IT'S A MATTER OF GIVE AND TAKE: EXPLORING THE ROLE OF KNOWLEDGE TRANSFER WITHIN SUPPLY CHAIN COLLABORATION

By

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Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

May 2014

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Dedication

This is dedicated to my Lord and Savior Jesus Christ, without his constant presence and guidance this dissertation would never have been written.

Acknowledgements

I would like to first give thanks and express my love for my ever-enduring husband, Rex. He has stood beside me through all of the trials that went along with receiving each academic degree. This dissertation must have been the most challenging time for him in our marriage and yet he stood beside me encouraging and cheering me onward at every step along the way.

To my children, thank you for your support and laughter that I needed to get through the program. Keep following your dreams.

To my mom and my mother and father-in law, thank you so much for your support, understanding and the example that you set for me of how to be part of a strong family.

To my dissertation advisor, Edmund Prater, I want to say "thank you." I don't know exactly how to express my gratitude but only to say that I couldn't have done it without you, your empathy, and, perhaps most importantly, your tolerance for strong willed women.

Lastly, I want to show my appreciation for the advice and guidance of my committee, Greg Frazier, Mary Whiteside and Zach Zacharia. You have been great mentors to me and provided me with direction to keep me on the right path and always looking forward. It has been a great privilege to work with such dedicated faculty and with those that genuinely care about their students.

April 16, 2014

Abstract

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Firm interdependence within supply chains continues to grow. This is driven by the need to leverage tangible and intangible resources within the supply chain for innovation, process management, customer satisfaction and meeting diverse stakeholder expectations. This research expands our understanding of supply chain collaboration by introducing new knowledge-based constructs that operationalize the abilities of a firm to transfer knowledge. These abilities are referred to as distributive capabilities. The distributive capabilities of an organization represent its ability to transfer commercially relevant knowledge through collaboration to a known recipient firm. Earlier research in this domain has focused on the abilities of a recipient to absorb knowledge and has blurred the roles of the source and recipient. This research disentangles these roles by

providing evidence that source capabilities to transfer knowledge are separate and distinct from the absorptive capacity of the recipient. Additionally, it is shown that distributive capabilities have direct and significant affects on levels of collaborative engagement between supply chain partners and indirect and significant affects on collaborative performance outcomes. Research in this area can increase our understanding of the knowledge transfer process and how that process can be proactively managed in order to reduce complexity and uncertainty in the supply chain.

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Chapter 1

Introduction

1.1 Research Problem

Faced with increasing environmental uncertainty and product complexity firm interdependence is growing as companies work together toward supply chain innovation, process management, and meeting diverse stakeholder expectations (Grant & Baden-Fuller, 2004; Mitchell & Singh, 1996; Teece, Pisano, & Shuen, 1997; Vargo & Lusch, 2004). Supply chain collaboration is a means by which firms are able to exploit the knowledge of both partners in order to manage and reduce uncertainty and address complexity (Patel, Terjesen & Li, 2012; Zacharia, Nix & Lusch, 2011). Ultimately, cooperation and collaboration allow supply chain partners to leverage an important intangible resource, supply chain knowledge (Craighead, Hult & Ketchen, 2009). "Knowledge is the most sought after remedy for uncertainty" (Davenport & Prusak, 1998). This research suggests that current literature provides an asymmetrical view of supply chain collaboration and posits a new knowledge transfer construct in order to promote a more holistic view of the collaborative process.

This paper builds upon and expands the work by Zacharia et al. (2011) by presenting a study of collaborations that is focused on how firms can improve operational and relational outcomes by managing knowledge within their supply chains. Expanding upon the model theorized by Zacharia et al. (2011), this

research suggests that a dimension of knowledge transfer is missing from their model. Based on a detailed review of the literature and 43 executive interviews across 30 industries (by SIC code), it is proposed that the model is lacking a construct to represent the ability of the knowledge holder (source) to share its knowledge with a supply chain partner (recipient). To clarify, the model presented in Zacharia et al. (2011) specifies two knowledge transfer dimensions collaborative process competence (CPC) and absorptive capacity (AC). These dimensions are presented in the model as the knowledge sharing abilities of a single recipient firm. However, knowledge transfer is dependent upon both a source and recipient of knowledge (Nonaka, 1994; Szulanski, 1996). Accordingly, it is necessary to consider the characteristics and abilities of both parties in such a dyadic relationship (De Vries, van den Hooff & de Ridder, 2006; Grant, 1996).

Supply chain management (SCM) literature borrows knowledge transfer constructs from other streams of research such as organizational theory and strategy (Hult, Ketchen & Slater, 2004) in order to study the behaviors of supply chain partners. While those streams of literature acknowledge the importance of organizational skills to seek out and absorb knowledge (AC), there is little written about the ability of a firm to share knowledge (Kuiken & van der Sijde, 2011; Tang, Mu & MacLachlan, 2010). Understandably, SCM literature is also lacking a parsimonious construct that encapsulates the abilities of a source to share

knowledge. Accordingly, this research is an attempt to introduce the role of the source into supply chain collaboration research and present a symmetrical and holistic view of supply chain collaboration by presenting a model that includes both the characteristics of a recipient and a source. This research will also show that while there is a scholarly interest in the abilities of a source to share knowledge, that interest has focused on the source's ability to disseminate knowledge, while it is proposed here that the source's role in knowledge transfer is greater than mere dissemination.

Based on the review of the literature and executive interviews, a new dimension to the composition of knowledge transfer is proposed: distributive capability (DC). *Distributive capability is conceptualized as the ability of a knowledge holder to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes.* The primary interest of this paper is the significance of knowledge transfer, how knowledge is transferred between supply chain partners, and what roles DC and AC play in the transfer. The primary motivation for this research is a theoretical gap in research where the key concepts of absorptive capacity, disseminative capacity, collaborative process competence and organizational knowledge transfer intersect. During the analysis of these four concepts it became evident that a systematic theoretical analysis of the role played by the source in supply chain collaborations did not exist.

There is a well-established body of literature supporting the role and abilities of the recipient in supply chain knowledge transfer transactions (e.g. AC) (Azadegan & Dooley, 2010; Cheung, Myers & Mentzer, 2010; Cohen & Levinthal, 1990; Lane & Lubatkin, 1998; Patel et al., 2012; Zahra & George, 2002; Zho, Huo, Selen &Yeung, 2011). And, although knowledge-based variables that affect supply chain collaborations have been suggested (such as AC, disseminative ability, and collaborative process competence) (Barratt, 2004; Cao & Zhang, 2011; Fugate, Stank & Mentzer, 2009; Wagner, 2012; Zacharia et al., 2011), there are few studies that examine how the abilities of the source affect an organization's ability to engage in collaborative activities that effectuate the successful transfer of knowledge between firms (Easterby-Smith, Lyles & Tsang, 2008; Mu, Tang & Maclachlan, 2010; Reagans & McEvily 2003).

