyer performance. *Journal of Operations Management, 18*(3), 317-333.

Siegle, D. (2010). Cloud Computing: A Free Technology Option to Promote Collaborative Learning. *Gifted Child Today, 33*(4), 41-45.

Simatupang, T. M., & Sridharan, R. (2005). The collaboration index: a measure for supply chain collaboration. *International Journal of Physical Distribution and Logistics Management, 35*(1), 44-62.

Sinkovics, R. R., & Roath, A. S. (2004). Strategic orientation, capabilities, and performance in manufacturer—3PL relationships. *Journal of Business Logistics, 25*(2), 43-64.

Smith, N. C., & Paul, D. (1991). *The management research handbook*: Taylor & Francis.

Sohrabi, H., & Montreuil, B. (2011). From Private Supply Networks and Shared Supply Webs to Physical Internet Enabled Open Supply Webs *Adaptation and Value Creating Collaborative Networks* (pp. 235-244): Springer.

Songini, M. L. (2002). Chain Reactions. *ComputerWorld* Retrieved August 5, 2013, from http://www.computerworld.com/s/article/70541/Chain_Reactions

Spekman, R. E., & Carraway, R. (2006). Making the transition to collaborative buyer–seller relationships: An emerging framework. *Industrial Marketing Management, 35*(1), 10-19.

Spekman, R. E., Kamauff Jr, J. W., & Myhr, N. (1998). An empirical investigation into supply chain management: a perspective on partnerships. *Supply Chain Management: An International Journal, 3*(2), 53-67.

Spekman, R. E., & Sweeney, P. J. (2006). RFID: from concept to implementation. *International Journal of Physical Distribution and Logistics Management, 36*(10), 736-754.

Stalk, G., Evans, P., & Sgulman, L. E. (1992). *Competing on capabilities: the new rules of corporate strategy* (Vol. 70): Harvard Business Review.

Stamas, P. J. (2013). *Towards a Service-Oriented Enterprise: The Design of a Cloud Business Integration Platform in a Medium-Sized Manufacturing Enterprise.* Dissertation.

Stank, T. P., Crum, M. R., & Arango, M. (1999). Benefits of interfirm coordination in food industry supply chains. *Journal of Business Logistics, 20*(2), 21-41.

Stank, T. P., & Daugherty, P. J. (1997). The impact of operating environment on the formation of cooperative logistics relationships. *Transportation Research Part E: Logistics and Transportation Review, 33*(1), 53-65.

Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics, 22*(1), 29-48.

Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. *Journal of the Royal Statistical Society. Series B (Methodological)*, 111-147.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS quarterly, 13*(2), 147-169.

Subashini, S., & Kavitha, V. (2011). A survey on security issues in service delivery models of cloud computing. *Journal of Network and Computer Applications, 34*(1), 1-11.

Subramani, M. (2004). How Do Suppliers Benefit From Information Technology Use In Supply Chain Relationships? *MIS quarterly, 28*(1), 45-73.

Sudman, S., & Blair, E. (1999). Sampling in the Twenty-First Century. *Journal of the Academy of Marketing Science, 27*(2), 269-277.

Tapscott, D., Lowy, A., & Ticoll, D. (2000). *Digital capital: Harnessing the power of business webs*: Harvard Business Press.

Telser, L. G. (1980). A theory of self-enforcing agreements. *Journal of Business, 53*(1), 27-44.

Thompson, W. J., & van der Walt, J. S. (2010). Business intelligence in the cloud. *South African Journal of Information Management, 12*(1), 1-15.

Thun, J.-H. (2010). Angles of Integration: An Empirical Analysis of the Alignment of Internet-Based Information Technology and Global Supply Chain Integration. *Journal of Supply Chain Management, 46*(2), 30-44. doi: 10.1111/j.1745-493X.2010.03188.x

Tian, Y., Lai, F., & Daniel, F. (2008). An examination of the nature of trust in logistics outsourcing relationship: empirical evidence from China. *Industrial Management and Data Systems, 108*(3), 346-367.

Trist, E. (1981). The evolution of socio-technical systems. *Occasional paper, 2*, 1981.

Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 35-67.

Vangen, S., & Huxham, C. (2003). Nurturing collaborative relations Building trust in interorganizational collaboration. *The Journal of Applied Behavioral Science, 39*(1), 5-31.

Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management, 21*(5), 523-539.

Viswanathan, N. (2010). Enabling Supply Chain Visibility and Collaboration in the Cloud: Aberdeen Group.

VMWare. (2008). Addressing Desktop Challenges, from http://www.vmware.com/pdf/vdi_solution.pdf

Vouk, M. A. (2004). Cloud computing–issues, research and implementations. *Journal of Computing and Information Technology, 16*(4), 235-246.

Wagner, S. M., Eggert, A., & Lindemann, E. (2010). Creating and appropriating value in collaborative relationships. *Journal of Business Research, 63*(8), 840-848.

Wagner, S. M., & Kemmerling, R. (2010). Handling Nonrsponse in Logistics Research. *Journal of Business Logistics, 31*(2), 357-381.

Wang, E. T., & Wei, H. L. (2007). Interorganizational Governance Value Creation: Coordinating for Information Visibility and Flexibility in Supply Chains*. *Decision Sciences, 38*(4), 647-674.

Wang, L., Von Laszewski, G., Younge, A., He, X., Kunze, M., Tao, J., & Fu, C. (2010). Cloud computing: a perspective study. *New Generation Computing, 28*(2), 137-146.

Weston, R., & Gore, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719-751.

Wetzels, M., Odekerken-Schroder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *Management Information Systems Quarterly, 33*(1), 177-195.

Whipple, J. M., & Frankel, R. (2000). Strategic alliance success factors. *Journal of Supply Chain Management, 36*(3), 21-28.

Whipple, J. M., Lynch, D. F., & Nyaga, G. N. (2010). A buyer's perspective on collaborative versus transactional relationships. *Industrial Marketing Management, 39*(3), 507-518.

Wilding, R., & Humphries, A. S. (2006). Understanding collaborative supply chain relationships through the application of the Williamson organisational failure framework. *International Journal of Physical Distribution and Logistics Management, 36*(4), 309-329.

Williamson, O. E. (1975). *Markets and hierarchies*: Free Press.

Williamson, O. E. (1979). Transaction-cost economics: the governance of contractual relations. *Journal of Law and Economics, 22*(2), 233-261.

Williamson, O. E. (1981). The economics of organization: the transaction cost approach. *American Journal of Sociology, 87*(3), 548-577.

Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review, 73*(4), 519-540.

Williamson, O. E. (1985). *The economic intstitutions of capitalism*: Simon and Schuster.

Williamson, O. E. (1989). Transaction cost economics. *Handbook of industrial organization, 1*, 135-182.

Wired.com. (2009). The Future of Cloud Computing: A Long-Term Forecast Retrieved October 11, 2013, from http://upstart.bizjournals.com/companies/innovation/2009/03/09/A-Long-Term-Forecas.html?page=all

Wu, J.-H., Shin, S.-S., & Heng, M. S. (2007). A methodology for ERP misfit analysis. *Information and Management, 44*(8), 666-680.