Although disseminative ability has been proposed as a knowledge transfer component there is little consensus on its role as a dimension of knowledge transfer (Kuiken & Sijde, 2011; Oppat, 2008; Niedergassel, 2011). There are few empirical studies that include this construct and it has yet to be operationalized in a holistic model of knowledge transfer. It is proposed in this paper that the construct has not found widespread acceptance due to difficulties in its operationalization (Kuiken & Sijde, 2011; Oppat, 2008; Niedergassel, 2011). Further, based on this research, it is also suggested that the abilities that allow a

firm to disseminate knowledge are part of the construct theorized in this research as DC.

For clarity it is important to state that this paper does not suggest that supply collaboration is a one-way flow of knowledge between a source and recipient, but rather a reciprocal and iterative process with at least two parties (Oppat, 2008). Supply chain collaborations represent vibrant and dynamic relationships between firms during which a two-way flow of knowledge, that is iteratively exchanging knowledge back and forth (Minbaeva, 2007), is utilized to exploit current knowledge and create new knowledge. However, it is critical to acknowledge that collaborations exist to fill some perceived need within one or more of the collaborative organizations. Many times there is a tendency for the CE to be spawned by a unilateral need e.g. an organization that needs an improved forecasting system may engage a consultant firm to assist in implementing a new system or a firm designing a new product needs engineering expertise that is not available internally may seek out a firm that has the necessary expertise. In these types of situations, it is important for supply chain managers to understand the knowledge transfer abilities of both parties in order to better manage the process and ensure they glean the most advantage from the relationship. This research provides managers a practical understanding of knowledge transfer dimensions and how they effect supply chain collaboration

and provides academics with a new knowledge-based construct with which to study supply chain activities.

It is apparent from a review of the literature that the roles of the knowledge source and recipient sometimes become blurred (Ardichvilli, Page & Wentling, 2003; De Vries et al., 2006; Spekman, Salmond & Lambe, 1997). Knowledge sharing is a process where organizations mutually trade or create knowledge. Accordingly, De Vries et al. (2006) suggest that all knowledge sharing behavior involves giving and getting knowledge. This mutual exchange can lead to confusing results. For example, the hypothesized significance of AC was not found when AC was tested in relation to: collaborative engagement (CE) (Zacharia et al., 2011); the fuzzy front end in new product development (Wagner, 2012); nor to improved cycle time (Hult et al., 2004). These results were surprising due to the strong face validity of the propositions and literature support. In each case, the AC that was tested was that of the focal firm and not of their supply chain partner. Further confusion is found in the literature in Lane & Lubatkin (1998). These authors proposed a reconceptualization of AC as a dyad level learning construct such that it is dependent upon certain characteristics of the source ***and*** certain characteristics of the recipient of knowledge. In this example, the AC of the recipient is confounded with the proposed DC of the source.

This blurring of behaviors and characteristics is understandable because organizations can perform both roles and in some cases perform both simultaneously (Davenport & Prusak, 1998). It is common for firms to participate in CE where they both supply knowledge and receive knowledge that is not internally available. For example, one executive interviewed shared an interesting experience about knowledge transfer when he was the VP of Marketing for a large multi-national baby supplies manufacturer. The company was a well-known branded manufacturer of baby toys, furniture and supplies. As a result of environmental pressures they decided to redesign one of their products, however, they did not have the internal expertise necessary for the design. Accordingly, they sought out the assistance of pediatricians to help them design the product. The manufacturer needed the pediatricians' expertise regarding how baby's progress from crawling to walking and how certain baby products assist in or detract from babies making this transition. Notably, the pediatricians' did not understand the nuances of manufacturing the products they were asked to help develop. In this case, the manufacturer played the role of the knowledge recipient as they needed the expertise of the pediatricians and they played the role of knowledge source as they needed to educate the pediatricians as to what was possible and/or not possible with regard to manufacturing and distributing the new product. This collaboration resulted in what the executive called "the baby product of the decade."

In an attempt to present the roles and characteristics of the knowledge holder (source) and knowledge seeker (recipient) in a clear, consistent and concise manner, this paper adopts a naming convention to simply use "source" and "recipient." These terms are representative of those used in organizational theory regarding knowledge transfer and knowledge management (Cohen & Levinthal, 1990; Davenport & Prusak, 1998; Gupta & Govindarajan, 2000; Michailova & Husted, 2003; Minbaeva & Michailova, 2004; Szulanski, 1996; Teece, 1977). They are also frequently used in multi-national corporation (MNC) literature as these terms as used to discuss the capacity of expatriates to share knowledge within the firm (Minbaeva & Michailova, 2004). More specifically these terms are used and defined as follows:

> *Sources* are those organizations that have substantial specialized commercial knowledge, based on expert knowledge and/or experience (Davenport & Prusak, 1998). This knowledge is rare and inimitable and is based on the collective intellectual capital available to the firm. Sources have the discretionary power to decide whether or not to share this knowledge with other firms. Additionally, sources' insights, judgments and/or understanding are perceived as useful to other firms.
>
> *Recipients* are those organizations that are looking for specialized knowledge for commercial application. They have an identified need that must be filled by knowledge that is not available within their firm. Accordingly, they seek out firms that they perceive to have the knowledge needed along with the ability and willingness to share that knowledge with others.

The primary goal of these distinctions is to clearly differentiate the two roles and an added benefit is improved parsimony in the wording of research

questions and hypotheses. From this point forward, this research will refer to sources and recipients. The preceding descriptions of both will be the assumed for all references to each.

1.2 Research Questions

This paper focuses on the firm as the primary unit of analysis. The firm is the proper unit of analysis for this paper because this paper explores the macro elements of supply chain collaboration: organizational antecedents and knowledge sharing outcomes (Foss, Husted & Michailova, 2010). Additionally, for the purposes of this research the firm is utilized as the unit of analysis in order to view the knowledge-based constructs used in this paper as functions of the firm, or as the collective skills that exceed the abilities of individuals (Nonaka, 1994; Spender, 1996). This paper ventures to better understand the effect of the source and recipient's knowledge transfer abilities at the firm level in collaborative supply chain activities. Effectually, it attempts to disentangle the effects of AC and DC in CE and collaborative outcomes.

Through empirical analysis this paper achieves several objectives:

- Provide a synthesis of the literature on supply chain collaboration and knowledge transfer.
- Conceptualize a holistic framework for strategic supply chain collaboration.
- Examine the potential interactive effects of AC (recipient) and DC (source) on levels of CE and the resulting operational and relational outcomes.