Wu, Y., Cegielski, C. G., Hazen, B. T., & Hall, D. J. (2013). Cloud Computing in Support of Supply Chain Information System Infrastructure: Understanding When to go to the Cloud. *Journal of Supply Chain Management, 49*(3), 25-41. doi: 10.1111/j.1745-493x.2012.03287.x

Xu, Z.-y., & Xie, Z.-h. (2010, 7-9 May 2010). *Information Technology, Supply Chain Integration and the Nature of Retail Firm.* Paper presented at the E-Business and E-Government (ICEE), 2010 International Conference.

Zacharia, Z. G., Nix, N. W., & Lusch, R. F. (2009a). An analyisis of Supply Chain Collaborations and their effect on performance outomes. *Journal of Business Logistics, 30*(2), 101-123.

Zacharia, Z. G., Nix, N. W., & Lusch, R. F. (2009b). An Analysis Of Supply Chain Collaborations And Their Effect On Performance Outcomes. *Journal of Business Logistics, 30*(2), 101-124.

Zacharia, Z. G., Sanders, N. R., & Nix, N. W. (2011). The Emerging Role of the Third-Party Logistics Provider (3PL) as an Orchestrator. *Journal of Business Logistics, 32*(1), 40-54. doi: 10.1111/j.2158-1592.2011.01004.x

Zhang, C., & Dhaliwal, J. (2009). An investigation of resource-based and institutional theoretic factors in technology adoption for operations and supply chain management. *International Journal of Production Economics, 120*(1), 252-269.

Zhang, L.-J., & Zhou, Q. (2009). *CCOA: Cloud computing open architecture.* Paper presented at the Web Services, 2009. ICWS 2009. IEEE International Conference.

Zhang, Q., Cheng, L., & Boutaba, R. (2010). Cloud computing: state-of-the-art and research challenges. *Journal of Internet Services and Applications, 1*(1), 7-18.

Zhu, K., Kraemer, K. L., & Xu, S. (2006). The process of innovation assimilation by firms in different countries: a technology diffusion perspective on e-business. *Management Science, 52*(10), 1557-1576.

# APPENDIX A
## SURVEY GEORGIA SOUTHERN UNIVERSITY 2/12 RESEARCHER VERSION

Survey on logistics managers' Perceptions of the Impact of Cloud Computing in Collaborative Relationships, Collaborative Advantage and Relational Outcomes Your opinion is important and your information will be kept confidential. Your involvement is voluntary and you can stop the survey at any point. If there are any questions or problems with the survey, or if you would like a copy of the results of the research project, please contact Maria Aviles at (912) 481-1059 or ma00278@georgiasouthern.edu. The IRB number for this study is H14302 and the contact number for the IRB at Georgia Southern University is 912-478-0843. Thank you in advance for your time and assistance.

A collaborative relationship is a joint effort with other organization that requires time and effort and cannot be done satisfactorily by one organization on its own.

| Is your principal collaborative relationship with | Intermediary | Third Party Service | Customer | Supplier |
|---|---|---|---|---|

We are interested in measuring your perceptions on the relationship you have with collaborating supply chain partners. Please circle the item that most closely approximates to your level of agreement

Relationship activities, the behavior of the firm that involve collaborative relationship increases: (Ellinger et al. 2003)

| My firm and its supply chain (SC) partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...interact on a real time basis. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...achieve goals collectively. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...develop mutual understanding of responsibilities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...informally work together. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...share ideas, information, and/or resources. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have joint teams. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...conduct joint planning to anticipate and resolve operational problems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...make joint decisions about ways to improve overall cost efficiency. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...share cost information. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of trust, the firm's reliance on customer/supplier that increases collaborative relationship: (Gibson, et al., 2002)

| Trust | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| My firm's SC partners keep the promises made. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My firm believes the information this SC partners provide us. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My firm's SC partners is genuinely concerned that we succeed. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| We trust this SC partners keeps our best interests in mind. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My firm's SC partners considers our welfare as well as its own. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My firm's SC partners is trustworthy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of communication, the firm's contact with customer/supplier increases collaborative relationship: (Jonsson & Zineldin, 2003)

| My firm' SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...keeps us informed of new developments. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...sales personnel frequently visit our place of business. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...devotes a lot of time in getting to know our staff. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...gives us opportunities to participate in goal setting to enhance performance. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

For the following items, please note your level of agreement regarding your perceptions of the collaborative advantage your firm has gained. In terms of process efficiency, the collaborative relationship of my firm increases collaborative advantage : (Cao & Zhang, 2010)

| My firm with SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...meet agreed upon unit costs in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...meet productivity standards in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...meet on-time delivery requirements in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...meet inventory requirements (finished goods) in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of offering flexibility, the collaborative relationship of my firm increases collaborative advantage : (Cao & Zhang, 2010)

| My firm with SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...offer a variety of product and services efficiently in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...offer customized products and services with different features quickly in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...meet different customer volume requirements efficiently in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have good responsiveness in comparison with industry norms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of business synergy, the collaborative relationship of my firm increases collaborative advantage : (Cao & Zhang, 2010)

| My firm and SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...have integrated IT infrastructure and IT resources. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have integrated knowledge bases and know-how. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have integrated marketing efforts. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have integrated production systems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of quality, the collaborative relationship of my firm increases collaborative advantage : (Cao & Zhang, 2010)

| My firm and SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...offer products that are highly reliable. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...offer products that are highly durable. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...offer high quality products to our customers. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have helped each other to improve product quality. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

In terms of innovation, the collaborative relationship of my firm increases collaborative advantage : (Cao & Zhang, 2010)

| My firm and SC partners | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...introduce new products and services to market quickly. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have rapid new product development. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...have time-to-market lower than industry average. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...innovate frequently. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

For the following items, please note your level of agreement regarding your perceptions of the demonstrable value that the participants have gained from collaborative relationships. Satisfaction with the relationship, the collaborative relationship of my firm increases relational outcomes(Kauser & Shaw, 2004)

| My firm is satisfied with this relationship in terms of: | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...Coordination of activities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Participation in decision making. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Level of commitment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Level of information sharing. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Management of activities. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Satisfaction with the results, the collaborative relationship of my firm increases relational outcomes (Kauser & Shaw, 2004)

| My firm is satisfied with this relationship in terms of: | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...Profitability. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Market share. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Sales growth. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Performance, the collaborative relationship of my firm increases relational outcomes (Dahistrom, et al., 1996; Knemeyer, et al., 2003)

| This relationship has: | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...Reduced our order cycle times. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Improved our order processing accuracy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Improved our on-time delivery. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Increased our forecast accuracy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Reduced our inventory. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Achieved cost reductions. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Improved our fill rate | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Increased our profitability. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