Good supply chain theory helps to close the gap between "what we know" and "what we need to know" (Ketchen and Hult, 2011). Toward that end and addressing "what we need to know," this paper investigates the following research questions:

The initial step in the research, qualitative executive interviews, addresses the first question:

1. What characteristics constitute the ability of a source to successfully transfer knowledge?

Research questions 2 through 7 are addressed using a survey methodology:

2. Is the source's DC related to increased levels of CE in supply chain activities between firms?

3. Is the source's DC positively related to operational and relational outcomes in supply chain collaborations?

4. Does the source's DC play a moderating role on the affect of the recipient's AC within the collaboration model?

5. Is the recipient's AC related to increased levels of CE in supply chain activities between firms?

6. Is the recipient's AC positively related to operational and relational outcomes in supply chain collaborations?

7. Does the recipient's AC play a moderating role on the affect of source's DC on collaborative operational and relational outcomes?

8. Can the results of Zacharia et al., 2011 be replicated as they pertain to perceived interdependence (PI) and collaborative engagement (CE)?

For clarity and in support of this proposal a table showing the association between the research questions, theoretical bases and hypotheses is presented in Appendix A.

1.3 Significance of this Research

There are few empirical studies on supply chain knowledge sharing and collaboration (Li, Tarafdar & Rao, 2012). Nonetheless, empirical research on supply chain collaboration is important because it can increase our understanding of the knowledge transfer process and how that process can be proactively managed in order to promote positive operational and relational outcomes. Supply chain knowledge and innovation that is not shared with supply chain partners has little value (Argote & Ingram, 2000) therefore it is imperative that research provides managers ideas to improve knowledge sharing.

This research gives managers and academics a holistic view of knowledge transfer within supply chain collaboration by introducing the role of the source. Difficulties in inter-organizational knowledge management are caused by the lack of clear understanding about its dimensions and antecedents (Li et al., 2012). Due to its social complexity and path dependence supply chain wide collaboration is difficult to replicate by other firms and is therefore likely to be the source of inter-firm competitive advantage (Gold, Seuring & Beske, 2010). This concept is not only important in interorganizational supply chain coordination, it is important to help managers leverage a firm's core competences across its business units, especially in complex global corporations (Ghoshal & Bartlett, 1995).

One executive interviewed shared a failed attempt at knowledge sharing. She said, "the information was so complex that we all just left scratching our heads." This is an indicator that firms would benefit from better understanding their internal capabilities to engage in internal knowledge transfer. With this type of insight firms can develop a level of self-awareness regarding their knowledge bases and proactively manage these resources within the firm (Lane & Lubatkin, 1998). Part of this self-awareness is to understand the firm's strengths and weaknesses as they pertain to AC and DC. "Combining information…leads not only to new information but also to new understanding. This fact highlights the role of *information distribution* [emphasis added] as a precursor to aspects of organizational learning that involve information interpretation" (Huber 1991).

This paper describes the theoretical foundations undergirding this research and includes a literature review of knowledge transfer and supply chain collaboration, and a presentation of the overall conceptual framework and 10 hypotheses. The paper then provides a discussion of the methodology, sample set, and survey used to test the hypotheses. In conclusion, this paper provides a discussion and implications of the empirical results, limitations of this study and resulting ideas for future research.

Specifically, chapter 2 presents the theoretical foundation for this research. The chapter focuses on three theories: the resource-based view (RBV); the knowledge-based view (KBV) and the relational view of joint competitive

advantage (RV) of the firm. The basic pillars of theoretical support are presented for each assertion framing this research about supply chain collaboration and knowledge transfer.

Chapter 3 presents the conceptual framework for strategic supply chain collaboration that is the focus of this paper. The chapter begins by presenting a review of supply chain collaboration literature and introduces the research and collaborative model of Zacharia et al. (2011). The model tested is an expansion Zacharia et al.'s model (2011). This expansion incorporates the roles of the source (DC) and the recipient (AC) to further understand the impact of knowledge transfer between organizations engaged in collaborative activities.

Once the model is introduced a detailed discussion of each construct, including its theoretical basis and supporting literature, is presented and used as the foundation for the relationships proposed in the model. The result is the development of 10 hypotheses.

The research methodology is presented in Chapter 4. This section describes the initial interviews with executives that are used as a basis for scale development to be used in the measurement instrument, a survey. A survey is utilized to gather data regarding supply chain collaboration and, more specifically, knowledge transfer within the supply chain. The survey is described in this section. Additionally, the sample set, response rates and demographics of the survey respondents are described in detail.

Data collected through surveys is analyzed in Chapter 5. This chapter describes the analysis that was undertaken to examine the data. Specifically, a two-step method was undertaken to execute structural equations modeling. The first step presented is an examination of the data and resulting constructs using two types of factor analysis. The next step presented is a test of the proposed structural model.

A discussion of the results of this research is presented in Chapter 6. Followed by the contributions of this research, implications for future research and limitations of this study both of which are presented in Chapter 7 and a conclusion.

Chapter 2

Theoretical Paradigms

This chapter sets the stage for this research by introducing the theories that together form the foundation for the hypotheses presented in this research. The RBV (Barney, 1991; Wernerfelt, 1995), the KBV (Grant, 1996; Nonaka, 1994) and the RV (Dyer & Singh, 1998) are presented as the basic building blocks for the supply chain collaboration framework presented in Chapter 3.

This paper suggests that relationships with other firms are never void of the implications associated with resources that reside within the firm. Both internal and external resources work in conjunction with one another toward competitive and collaborative advantage. The hypotheses here are built upon interwoven resources that have their genesis both inside and outside the firm. Accordingly, it is appropriate that the RV along with the RBV and the KBV be presented as interworking theories to support this research. This section addresses each theory and how they work together to support this research.

2.1 The Resource-Based View

The RBV suggests that resources that are valuable, rare, imitable and unable to be substituted are drivers of competitive advantage (Barney, 1991; Wernerfelt, 1995). Firm resources include organizational processes, capabilities and tangible and intangible assets that are controlled by the firm (Barney, 1991). Firms coordinate these resources as they pursue competitive advantage (Penrose,

1959; Barney, 2002). A firm is able to generate, adopt and apply strategies that improve the firm's ability to compete in their markets by leveraging (e.g. mobilizing, coordinating and deploying) their resources (Sirmon, Hitt & Ireland, 2007). Much like described in the suppositions of Dierickx & Cool (1989), this theoretical lens focuses on the internal resources of the firm (Cao & Zhang, 2011) and the path dependence of firm resources and capabilities (Barney, 2012). The RBV suggests that the primary drivers of supernormal rents include: physical capital resources, human capital resources, intangible resources (e.g. reputation) and organizational capital resources.

The organization plays the role of coordinating resources with competitive advantage as the goal (Penrose, 1959; Barney, 2002). Firms that proactively manage the generation or attainment and coordination of resources generate synergies that lead to new capabilities that create advantage (Sirmon et al., 2007). Therefore it is important to understand the organizational capacities, capabilities and competencies that firms utilize to actively manage their resources. More specifically, this paper focuses on how firms can better manage knowledge-based resources by understanding and proactively managing the organizational skills within themselves and their supply chain partners.

The RBV has been used to explain a broad range of supply chain activities and constructs (Hult, Ketchen & Nichols 2003; Barney, 2012). However, room remains for the RBV to expand our understanding of SCM. For example, Sarkis,

Zhu & Lai (2011) call for the "development of scales that are capable of measuring the various competitive dimensions of value, rarity, imitability and nonsubstituability" for SCM topics. Additionally, Priem & Swink (2012) argue that if the RBV is used to support supply chain practices that researchers would "do well" to look beyond simple supply chain integration and "clearly specify other possible capabilities evidenced in process- and knowledge- based organizational skills." In response to these calls for the expansion of our understanding of supply chain resources and for the purposes of this research, the RBV is utilized to establish a foundation to support the following assertions:

1. Knowledge that is valuable, rare, inimitable or nonsubstitutable can drive supernormal performance outcomes (Barney, 1991; Grant, 1996).

2. Knowledge transfer capacities and capabilities that are valuable, rare, inimitable or nonsubstitutable allow the firm to proactively manage its knowledge bases and drive supernormal performance outcomes (Barney, 1991; Grant, 1996; Kogut & Zander 1992).

3. Organizational level capabilities enable the absorption and application of resources toward supernormal performance outcomes (Barney, 1991; 1994 and 2002).

The next section adopts the ideals of the RBV and further explores how knowledge, as a resource of the firm, is a primary source of differential or ricardian rents (those returns associated with owning valuable scarce resources including, but not limited to, specific knowledge) (Grant, 1996; Mahoney & Pandian, 1992).

2.2 The Knowledge-Based View

The KBV of the firm suggests that organizations that are able to combine the knowledge of individuals in a synergistic manner promote sustainable competitive advantage (Grant, 1996; Spender & Grant, 1996; Takeishi, 2001). Individual knowledge is combined, coordinated, transformed and amplified by the collective and legitimized into organizational knowledge (Nonaka, 1994; Spender, 1996). Kogut & Zander (1992) expand this idea and suggest that firms exist to coordinate the specialized knowledge of individuals. They also introduced the idea that organizations can process and store larger amounts of knowledge than individuals (Kogut & Zander, 1992).

Organizational knowledge is predicated on the collective justified belief that something is true and dynamic (Nonaka, 1994) and path dependent (Sarkis et al., 2011) and is therefore unique to each firm (Penrose, 1959). Through dynamic intrafirm and interfirm networks and interdependencies the organization is able to aggregate, internalize and transform the knowledge of individuals into difficult to emulate routines (Grant, 1996; Kogut & Zander, 1992; Levinthal & March, 1993; Penrose, 1959).

The inimitable nature of this resource makes it a key component of competitive advantage (Grant, 1996; Levinthal & March, 1993; Penrose, 1959). Competitive advantage, driven by uniqueness and the ability to execute and retain that uniqueness, is strategically dependent upon an organization's ability to

manage knowledge (Spender & Grant, 1996). Drawing heavily on RBV, KBV provides explanations of and bases upon which knowledge-based predictions can be made regarding organizational decisions and activities along with their related outcomes (Grant, 1996; Foss et al., 2010).

The KBV suggests that the primary drivers of supernormal rents are organizational knowledge, knowledge transfer abilities, knowledge management abilities and knowledge management systems (Grant, 1996; Kogut & Zander, 1992; Sarkis & Reyes, forthcoming). Building upon these drivers, the KBV is utilized in this paper to establish a foundation to support the following assertions:

1. Dimensions of knowledge transfer can influence performance outcomes (Grant, 1996; Kogut & Zander, 1992; Priem & Swink, 2012).
2. Collaborative efforts involving knowledge transfer can lead to positive performance outcomes (Grant, 1996; Hult et al., 2003; Priem & Swink, 2012; Sarkis & Reyes, forthcoming; Zacharia et al., 2011).
3. There are different types of knowledge and they require different capabilities to effectively manage each individually and collectively (Polyani, 1966; Nonaka, 1994; Kogut & Zander, 1992).

To be clear, it is not suggested that the RBV and the KBV can each alone or together support the collaborative framework presented in this research. Rather it is posited here that a firm must be able to identify and manage its internal resources before being able to interact with other firms and successfully leverage external resources. Accordingly, the RBV and the KBV must be utilized in conjunction with the RV. The RV and its relationship with the RBV and the KBV in supply chain collaboration are discussed in the next section.

2.3 The Relational View

The RBV and the KBV were presented in the preceding sections. Specifically, these sections described how these theories support this research and the resulting hypotheses from the perspective of managing resources that are internal to the firm. These theories are not sufficient to adequately explain the phenomena that are associated with the generation of collaborative advantage from supply chain collaboration. In order to provide holistic view of supply chain collaboration it is essential to acknowledge the role of external resources in the generation of supernormal operational outcomes. The RV provides the theoretical bases to support the implications of supply chain collaboration on operational outcomes. Specifically, the RV addresses the social nature of firms and how they operate within socially complex environments and relationships (Dyer & Singh, 1998). The RV suggests that a "firm's critical resources may extend beyond firm boundaries" (Dyer & Singh, 1998).

Supply chain management requires the use of complex and scarce resources (Barney, 2012). Additionally, firm's supply chain is inherently made up of multiple interdependent organizations. Supply chain collaboration allows firms to leverage the interfirm linkages of the supply chain to access complex and scarce resources that reside within their supply chain partners (Ahuja, 2000; McEvily & Marcus, 2005; Zacharia et al., 2011). The RV supports and explains

these relational advantages by suggesting that they are dependent on the "relationships in which the firm is embedded" (Dyer & Singh, 1998).

The RV suggests that the primary drivers of supernormal rents are: relationship specific assets, interfirm knowledge sharing routines, complementary resources and capabilities, and effective governance. Not only does RV support the idea that relationships allow interfirm access to scarce resources, it also suggests that organizational capabilities can grow out of collaborations and knowledge sharing between firms (Dyer & Singh, 1998; Huber, 1991; McEvily & Marcus, 2005; Takeishi, 2001). The RV provides support for assertions that are essential to the hypotheses that are developed in this paper. These assertions include:

1. Interorganizational knowledge transfer routines can provide access to partner specific assets, such as specialized knowledge.
2. Supply chain partners can combine resources to derive relational rents.
3. Supply chain partners can derive new capabilities through external ties.
4. Interfirm knowledge sharing routines between firms can support the socialization and exploitation of resources between supply chain partners for mutual benefit.