The following statements refer implementation of cloud computing in your organization. Please circle the item that describes the use of the following systems

| My firm has this type of system. If "yes" please let us know if the system is on the cloud | Yes | No | Cloud computing application | Don't Know | N/A |
|---|---|---|---|---|---|
| Order Management System (OMS) | Yes | No | Cloud | Don't Know | N/A |
| Warehouse Management Systems (WMS) | Yes | No | Cloud | Don't Know | N/A |
| Transportation Management Systems (TMS) | Yes | No | Cloud | Don't Know | N/A |
| Enterprise Resource Planning (ERP) | Yes | No | Cloud | Don't Know | N/A |
| Retail Information System (RIS) | Yes | No | Cloud | Don't Know | N/A |
| Sales Information System (SIS) | Yes | No | Cloud | Don't Know | N/A |
| Logistics Data Warehouse | Yes | No | Cloud | Don't Know | N/A |
| Other, please describe:_____ | Yes | No | Cloud | Don't Know | N/A |

| If your organization is not using cloud computing, from what you understand about cloud computing, it would: | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...Be beneficial to your organizational outcomes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

The following statements refer to the diffusion of cloud computing in your organization. Please circle the number that best reflects the extent of diffusion of cloud computing in the following: In terms of use, the proportion of cloud computing use (Zhang & Dhaliwal, 2009)

| | None/ Never | A few/ Rarely | Some/ Occasionally | Half/ Sometimes | A lot/ Frequently | Most/ Usually | All/ Every time |
|---|---|---|---|---|---|---|---|
| Proportion of total SC partners with whom you interact through cloud computing applications | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Proportion of total SC partners transactions done through cloud computing applications. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Proportion of overall interactions with SC partners through cloud computing applications | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

The following statements refer to the use of cloud computing in your organization. Please circle the number that best your organization's use of cloud computing: In terms of use, cloud computing (Sanders, 2007)

| Your firm: | Strongly Disagree | Disagree | Disagree Somewhat | Neither Agree or Disagree | Agree Somewhat | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| ...Uses cloud computing relative more compared to industry average. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Uses cloud computing relative more compared to key competitors | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Uses cloud computing relative more compared to key customers | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Uses cloud computing relative more compared to key suppliers | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ...Relies on cloud computing in conducting business processes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Now I Would Like To Ask You About your Company:

Characteristics of the respondent
Number of years worked in the company ____
Number of years experience in the industry ____
Position in the company_____

Characteristics of the respondent
Firm size Cao and Zhang 2011)(Bellingkrodt & Wallenburg, 2013)
_____(1) 1-50 employees
_____(2) 51 and 100
_____(3) 101 and 250
_____(4) 251-500
_____(5) 501 and 1000
_____(6) 1001+

Gross revenue
_____(1) Below 50
_____(2) 50 to 250
_____(3) 251 and 500
_____(4) 500 and 1000
_____(5) Over 1000

Industry group
_____(1) Manufacture
_____(2) Insurance
_____(3) Healthcare
_____(4) Logistics
_____(4)Other,  Please describe_____

THANK YOU FOR YOUR TIME AND WILLINGNESS TO PARTICIPATE IN THIS SURVEY

# APPENDIX B

## ACRONYMS USED FOR CODING ITEMS IN SUB-CONSTRUCTS

CR Collaborative Relationships

CRRA Relational Activities

CRT Trust

CRC Communication

CA Collaborative Advantage

CAPE Process Efficiency

CAOF Offering Flexibility

CABS Business Synergy

CAQ Quality

CAIInnovation

RO Relational Outcomes

ROREL Satisfaction with the Relationship

RORES Satisfaction with the Results

ROP Performance

# APPENDIX C

## MEASUREMENT ITEMS

Collaborative Relationships

CRRA_1 My firm and its supply chain (SC) partners interact on a real time basis.

CRRA_2 My firm and its supply chain (SC) partners achieve goals collectively.

CRRA_3 My firm and its supply chain (SC) partners develop mutual understanding of responsibilities.

CRRA_4 My firm and its supply chain (SC) partners informally work together. share ideas, information, and/or resources.

CRRA_5 My firm and its supply chain (SC) partners have joint teams.

CRRA_6 My firm and its supply chain (SC) partners conduct joint planning to anticipate and resolve operational problems.

CRRA_7 My firm and its supply chain (SC) partners make joint decisions about ways to improve overall cost efficiency.

CRRA_8 My firm and its supply chain (SC) partners share cost information.

CRRA_9 My firm and its supply chain (SC) partners.

MCRRA Mean collaborative relationships relational activities.

CRT_1 My firm's SC partners keep the promises made.

CRT_10 Me trust this SC partners keeps our best interests in mind.

CRT_2 My firm's SC partners is genuinely concerned that we succeed.

CRT_3 My firm's SC partners considers our welfare as well as its own.

CRT_4 My firm's SC partners is trustworthy.

CRT_9 My firm believes the information this SC partners provide us.

MCRT Mean collaborative relationships trust.

CRC_5 My firm' SC partners keeps us informed of new developments.

CRC_6 My firm' SC partners sales personnel frequently visit our place of business.

CRC_7 My firm' SC partners devotes a lot of time in getting to know our staff.

CRC_8 My firm' SC partners gives us opportunities to participate in goal setting to enhance performance.

MCRC Mean collaborative relationships relational communication.

MCR Mean of collaborative relationships sub groups means: relational activities, trust and communication.

Collaborative Advantage

CAPE_1 My firm with SC partners meet agreed upon unit costs in comparison with industry norms.

CAPE_2 My firm with SC partners meet productivity standards in comparison with industry norms.

CAPE_3 My firm with SC partners meet on-time delivery requirements in comparison with industry norms.

CAPE_4 My firm with SC partners t inventory requirements (finished goods) in comparison with industry norms.

MCAPE Mean collaborative advantage process efficiency.

CAOF_5 My firm with SC partners offer a variety of product and services efficiently in comparison with industry norms.

CAOF_6 My firm with SC partners offer customized products and services with different features quickly in comparison with industry norms.

CAOF_7 My firm with SC partners meet different customer volume requirements efficiently in comparison with industry norms.

CAOF_8 My firm with SC partners have good responsiveness in comparison with industry norms.

MCAOFMean collaborative advantage offering flexibility.

CABS_1 My firm and SC partners have integrated IT infrastructure and IT resources.

CABS_2 My firm and SC partners have integrated knowledge bases and know-how.

CABS_3 My firm and SC partners have integrated marketing efforts.

CABS_4 My firm and SC partners have integrated production systems.

CAQ_1 My firm and SC partners offer products that are highly reliable.

CAQ_2 My firm and SC partners offer products that are highly durable.

CAQ_3 My firm and SC partners offer high quality products to our customers.

CAQ_4 My firm and SC partners have helped each other to improve product quality.

CAI_5 My firm and SC partners introduce new products and services to market quickly.

CAI_6 My firm and SC partners have rapid new product development.

CAI_7 My firm and SC partners have time-to-market lower than industry average.

CAI_8 My firm and SC partners innovate frequently.

MCAI Mean collaborative advantage innovation.

MCA Mean of means collaborative advantage sub groups offering flexibility, process efficiency and innovation.

Relational Outcomes

ROREL_1 My firm is satisfied with this relationship in terms of: Coordination of activities.

ROREL_2 My firm is satisfied with this relationship in terms of: Participation in decision making.

ROREL_3 My firm is satisfied with this relationship in terms of: Level of commitment..

ROREL_4 My firm is satisfied with this relationship in terms of Level of information sharing.

ROREL_5 My firm is satisfied with this relationship in terms of: Management of activities.

MROREL Mean relational outcomes satisfaction with the relationship.

RORES_1 My firm is satisfied with this relationship in terms of: Profitability.

RORES_2 My firm is satisfied with this relationship in terms of: Market share.

RORES_3 My firm is satisfied with this relationship in terms of: Sales growth.

MRORES Mean relational outcomes satisfaction with the results.

ROP_1 This relationship has Reduced our order cycle times.

ROP_2 This relationship has Improved our order processing accuracy.

ROP_3 This relationship has Improved our on-time delivery.

ROP_4 This relationship has Increased our forecast accuracy.

ROP_5 This relationship has Reduced our inventory.

ROP_6 This relationship has Achieved cost reductions.

ROP_7 This relationship has Improved our fill rate.

ROP_8 This relationship has Increased our profitability.

MROP Mean relational outcomes performance.

MRO Mean of relational outcomes subgroup means satisfaction with the relationship, satisfaction with the results and performance.

MCRMCA Product of mean collaborative relationships and mean collaborative advantage.

MCRMRO Product of mean collaborative relationships and mean relational outcomes.

CCU Cloud computing use dummy coded

MCRCCU Product of mean collaborative relationships and cloud computing use dummy coded.

Size_cat firm size dummy code

MCRSize Product of mean collaborative relationships and firm size dummy coded

# APPENDIX D

## DISCRIMINAT VALIDITY - FACTOR ANALYSIS

| | Innovation | Offering Flexibility | Process Efficiency | Communication | Relational Activities | Trust | Performance | Satisfaction | Satisfaction |
|---|---|---|---|---|---|---|---|---|---|
| **CAI_1** | **0.897** | 0.552 | 0.494 | 0.438 | 0.426 | 0.433 | 0.456 | 0.471 | 0.539 |
| **CAI_2** | **0.878** | 0.472 | 0.448 | 0.399 | 0.366 | 0.385 | 0.434 | 0.408 | 0.424 |
| **CAI_3** | **0.782** | 0.276 | 0.348 | 0.438 | 0.378 | 0.387 | 0.356 | 0.363 | 0.388 |
| **CAI_4** | **0.831** | 0.381 | 0.388 | 0.487 | 0.462 | 0.417 | 0.360 | 0.395 | 0.477 |
| **CAOF_1** | 0.494 | **0.852** | 0.648 | 0.407 | 0.512 | 0.437 | 0.326 | 0.474 | 0.421 |
| **CAOF_2** | 0.394 | **0.855** | 0.513 | 0.407 | 0.492 | 0.471 | 0.387 | 0.474 | 0.386 |
| **CAOF_3** | 0.383 | **0.848** | 0.523 | 0.376 | 0.503 | 0.394 | 0.313 | 0.402 | 0.378 |
| **CAOF_4** | 0.441 | **0.836** | 0.650 | 0.588 | 0.652 | 0.525 | 0.533 | 0.636 | 0.350 |
| **CAPE_1** | 0.393 | 0.516 | **0.799** | 0.531 | 0.569 | 0.532 | 0.357 | 0.487 | 0.237 |
| **CAPE_2** | 0.481 | 0.590 | **0.897** | 0.579 | 0.565 | 0.601 | 0.426 | 0.584 | 0.364 |
| **CAPE_3** | 0.368 | 0.641 | **0.822** | 0.544 | 0.614 | 0.589 | 0.533 | 0.580 | 0.319 |
| **CAPE_4** | 0.428 | 0.568 | **0.826** | 0.375 | 0.416 | 0.399 | 0.385 | 0.370 | 0.227 |
| **CRC_1** | 0.468 | 0.478 | 0.549 | **0.828** | 0.531 | 0.641 | 0.457 | 0.626 | 0.386 |
| **CRC_2** | 0.274 | 0.165 | 0.250 | **0.620** | 0.198 | 0.318 | 0.189 | 0.316 | 0.230 |
| **CRC_3** | 0.449 | 0.531 | 0.512 | **0.827** | 0.656 | 0.525 | 0.404 | 0.557 | 0.325 |
| **CRC_4** | 0.406 | 0.403 | 0.530 | **0.858** | 0.721 | 0.571 | 0.458 | 0.600 | 0.339 |
| **CRRA_1** | 0.235 | 0.569 | 0.413 | 0.385 | **0.574** | 0.283 | 0.323 | 0.354 | 0.266 |
| **CRRA_2** | 0.431 | 0.597 | 0.441 | 0.551 | **0.829** | 0.571 | 0.544 | 0.655 | 0.436 |
| **CRRA_3** | 0.241 | 0.430 | 0.379 | 0.493 | **0.746** | 0.502 | 0.416 | 0.581 | 0.371 |
| **CRRA_5** | 0.437 | 0.573 | 0.446 | 0.547 | **0.800** | 0.519 | 0.375 | 0.491 | 0.351 |
| **CRRA_6** | 0.384 | 0.459 | 0.499 | 0.609 | **0.813** | 0.508 | 0.371 | 0.521 | 0.312 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CRRA_7** | 0.462 | 0.549 | 0.585 | 0.658 | **0.838** | 0.547 | 0.463 | 0.647 | 0.388 |
| **CRRA_8** | 0.411 | 0.485 | 0.666 | 0.609 | **0.844** | 0.657 | 0.554 | 0.620 | 0.440 |
| **CRRA_9** | 0.305 | 0.297 | 0.534 | 0.500 | **0.677** | 0.491 | 0.381 | 0.393 | 0.227 |
| **CRT_1** | 0.375 | 0.509 | 0.555 | 0.589 | 0.542 | **0.876** | 0.485 | 0.686 | 0.510 |
| **CRT_2** | 0.406 | 0.382 | 0.455 | 0.528 | 0.557 | **0.900** | 0.385 | 0.588 | 0.464 |
| **CRT_3** | 0.411 | 0.343 | 0.525 | 0.502 | 0.551 | **0.836** | 0.380 | 0.588 | 0.516 |
| **CRT_4** | 0.462 | 0.548 | 0.636 | 0.632 | 0.620 | **0.898** | 0.463 | 0.637 | 0.499 |
| **CRT_5** | 0.427 | 0.557 | 0.591 | 0.661 | 0.657 | **0.854** | 0.540 | 0.690 | 0.451 |
| **ROP_1** | 0.447 | 0.349 | 0.309 | 0.361 | 0.409 | 0.389 | **0.792** | 0.519 | 0.503 |
| **ROP_2** | 0.364 | 0.383 | 0.412 | 0.287 | 0.399 | 0.387 | **0.821** | 0.440 | 0.431 |
| **ROP_3** | 0.388 | 0.483 | 0.590 | 0.499 | 0.566 | 0.558 | **0.806** | 0.617 | 0.451 |
| **ROP_4** | 0.380 | 0.255 | 0.253 | 0.447 | 0.384 | 0.289 | **0.703** | 0.345 | 0.301 |
| **ROP_5** | 0.358 | 0.291 | 0.469 | 0.395 | 0.422 | 0.309 | **0.710** | 0.309 | 0.200 |
| **ROP_6** | 0.197 | 0.309 | 0.259 | 0.343 | 0.376 | 0.321 | **0.654** | 0.469 | 0.356 |
| **ROP_7** | 0.454 | 0.386 | 0.495 | 0.382 | 0.460 | 0.421 | **0.844** | 0.525 | 0.370 |
| **ROP_8** | 0.278 | 0.294 | 0.256 | 0.327 | 0.369 | 0.417 | **0.704** | 0.395 | 0.482 |
| **ROREL_1** | 0.431 | 0.539 | 0.546 | 0.585 | 0.590 | 0.574 | 0.531 | **0.883** | 0.583 |
| **ROREL_2** | 0.428 | 0.494 | 0.552 | 0.648 | 0.667 | 0.697 | 0.556 | **0.900** | 0.604 |
| **ROREL_3** | 0.413 | 0.549 | 0.576 | 0.594 | 0.641 | 0.713 | 0.612 | **0.919** | 0.612 |
| **ROREL_4** | 0.465 | 0.519 | 0.486 | 0.625 | 0.604 | 0.621 | 0.466 | **0.866** | 0.640 |
| **RORES_1** | 0.393 | 0.358 | 0.310 | 0.386 | 0.424 | 0.553 | 0.514 | 0.638 | **0.856** |
| **RORES_2** | 0.556 | 0.431 | 0.294 | 0.358 | 0.386 | 0.433 | 0.417 | 0.608 | **0.904** |
| **RORES_3** | 0.502 | 0.421 | 0.314 | 0.352 | 0.411 | 0.496 | 0.451 | 0.571 | **0.905** |