2.4 Summary of Theoretical Support

A table of the theories reviewed in this chapter is shown below (see Table 2-1). The preceding sections describe how supply chain collaboration is supported by an amalgam of three related theories. Each of the research questions

Table 2-1 Theoretical Base for Collaboration and Knowledge Transfer Conceptual Model

Dimensions	RBV	KBV	RV
Unit of analysis	Firm	Firm	Dyad or network of firms
Primary sources of supernormal returns	Physical capital resources	Knowledge	Relationship specific assets
	Human capital resources	Knowledge transfer abilities	Interfirm knowledge sharing routines
	Intangible resources (e.g. reputation)	Knowledge management abilities	Complementary resources/cap-abilities
	Organizational capital resources	Knowledge management systems	Effective governance
Ownership of rent generating assets	Individual Firm	Individual Firm	Collective
Assertions supported	Knowledge that is valuable, rare, inimitable or nonsubstitutable can drive supernormal performance outcomes.	Dimensions of knowledge transfer can influence performance outcomes.	Supply chain partners can derive new capabilities through external ties.

Table 2-1 - Continued

Dimensions	RBV	KBV	RV
Assertions supported	Organizational level capabilities enable the absorption and application of resources toward supernormal performance outcomes.	There are different types of knowledge and they require different capabilities to effectively manage each individually and collectively.	Interorganizational knowledge transfer routines can provide access to partner specific assets, such as specialized knowledge.
			Interfirm knowledge sharing routines between firms can support the socialization and exploitation of resources between supply chain partners for mutual benefit.
Citations	Barney, 1991; Wernerfelt, 1995	Kogut & Zander 1992; Grant, 1996; Nonaka, 1994	Dyer & Singh 1998; Takeishi, 2001

and hypotheses has been carefully constructed considering one or more of the presented theories as their basis. In order to provide additional clarity, Appendix A provides a table showing the relationships between the research questions, theories (the RBV, the KBV and the RV) and the hypotheses set out in Chapter 3.

The next chapter provides an introduction to the conceptual framework for the proposed model of strategic supply chain collaboration. In addition a literature review is presented that describes the current state of research on this topic. Each construct that is introduced is steeped in current literature and supported with theory. Additionally, the relationships between the constructs are discussed and predictions are made.

Chapter 3

Conceptual Framework And Hypotheses Development

3.1 Supply Chain Collaboration

Supply chain collaboration is steeped in the relational view (Dyer & Singh, 1998). Without the relational rents that are achieved through collaboration the participation of firms in such activity would be specious, at best. This paradigm suggests that supply chain partners can combine resources to derive supernormal rents and new capabilities through ties that extend beyond the boundaries of the firm (Dyer & Singh, 1998). The pursuit of relational rents, access to new specialized knowledge and derivation of new capabilities that are beyond the singular reach of the firm drive them to cooperate with other firms within a network of interdependent relationships (Chen, Paulraj & Lado, 2004; Eisenhardt & Schoonhaven, 1996; Vachon & Klassen, 2008). In fact, as the knowledge base of an industry becomes more globally dispersed, culturally diverse and complex, the sources of specialized knowledge are just as dispersed, diverse and complex, the knowledge needed to fuel innovation, jointly manage tangible and intangible resources and drive positive performance outcomes is becoming more dependent on networks than on individual firms (Chen et al., 2004; Cheung, Myers & Mentzer, 2010).

Gray (1989) describes collaboration as "a process of joint decision-making among key stakeholders of a problem domain about the future of that domain." This paper adapts Gray's definition for collaboration and applies to the supply chain. This is generally dyadic cooperation between firms, but can extend beyond primary suppliers to the extended supply chain. Additionally, supply chain collaboration exists within both the forward and reverse supply chains. Within this paper, there is a purposeful focus on dyadic relationships in the forward supply chain. This focus is chosen so that this research builds upon current literature and joins the discussion that is beginning to mature on this topic.

When stakeholders identify and accept the potential advantages of cooperating with one another collaborations allow firms to pursue shared visions and resolve conflicts (Gray, 1989). This type of collaborative advantage is present in supply chain management when firms with heterogeneous resources work together to gain strategic benefits in order to achieve gain over competitors (Cao & Zhang, 2011). Collaboration includes knowledge integration and cooperation between firms that both may be considered resources that lend themselves to competitive advantage (Grant, 1996; Huber, 1991). This nature of supply chain partnering allows for the combination of synergistic resources and ultimately leads to supernormal operational performance (Cao & Zhang, 2011). Supply chain collaboration takes the form of joint sense making (e.g. collaborative market studies), joint planning (e.g. collaborative planning,

forecasting and replenishment), joint knowledge creation (e.g. new product development) and decision making (e.g. facility location) (Cheung et al., 2010; Selnes & Sallis, 2003).

Barratt (2004) lists inter-organizational boundary spanning supply chain activities as: production scheduling, supply planning, new product introduction, demand replenishment, collaborative planning and shared distribution. The literature review for this paper and the precursor executive interviews suggest that other activities that involve supply chain collaboration include current topics such as greening of the supply chain, life cycle analysis, design for environment, managing the reverse supply chain, and social responsibilities (e.g. managing the supply chain such that the ultimate consumer's needs are met in a socially responsible way).

Supply chain collaboration is an important topic of study because of the collaborative advantages that accrue from these types of activities. Collaboration is a process that requires firms to actively cooperate (Gray, 1989). The active nature of collaboration leads to dynamic capabilities that allow firms to address rapidly changing environments (Teece et al., 1997). Dynamic capabilities allow a firm to "integrate, build and reconfigure internal and external competences" (Teece et al., 1997). These dynamic capabilities can become a means for firms to overcome competency limitations (Mitchell & Singh, 1996). Because collaborative activities lead to the creation of dynamic capabilities that are

difficult to emulate, the RBV and the RV support the assertion that supply chain collaboration leads to positive operational outcomes and relational rents (Barney, 1991; Dyer & Singh, 1998; Singh & Mitchell, 1996; Lorenzoni & Lipparini, 1999). Vachon & Klassen (2008) found direct effects of collaboration on cost, quality, delivery and flexibility. These findings support the hypotheses laid out later in this paper that propose the effects of several collaborative constructs on performance outcomes.

Supply chain collaborations have been studied in many contexts (Vachon & Klassen, 2006). However, the current stream of research has been focused on long-term collaborations such as partnerships and alliances (Zacharia et al., 2011). Recently, Zacharia et al. (2011) has provided evidence that supply chain collaborations are increasing due to the nature of today's dynamic environment and the "virtualization" of supply chain engagements. Other streams of research such as organizational management and network theory support this. McFayden & Cannella (2004) found that collaborative partners become "more alike and develop similar knowledge stocks" when they have repeated interactions. Because of this homogenization between partners, collaborative advantages tend to decrease as the length of time two firms work together increases (McFayden & Cannella (2004). Based on interviews with executives across 30 industries (by SIC code) this research found further evidence that supply chain collaborations continue to increase as firms engage in joint problem solving activities,

innovation, and knowledge integration within their supply chains. The key driver leading to their participation in these activities was generally described as the need to capitalize on their own expert knowledge or to leverage the knowledge of collaborative partners.

Supply chain collaboration is driven, at least in part, by knowledge seeking firms looking for experiential expertise, expert knowledge on complex topics or assistance from firms with rare and inimitable core competencies. Despite the importance of knowledge seeking to the genesis of supply chain collaboration, there has been little academic research focused on knowledge transfer within this domain (Marra, Ho & Edwards, 2012). More specifically, there is a lack of research on how the dimensions of knowledge transfer operate between supply chain partners and how they can be managed to optimize supply chain performance (Marra et al., 2012). Acknowledging this gap in the literature, Priem & Swink (2012) suggest, "Beyond integration, supply chain management research would do well to clearly specify other possible capabilities evidenced in process- and knowledge-based organizational skills." One exception to this literature gap is a recent study by Zacharia, et al. (2011) wherein the team explored the role of knowledge transfer in collaborations by specifically studying a collaborative model that includes AC.

This paper approaches supply chain collaboration from the perspective of collaborative relationships between supply chain partners. More specifically, this

empirical analysis seeks to expand upon the model of supply chain collaboration presented by Zacharia et al. (2011). Their model is shown as Figure 3-1. Zacharia et al. (2011) found positive affective relationships along all the hypothesized paths shown in Figure 3-1 with one exception. The hypothesized relationship between AC and CE was not found to be significant. However, their results do suggest a significant relationship between AC and CPC such that CPC was concluded to be a mediator between AC and operational and relational outcomes.

The AC that is tested in Zacharia et al.'s 2011 model is representative of the focal firm. In fact, each of the constructs in the model is assumed to be a characteristic of the focal firm. In this way, the model is a one-dimensional view of the capabilities that enhance outcomes in supply chain collaboration. Because collaboration is, by definition, a collective activity of two or more actors, a two-dimensional perspective of supply chain collaboration presents a more holistic view of collaboration. Accordingly, this paper presents a model that includes characteristics of two firms assuming a dyadic perspective of collaboration. This is done by the proposition of a new construct namely, the DC of the source.

The next chapter will present the expanded model that includes DC. By defining DC and clearly discriminating between the characteristics of the source and the recipient of knowledge, this research shows that AC plays a more

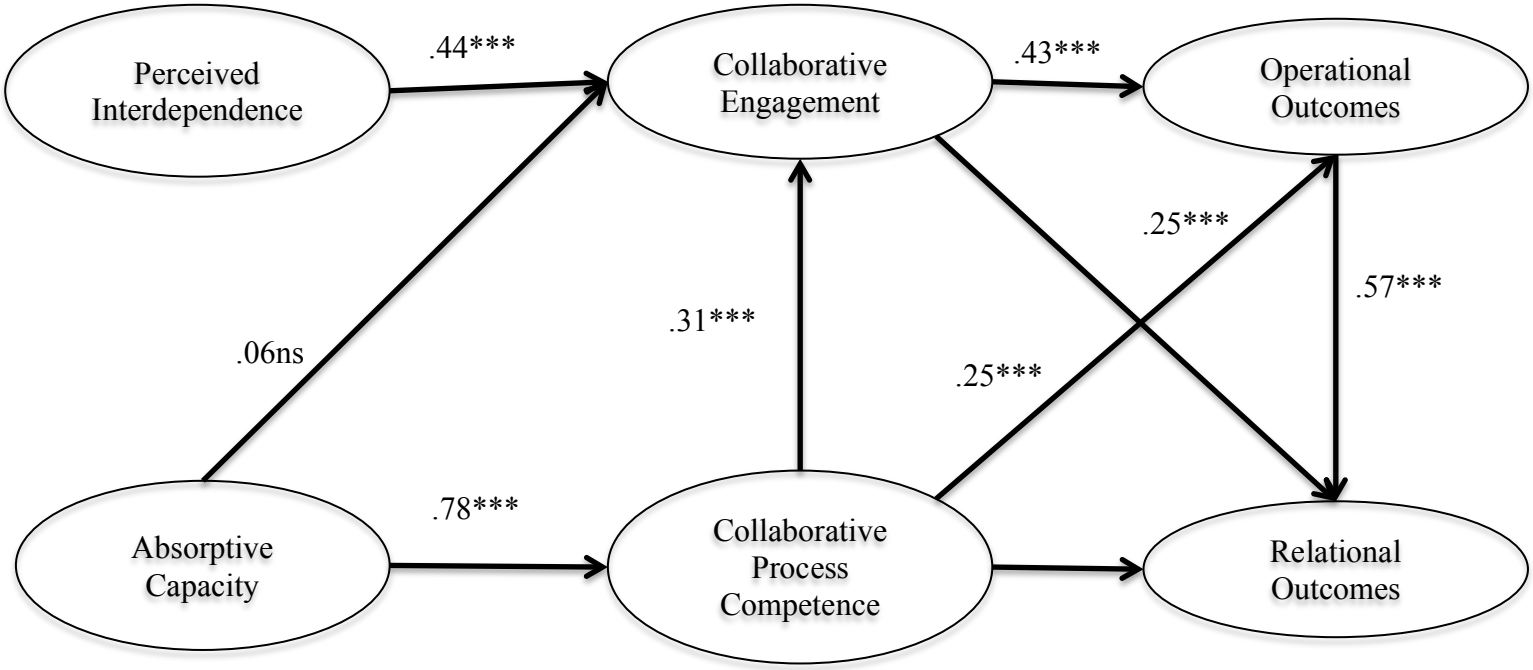

Figure 3-1 Conceptual Model for Capabilities That Enhance Outcomes of Supply Chain Collaboration

(Zacharia et al., 2011)

significant role in supply chain collaboration than has been shown in the literature to date.

3.2 Framework and Hypotheses Development

This paper seeks to expand on the model of supply chain collaboration presented in Zacharia et al. (2011). The proposed constructs in the expanded model are based on the detailed research presented in Zacharia et al. (2011), an extant literature review and a series of 43 executive interviews providing 86 critical incident observations. (The detailed description of these interviews, the method and results are all set out in Appendix B to this paper). The constructs that are different than shown in the original model presented by Zacharia et al. (2011), the DC and CPC of the *source*, are dimensions of knowledge transfer that support the sharing and pooling of knowledge that takes place during supply chain collaboration. The proposed new model of strategic supply chain collaboration is shown in Figure 3-2.