# APPENDIX E

## COLLINEARITY - VIF

| Indicators | VIF | VIF without CRRA4 | VIF without CRRA4-CRT6 | VIF without CRRA4-CRT6-ROREL5 |
|---|---|---|---|---|
| CAI_1 | 3.123 | 3.123 | 3.123 | 3.123 |
| CAI_1 | 3.801 | 3.801 | 3.801 | 3.801 |
| CAI_2 | 2.894 | 2.894 | 2.894 | 2.894 |
| CAI_2 | 3.181 | 3.181 | 3.181 | 3.181 |
| CAI_3 | 1.886 | 1.886 | 1.886 | 1.886 |
| CAI_3 | 2.342 | 2.342 | 2.342 | 2.342 |
| CAI_4 | 2.147 | 2.147 | 2.147 | 2.147 |
| CAI_4 | 2.312 | 2.312 | 2.312 | 2.312 |
| CAOF_1 | 2.168 | 2.168 | 2.168 | 2.168 |
| CAOF_1 | 3.323 | 3.323 | 3.323 | 3.323 |
| CAOF_2 | 2.279 | 2.279 | 2.279 | 2.279 |
| CAOF_2 | 2.498 | 2.498 | 2.498 | 2.498 |
| CAOF_3 | 2.173 | 2.173 | 2.173 | 2.173 |
| CAOF_3 | 2.380 | 2.380 | 2.380 | 2.380 |
| CAOF_4 | 1.999 | 1.999 | 1.999 | 1.999 |
| CAOF_4 | 2.951 | 2.951 | 2.951 | 2.951 |
| CAPE_1 | 2.149 | 2.149 | 2.149 | 2.149 |
| CAPE_1 | 2.552 | 2.552 | 2.552 | 2.552 |
| CAPE_2 | 2.965 | 2.965 | 2.965 | 2.965 |
| CAPE_2 | 3.505 | 3.505 | 3.505 | 3.505 |
| CAPE_3 | 1.947 | 1.947 | 1.947 | 1.947 |
| CAPE_3 | 2.544 | 2.544 | 2.544 | 2.544 |
| CAPE_4 | 2.037 | 2.037 | 2.037 | 2.037 |
| CAPE_4 | 2.331 | 2.331 | 2.331 | 2.331 |
| CRC_1 | 1.843 | 1.843 | 1.843 | 1.843 |
| CRC_1 | 2.618 | 2.612 | 2.593 | 2.593 |
| CRC_2 | 1.383 | 1.383 | 1.383 | 1.383 |
| CRC_2 | 1.946 | 1.852 | 1.803 | 1.803 |
| CRC_3 | 1.798 | 1.798 | 1.798 | 1.798 |
| CRC_3 | 2.702 | 2.695 | 2.630 | 2.630 |
| CRC_4 | 2.008 | 2.008 | 2.008 | 2.008 |
| CRC_4 | 3.348 | 3.328 | 3.161 | 3.161 |
| CRRA_1 | 1.418 | 1.417 | 1.417 | 1.417 |
| CRRA_1 | 1.632 | 1.632 | 1.620 | 1.620 |
| CRRA_2 | 3.014 | 2.809 | 2.809 | 2.809 |
| CRRA_2 | 3.458 | 3.147 | 3.067 | 3.067 |