Organizational level capabilities, like those shown in Figure 3-2, can be expected to translate into performance outcomes and ultimately value to stakeholders (Hunt & Davis, 2012; Vachon & Klassen, 2008; Zacharia et al., 2011; Zhang, Vonderembse & Lim, 2006). The RBV supports this assertion when organizational capabilities are shown to be valuable, rare, inimitable and unable to be substituted (Barney, 1991 and 2002). Capabilities shape the ways that knowledge, skills and expertise are managed and deployed within a firm,

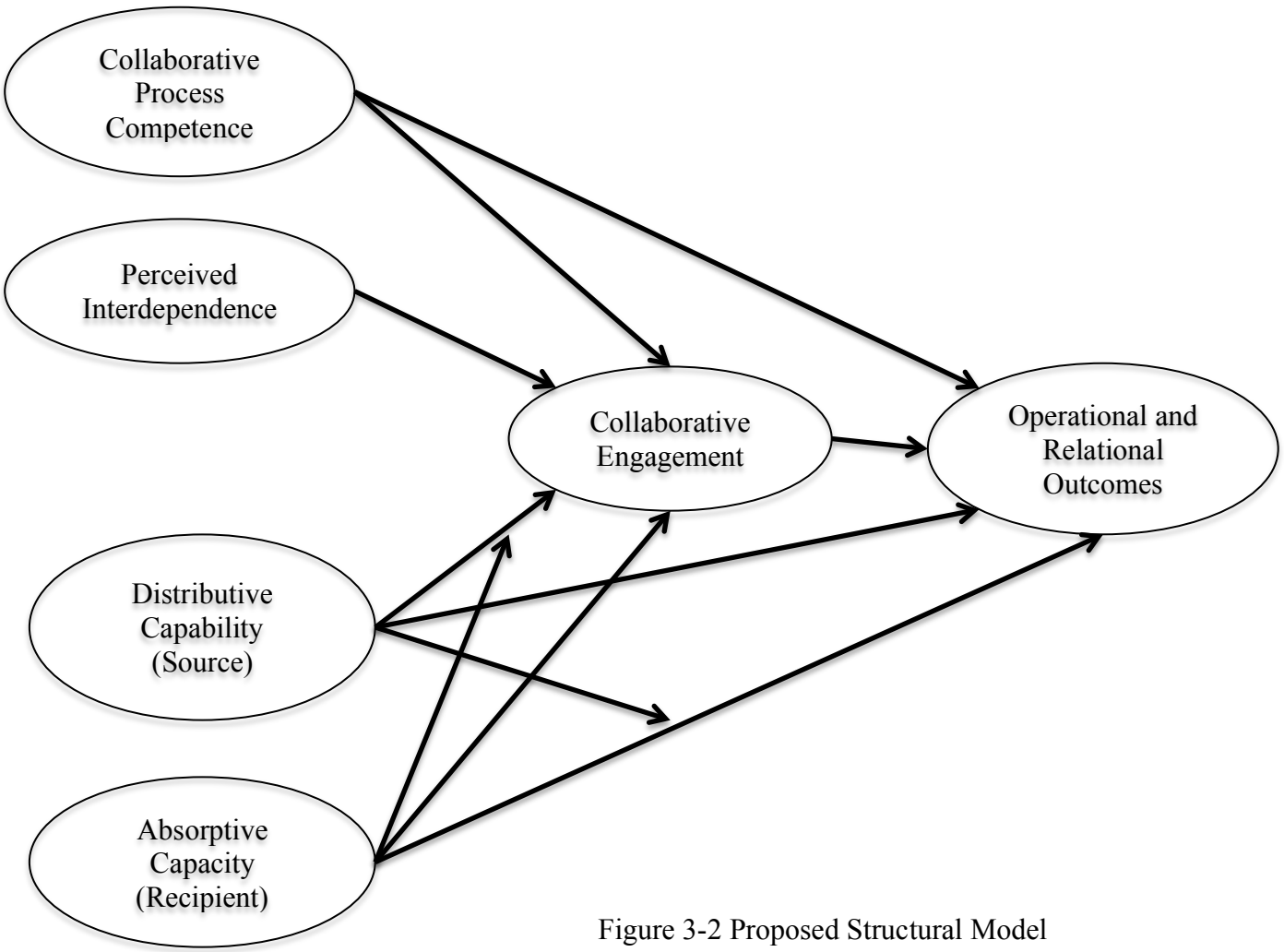

Figure 3-2 Proposed Structural Model

ultimately, capabilities define what a firm is able to do or become (Zander & Kogut, 1995). Capabilities are often more than just the result of experience-based learning (Ethiraj, Kale, Krishnan & Singh, 2005). They can also be deliberately designed, accessed or acquired in order to improve systems and structures and to pursue the continual improvement of routines and practices (Zollo & Winter, 2002). Because the model proposes that a firm leverages multiple resources at its disposal to support successful collaboration, it is important to clarify here that capabilities are assumed to be the "capacities of a group of resources to perform some task or activity" (Gavronski, Klassen, Vachon & Machado do Nascimento, 2011). Competitive capabilities are a set of combined resources that allow a firm to achieve strategic objectives (McEvily & Marcus, 2005) and are rent generating assets (Ethiraj et al., 2005).

This section explores PI (a suggested pre-condition to collaboration), CE (level of involvement in collaborative activities) and collaborative and knowledge-based capabilities and capacities that lead to supernormal performance outcomes. More specifically, it is the goal of this chapter to provide conceptual definitions, domain limitations, relationship descriptions and predictions (Wacker, 1998) for the collaborative and knowledge transfer constructs that are included in the proposed framework for strategic supply chain collaboration.

Table 3-1 provides a summary of all the constructs and their proposed antecedents that are described in this section.