| | | | | |
|---|---|---|---|---|
| CRRA_3 | 2.252 | 2.248 | 2.248 | 2.248 |
| CRRA_3 | 2.341 | 2.329 | 2.328 | 2.328 |
| CRRA_4 | 1.312 | | | |
| CRRA_4 | 1.523 | | | |
| CRRA_5 | 2.454 | 2.393 | 2.393 | 2.393 |
| CRRA_5 | 3.053 | 2.932 | 2.908 | 2.908 |
| CRRA_6 | 2.519 | 2.498 | 2.498 | 2.498 |
| CRRA_6 | 2.864 | 2.855 | 2.845 | 2.845 |
| CRRA_7 | 3.033 | 3.031 | 3.031 | 3.031 |
| CRRA_7 | 3.877 | 3.871 | 3.398 | 3.398 |
| CRRA_8 | 3.261 | 3.252 | 3.252 | 3.252 |
| CRRA_8 | 4.531 | 4.526 | 4.132 | 4.132 |
| CRRA_9 | 1.950 | 1.933 | 1.933 | 1.933 |
| CRRA_9 | 2.485 | 2.479 | 2.364 | 2.364 |
| CRT_1 | 2.994 | 2.994 | 2.988 | 2.988 |
| CRT_1 | 3.628 | 3.566 | 3.564 | 3.564 |
| CRT_2 | 3.760 | 3.760 | 3.736 | 3.736 |
| CRT_2 | 4.292 | 4.131 | 4.092 | 4.092 |
| CRT_3 | 3.977 | 3.977 | 2.794 | 2.794 |
| CRT_3 | 4.516 | 4.516 | 3.231 | 3.231 |
| CRT_4 | 3.252 | 3.252 | 3.235 | 3.235 |
| CRT_4 | 4.230 | 4.229 | 4.211 | 4.211 |
| CRT_5 | 3.612 | 3.612 | 2.629 | 2.629 |
| CRT_5 | 4.306 | 4.302 | 3.408 | 3.408 |
| CRT_6 | 4.546 | 4.546 | | |
| CRT_6 | 6.300 | 6.289 | | |
| ROP_1 | 2.528 | 2.528 | 2.528 | 2.486 |
| ROP_1 | 2.156 | 2.156 | 2.156 | 2.156 |
| ROP_2 | 3.553 | 3.553 | 3.553 | 3.537 |
| ROP_2 | 3.075 | 3.075 | 3.075 | 3.075 |
| ROP_3 | 3.351 | 3.351 | 3.351 | 3.314 |
| ROP_3 | 2.665 | 2.665 | 2.665 | 2.665 |
| ROP_4 | 2.258 | 2.258 | 2.258 | 2.213 |
| ROP_4 | 2.000 | 2.000 | 2.000 | 2.000 |
| ROP_5 | 2.393 | 2.393 | 2.393 | 2.393 |
| ROP_5 | 2.106 | 2.106 | 2.106 | 2.106 |
| ROP_6 | 1.829 | 1.829 | 1.829 | 1.828 |
| ROP_6 | 1.618 | 1.618 | 1.618 | 1.618 |
| ROP_7 | 3.510 | 3.510 | 3.510 | 3.450 |
| ROP_7 | 2.967 | 2.967 | 2.967 | 2.967 |
| ROP_8 | 2.316 | 2.316 | 2.316 | 2.303 |
| ROP_8 | 1.733 | 1.733 | 1.733 | 1.733 |
| ROREL_1 | 2.873 | 2.873 | 2.873 | 2.857 |
| ROREL_1 | 2.733 | 2.733 | 2.733 | 2.709 |
| ROREL_2 | 4.279 | 4.279 | 4.279 | 4.169 |

| | | | | |
|---|---|---|---|---|
| ROREL_2 | 3.534 | 3.534 | 3.534 | 3.298 |
| ROREL_3 | 5.461 | 5.461 | 5.461 | 4.525 |
| ROREL_3 | 4.191 | 4.191 | 4.191 | 3.669 |
| ROREL_4 | 3.264 | 3.264 | 3.264 | 3.083 |
| ROREL_4 | 2.848 | 2.848 | 2.848 | 2.528 |
| ROREL_5 | 5.043 | 5.043 | 5.043 | |
| ROREL_5 | 4.030 | 4.030 | 4.030 | |
| RORES_1 | 1.803 | 1.803 | 1.803 | 1.803 |
| RORES_1 | 2.936 | 2.936 | 2.936 | 2.932 |
| RORES_2 | 2.874 | 2.874 | 2.874 | 2.874 |
| RORES_2 | 4.156 | 4.156 | 4.156 | 3.661 |
| RORES_3 | 2.883 | 2.883 | 2.883 | 2.883 |
| RORES_3 | 3.816 | 3.816 | 3.816 | 3.703 |

# APPENDIX F

## INDEPENDENT T-TEST RESULTS FOR CLOUD COMPUTING USERS AND NONUSERS

Group Statistics

| | CCU | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| MCRRA | CCU | 41 | 5.634 | 1.019 | .159 |
| | NoCCU | 49 | 5.354 | 1.068 | .152 |
| MCRT | CCU | 41 | 5.761 | .861 | .134 |
| | NoCCU | 49 | 5.289 | 1.164 | .166 |
| MCRC | CCU | 41 | 5.231 | 1.128 | .176 |
| | NoCCU | 49 | 4.663 | 1.175 | .167 |
| MCAPE | CCU | 41 | 5.317 | 1.157 | .180 |
| | NoCCU | 49 | 5.137 | 1.066 | .152 |
| MCAOF | CCU | 41 | 5.603 | 1.067 | .166 |
| | NoCCU | 49 | 5.423 | 1.098 | .156 |
| MCAI | CCU | 41 | 4.811 | 1.330 | .207 |
| | NoCCU | 49 | 4.433 | 1.231 | .175 |
| MROREL | CCU | 41 | 5.542 | 1.024 | .160 |
| | NoCCU | 49 | 5.280 | 1.150 | .164 |
| MRORES | CCU | 41 | 5.056 | 1.196 | .186 |
| | NoCCU | 49 | 4.972 | 1.094 | .156 |
| MROP | CCU | 41 | 4.899 | 1.204 | .188 |
| | NoCCU | 49 | 4.719 | .896 | .128 |
| MCR | CCU | 41 | 5.542 | .914 | .142 |
| | NoCCU | 49 | 5.102 | .971 | .138 |
| MCA | CCU | 41 | 5.243 | 1.050 | .164 |
| | NoCCU | 49 | 4.998 | .898 | .128 |
| MRO | CCU | 41 | 5.166 | 1.018 | .159 |
| | NoCCU | 49 | 4.990 | .887 | .126 |
| MCRMCA | CCU | 41 | 29.754 | 9.666 | 1.509 |
| | NoCCU | 49 | 26.154 | 7.994 | 1.142 |
| MCRMRO | CCU | 41 | 29.281 | 9.331 | 1.457 |
| | NoCCU | 49 | 26.155 | 8.219 | 1.174 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| MCRRA | Equal variances assumed | .066 | .799 | 1.262 | 88 | .210 | .279 | .221 | -.160 | .719 |
| | Equal variances not assumed | | | 1.267 | 86.453 | .209 | .279 | .220 | -.159 | .718 |
| MCRT | Equal variances assumed | 2.971 | .088 | 2.145 | 88 | .035 | .471 | .219 | .034 | .907 |
| | Equal variances not assumed | | | 2.203 | 86.788 | .030 | .471 | .213 | .045 | .896 |
| MCRC | Equal variances assumed | .303 | .583 | 2.327 | 88 | .022 | .568 | .244 | .082 | 1.053 |
| | Equal variances not assumed | | | 2.335 | 86.316 | .022 | .568 | .243 | .084 | 1.052 |
| MCAPE | Equal variances assumed | .344 | .559 | .764 | 88 | .447 | .179 | .234 | -.287 | .645 |
| | Equal variances not assumed | | | .758 | 82.374 | .450 | .179 | .236 | -.291 | .649 |
| MCAOF | Equal variances assumed | .137 | .712 | .785 | 88 | .435 | .180 | .229 | -.276 | .636 |
| | Equal variances not assumed | | | .787 | 85.998 | .434 | .180 | .228 | -.275 | .635 |
| MCAI | Equal variances assumed | 1.156 | .285 | 1.395 | 88 | .167 | .377 | .270 | -.160 | .914 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | 1.385 | 82.555 | .170 | .377 | .272 | -.164 | .919 |
| MROREL | Equal variances assumed | .925 | .339 | 1.130 | 88 | .261 | .262 | .231 | -.198 | .722 |
| | Equal variances not assumed | | | 1.142 | 87.641 | .256 | .262 | .229 | -.193 | .718 |
| MRORES | Equal variances assumed | .464 | .497 | .348 | 88 | .729 | .084 | .241 | -.396 | .564 |
| | Equal variances not assumed | | | .345 | 82.077 | .731 | .084 | .243 | -.400 | .568 |
| MROP | Equal variances assumed | 3.632 | .060 | .812 | 88 | .419 | .180 | .221 | -.260 | .620 |
| | Equal variances not assumed | | | .791 | 72.651 | .432 | .180 | .227 | -.273 | .633 |
| MCR | Equal variances assumed | .083 | .774 | 2.196 | 88 | .031 | .439 | .200 | .041 | .837 |
| | Equal variances not assumed | | | 2.208 | 86.751 | .030 | .439 | .199 | .043 | .835 |
| MCA | Equal variances assumed | 1.237 | .269 | 1.196 | 88 | .235 | .245 | .205 | -.162 | .653 |
| | Equal variances not assumed | | | 1.179 | 79.237 | .242 | .245 | .208 | -.168 | .660 |
| MRO | Equal variances assumed | .765 | .384 | .873 | 88 | .385 | .175 | .200 | -.223 | .574 |
| | Equal variances not assumed | | | .862 | 80.040 | .391 | .175 | .203 | -.229 | .580 |
| MCRMCA | Equal variances assumed | 1.618 | .207 | 1.934 | 88 | .056 | 3.59 | 1.861 | -.099 | 7.298 |
| | Equal variances not assumed | | | 1.902 | 77.685 | .061 | 3.59 | 1.892 | -.169 | 7.368 |
| MCRMRO | Equal variances assumed | .490 | .486 | 1.689 | 88 | .095 | 3.125 | 1.850 | -.551 | 6.803 |
| | Equal variances not assumed | | | 1.670 | 80.514 | .099 | 3.125 | 1.871 | -.598 | 6.850 |

# APPENDIX G

## INDEPENDENT T-TEST RESULTS FOR LARGE FIRMS

Group Statistics

| | CCU | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| MCRRA | CCU | 22 | 5.716 | 1.037 | .221 |
| | NoCCU | 23 | 5.359 | 1.176 | .245 |
| MCRT | CCU | 22 | 5.882 | .706 | .150 |
| | NoCCU | 23 | 5.270 | 1.251 | .261 |
| MCRC | CCU | 22 | 5.080 | 1.299 | .277 |
| | NoCCU | 23 | 4.739 | 1.181 | .246 |
| MCAPE | CCU | 22 | 5.466 | .904 | .193 |
| | NoCCU | 23 | 5.033 | 1.051 | .219 |
| MCAOF | CCU | 22 | 5.773 | .938 | .200 |
| | NoCCU | 23 | 5.272 | 1.074 | .224 |
| MCAI | CCU | 22 | 4.852 | 1.184 | .253 |
| | NoCCU | 23 | 4.478 | 1.467 | .306 |
| MROREL | CCU | 22 | 5.545 | 1.034 | .220 |
| | NoCCU | 23 | 5.293 | 1.150 | .240 |
| MRORES | CCU | 22 | 5.061 | 1.158 | .247 |
| | NoCCU | 23 | 5.043 | 1.236 | .258 |
| MROP | CCU | 22 | 4.949 | 1.196 | .255 |
| | NoCCU | 23 | 4.620 | 1.035 | .216 |
| MCR | CCU | 22 | 5.559 | .933 | .199 |
| | NoCCU | 23 | 5.122 | 1.067 | .222 |
| MCA | CCU | 22 | 5.364 | .828 | .176 |
| | NoCCU | 23 | 4.928 | 1.019 | .213 |
| MRO | CCU | 22 | 5.185 | .999 | .213 |
| | NoCCU | 23 | 4.986 | .957 | .199 |
| MCRMCA | CCU | 22 | 30.361 | 9.035 | 1.926 |
| | NoCCU | 23 | 26.081 | 9.222 | 1.923 |
| MCRMRO | CCU | 22 | 29.338 | 9.581 | 2.043 |
| | NoCCU | 23 | 26.390 | 9.427 | 1.966 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| MCRRA | Equal variances assumed | .213 | .647 | 1.079 | 43.000 | .287 | .357 | .331 | -.311 | 1.025 |
| | Equal variances not assumed | | | 1.082 | 42.722 | .285 | .357 | .330 | -.309 | 1.023 |
| MCRT | Equal variances assumed | 5.640 | .022 | 2.009 | 43.000 | .051 | .612 | .305 | -.002 | 1.227 |
| | Equal variances not assumed | | | 2.033 | 35.002 | .050 | .612 | .301 | .001 | 1.224 |
| MCRC | Equal variances assumed | .133 | .717 | .921 | 43.000 | .362 | .340 | .370 | -.405 | 1.086 |
| | Equal variances not assumed | | | .919 | 42.173 | .364 | .340 | .371 | -.407 | 1.088 |
| MCAPE | Equal variances assumed | .687 | .412 | 1.480 | 43.000 | .146 | .433 | .293 | -.157 | 1.024 |
| | Equal variances not assumed | | | 1.485 | 42.538 | .145 | .433 | .292 | -.155 | 1.022 |
| MCAOF | Equal variances assumed | .830 | .367 | 1.664 | 43.000 | .103 | .501 | .301 | -.106 | 1.108 |
| | Equal variances not assumed | | | 1.669 | 42.663 | .103 | .501 | .300 | -.105 | 1.107 |
| MCAI | Equal variances assumed | .206 | .652 | .938 | 43.000 | .353 | .374 | .399 | -.430 | 1.178 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | .943 | 41.841 | .351 | .374 | .397 | -.427 | 1.175 |
| MROREL | Equal variances assumed | .513 | .478 | .772 | 43.000 | .444 | .252 | .326 | -.406 | .910 |
| | Equal variances not assumed | | | .774 | 42.844 | .443 | .252 | .326 | -.405 | .909 |
| MRORES | Equal variances assumed | .023 | .879 | .048 | 43.000 | .962 | .017 | .357 | -.704 | .738 |
| | Equal variances not assumed | | | .048 | 42.982 | .962 | .017 | .357 | -.703 | .737 |
| MROP | Equal variances assumed | .520 | .475 | .989 | 43.000 | .328 | .329 | .333 | -.342 | 1.001 |
| | Equal variances not assumed | | | .986 | 41.521 | .330 | .329 | .334 | -.345 | 1.003 |
| MCR | Equal variances assumed | .413 | .524 | 1.459 | 43.000 | .152 | .437 | .299 | -.167 | 1.040 |
| | Equal variances not assumed | | | 1.463 | 42.669 | .151 | .437 | .298 | -.165 | 1.039 |
| MCA | Equal variances assumed | .856 | .360 | 1.571 | 43.000 | .123 | .436 | .278 | -.124 | .996 |
| | Equal variances not assumed | | | 1.579 | 41.914 | .122 | .436 | .276 | -.121 | .994 |
| MRO | Equal variances assumed | .050 | .823 | .684 | 43.000 | .498 | .199 | .292 | -.389 | .787 |
| | Equal variances not assumed | | | .683 | 42.664 | .498 | .199 | .292 | -.389 | .788 |
| MCRMCA | Equal variances assumed | .036 | .850 | 1.572 | 43.000 | .123 | 4.280 | 2.723 | -1.212 | 9.772 |
| | Equal variances not assumed | | | 1.572 | 42.973 | .123 | 4.280 | 2.722 | -1.209 | 9.769 |
| MCRMRO | Equal variances assumed | .001 | .978 | 1.041 | 43.000 | .304 | 2.949 | 2.834 | -2.766 | 8.663 |
| | Equal variances not assumed | | | 1.040 | 42.837 | .304 | 2.949 | 2.835 | -2.769 | 8.666 |

# APPENDIX H

## INDEPENDENT T-TEST RESULTS FOR SMALL FIRMS

Group Statistics

| | | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| MCRRA | CCU | 19 | 5.539 | 1.020 | .234 |
| | NoCCU | 26 | 5.351 | .987 | .194 |
| MCRT | CCU | 19 | 5.621 | 1.015 | .233 |
| | NoCCU | 26 | 5.308 | 1.106 | .217 |
| MCRC | CCU | 19 | 5.408 | .894 | .205 |
| | NoCCU | 26 | 4.596 | 1.190 | .233 |
| MCAPE | CCU | 19 | 5.145 | 1.403 | .322 |
| | NoCCU | 26 | 5.231 | 1.093 | .214 |
| MCAOF | CCU | 19 | 5.408 | 1.197 | .275 |
| | NoCCU | 26 | 5.558 | 1.123 | .220 |
| MCAI | CCU | 19 | 4.763 | 1.515 | .348 |
| | NoCCU | 26 | 4.394 | 1.008 | .198 |
| MROREL | CCU | 19 | 5.539 | 1.042 | .239 |
| | NoCCU | 26 | 5.269 | 1.175 | .230 |
| MRORES | CCU | 19 | 5.053 | 1.273 | .292 |
| | NoCCU | 26 | 4.910 | .973 | .191 |
| MROP | CCU | 19 | 4.842 | 1.246 | .286 |
| | NoCCU | 26 | 4.808 | .764 | .150 |
| MCR | CCU | 19 | 5.523 | .918 | .211 |
| | NoCCU | 26 | 5.085 | .900 | .177 |
| MCA | CCU | 19 | 5.105 | 1.270 | .291 |
| | NoCCU | 26 | 5.061 | .792 | .155 |
| MRO | CCU | 19 | 5.145 | 1.067 | .245 |
| | NoCCU | 26 | 4.996 | .840 | .165 |
| MCRMCA | CCU | 19 | 29.052 | 10.556 | 2.422 |
| | NoCCU | 26 | 26.220 | 6.919 | 1.357 |
| MCRMRO | CCU | 19 | 29.215 | 9.296 | 2.133 |
| | NoCCU | 26 | 25.948 | 7.171 | 1.406 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| MCRRA | Equal variances assumed | .001 | .972 | .624 | 43.000 | .536 | .189 | .302 | -.421 | .798 |
| | Equal variances not assumed | | | .621 | 38.202 | .538 | .189 | .304 | -.426 | .803 |
| MCRT | Equal variances assumed | .118 | .733 | .971 | 43.000 | .337 | .313 | .323 | -.337 | .964 |
| | Equal variances not assumed | | | .985 | 40.712 | .331 | .313 | .318 | -.330 | .956 |
| MCRC | Equal variances assumed | 2.555 | .117 | 2.500 | 43.000 | .016 | .812 | .325 | .157 | 1.467 |
| | Equal variances not assumed | | | 2.612 | 42.946 | .012 | .812 | .311 | .185 | 1.438 |
| MCAPE | Equal variances assumed | 2.392 | .129 | -.231 | 43.000 | .818 | -.086 | .372 | -.836 | .664 |
| | Equal variances not assumed | | | -.223 | 32.859 | .825 | -.086 | .387 | -.873 | .701 |
| MCAOF | Equal variances assumed | .100 | .753 | -.430 | 43.000 | .669 | -.150 | .348 | -.853 | .553 |
| | Equal variances not assumed | | | -.426 | 37.458 | .673 | -.150 | .352 | -.863 | .563 |
| MCAI | Equal variances assumed | 4.768 | .034 | .981 | 43.000 | .332 | .369 | .376 | -.389 | 1.127 |
| | Equal variances not assumed | | | .923 | 29.320 | .364 | .369 | .400 | -.448 | 1.186 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MROREL | Equal variances assumed | .510 | .479 | .799 | 43.000 | .429 | .270 | .338 | -.412 | .952 |
| | Equal variances not assumed | | | .814 | 41.310 | .420 | .270 | .332 | -.400 | .940 |
| MRORES | Equal variances assumed | 1.236 | .273 | .426 | 43.000 | .673 | .142 | .335 | -.532 | .817 |
| | Equal variances not assumed | | | .408 | 32.404 | .686 | .142 | .349 | -.568 | .853 |
| MROP | Equal variances assumed | 3.164 | .082 | .115 | 43.000 | .909 | .034 | .300 | -.571 | .640 |
| | Equal variances not assumed | | | .107 | 27.751 | .916 | .034 | .323 | -.627 | .696 |
| MCR | Equal variances assumed | .002 | .962 | 1.598 | 43.000 | .117 | .438 | .274 | -.115 | .990 |
| | Equal variances not assumed | | | 1.593 | 38.502 | .119 | .438 | .275 | -.118 | .994 |
| MCA | Equal variances assumed | 6.378 | .015 | .144 | 43.000 | .886 | .044 | .308 | -.576 | .665 |
| | Equal variances not assumed | | | .134 | 28.043 | .894 | .044 | .330 | -.632 | .721 |
| MRO | Equal variances assumed | .889 | .351 | .524 | 43.000 | .603 | .149 | .284 | -.424 | .722 |
| | Equal variances not assumed | | | .505 | 33.107 | .617 | .149 | .295 | -.451 | .749 |
| MCRMCA | Equal variances assumed | 3.504 | .068 | 1.087 | 43.000 | .283 | 2.832 | 2.605 | -2.421 | 8.085 |
| | Equal variances not assumed | | | 1.020 | 29.016 | .316 | 2.832 | 2.776 | -2.845 | 8.510 |
| MCRMRO | Equal variances assumed | .603 | .442 | 1.332 | 43.000 | .190 | 3.267 | 2.453 | -1.680 | 8.215 |
| | Equal variances not assumed | | | 1.279 | 32.617 | .210 | 3.267 | 2.555 | -1.933 | 8.467 |