Table 3-1 Proposed Constructs and Measures Based on Figure 3-2

Factors	Definitions	Source/Support
Perceived Interdependence	Perception that two or more firms have a symbiotic dependence upon one another. This can be an ongoing dependence or an episodic dependence to satisfy a particular need within one or both firms.	(Astley & Van de Ven, 1983; Larsson, et al., 1998; Zacharia et al., 2011)
Shared Goals	This represents the extent to which firms have mutually desired outcomes from collaborative activities.	(Gray, 1985; Spekman et al., 1997)
Reciprocal Needs	The perception that two or more firms have a symbiotic dependence upon one another in order to fill needs within their own organizations.	(Astley & Van de Ven, 1983; Larsson, et al., 1998; Zacharia et al., 2011)
Complimentary Resources	The extent to which two or more firms have resources that together will allow them to achieve results that they would be unable to achieve alone.	(Astley & Van de Ven, 1983; Eisenhardt & Schoonhoven, 1996; Gray, 1989)

Table 3-1 - Continued

Factors	Definitions	Source/Support
Collaborative Engagement	Level of a "firm's involvement in a collaboration effort."	(Zacharia, et al., 2011)
Stakes	The level of potential benefit to the parties involved in the collaboration.	(Logsdon, 1991)
Collaborative culture	The level of collaborative culture at each firm. Collaborative culture is supported by internal and external trust, transparency, consensus and communication with understanding.	(Barratt, 2004)
Commitment	Levels of commitment by the parties to work toward shared goals and to fill reciprocal needs.	(Astley & Van de Ven, 1983; Larsson, et al., 1998; Zacharia et al., 2011)

Table 3-1 - Continued

Factors	Definitions	Source/Support
Collaborative Process Competence (Source)	"Reflects the firm's ability to select appropriate partners, establish processes to monitor and manage the initiative, and resolve conflicts and differences of opinions as they arise." Ability to synthesize relevant knowledge, overcome constraints and barriers, and enable the teams to come to mutual understandings and shared goals.	(Interviews; Zacharia et al., 2011)
Manage process	The ability to manage the interactions between firms in order to ensure that roles and responsibilities are clear. This includes combining and synthesizing complementary knowledge and resources and monitoring the process in order to make adjustments where necessary. Additionally, this managing of the process includes the steps that the source takes to ensure the knowledge transfer is successful after the collaboration is complete. For example, this includes following up with the recipient to ensure that the new knowledge is being adapted and applied to the recipient's processes and culture.	(Interviews; Zacharia et al., 2011)
Opportunity optimization	Seeks out and acts upon opportunities to participate in knowledge sharing. The source actively provides the necessary tools, budget, executive support, and opportunities for collaboration and knowledge sharing. This includes creating physical or relational proximity in order to promote frequency of interactions between parties.	(Interviews, Peters and O'Connor, 1980; Argote, 2003; Szulanski, 2006; Zacharia et al., 2011)
Remove barriers	Ability to identify and overcome current and potential constraints or barriers to a successful project or knowledge transfer. Ignites and supports consensus of goals and processes between organizations.	(Interviews and Zacharia et al., 2011)

Table 3-1 - Continued

Factors	Definitions	Source/Support
Absorptive Capacity (Recipient)	The ability of a firm to "recognize the value of new, external information, assimilate it and apply it to commercial ends."	(Cohen & Levinthal, 1990; Zahra & George, 2002)
Acquisition	Ability of a firm to seek out, recognize, value, and acquire external knowledge that can be used for economic purposes.	(Cohen & Levinthal, 1990; Zahra & George, 2002)
Assimilation	Ability of a firm to absorb external knowledge. The leveraging of processes and routines to allow new knowledge to be analyzed, decoded and understood.	(Cohen & Levinthal, 1990; Zahra & George, 2002)
Transformation	Ability of a firm to develop and refine the acquired external knowledge to fit within current processes or to transform current routines. Transformation may include interpreting and combining new knowledge in new ways.	(Cohen & Levinthal, 1990; Zahra & George, 2002)
Application	Ability of a firm to incorporate new knowledge into their processes and routines. This also includes the abilities of a firm to exploit new knowledge to create new competences, innovation or processes.	(Cohen & Levinthal, 1990; Zahra & George, 2002)

Table 3-1 - Continued

Factors	Definitions	Source/Support
Distributive Capability (Source)	The ability of a knowledge holder to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes.	(Whitehead, 2012)
Disseminative capability	The ability of the source "to contextualize, format, adapt, translate and diffuse knowledge through a social and/or technological network." In this case and more specifically, this is the ability of the source to "convincingly articulate and communicate, spread knowledge in a way that other people can understand accurately, and finally, tactically put the learning into practice."	(Mu et al., 2010; Parent, Roy & St-Jacques, 2007)
Intellectual capital	The level of intellectual capital held by the source. Intellectual capital is defined as the "credible information and/or experience, held by individuals and/or residing in the infrastructure of the firm which is converted into [collaborative] value. It can reside in one or more individuals or in one or more infrastructure systems." Intellectual capital includes access to external expert knowledge by network ties.	(Craighead et al., 2009)
Partner knowledge	The level of understanding that the source has of the recipient in multiple dimensions - their needs, emotions, culture, politics, goals and desired outcomes as they relate to the collaborative project and overall company strategy.	Interviews

3.2.1 Perceived Interdependence

Many times supply chain partners do not have a common organizational affiliation (Hult et al., 2003). They partner in order to leverage each other's tangible and intangible resources. Any collaborative relationship is primarily forged based on resources that are heterogeneous between organizations (Teece et al., 1997). The need for resources that do not reside within the firm and shared goals are the pillars of inter-organizational collaborative activities. However, after the problem setting stage of collaboration, the level of CE between the parties is at least partially driven by the PI between the firms (Stock & Tatikonda, 2000; Zacharia, Nix & Lusch, 2009; Zacharia et al., 2011). Logsdon (1991) describes PI as an essential precondition to a firm's entrance into a collaborative relationship. In this sense PI is conceptualized as the perception that two or more firms have an episodic or ongoing symbiotic dependence upon one another (Astley & Van de Ven, 1983; Larsson, Bengtsson, Henriksson & Sparks, 1998; Zacharia et al., 2011). This perception of mutual dependence leads semiautonomous firms to strategically interact in order to affect their collective environment and mutually agreed upon performance outcomes (Astley & Van de Ven, 1983 and Mentzer, Min & Zacharia, 2000). Firms often engage in collaborative activities because they believe that if they cooperate with another firm that has complementary resources and/or capabilities that they will achieve results that they would be unable to achieve alone (Astley & Van de Ven, 1983;

Eisenhardt & Schoonhoven, 1996 and Gray 1989). This reasoning for collaborative activity is theoretically sound and is supported by organizational theory, namely the RV. The RV supports organizational decisions based on resource and capability access that expands beyond the boundaries of the organization.

When this is true, that firms believe that they are mutually dependent on one another, they engage more intensely in collaborative activities (Stock & Tatikonda, 2000; Zacharia et al., 2011). Further, PI promotes a working consensus among the parties as to the mutually desired outcomes (Gray, 1985 and Spekman et al., 1997) and reciprocal needs (Zacharia et al., 2011). High levels of consensus are conducive to higher levels of CE (Gray, 1985; Logsdon, 1991; Spekman et al., 1997; interviews).

Zacharia et al. (2011) found a significant and positive relationship between the levels of PI and the levels of CE between firms in collaborative initiatives. This research, at least in part, is attempting to replicate certain findings based on the model of collaboration in Zacharia et al. (2011). Therefore, the following relationship is hypothesized:

> *Hypothesis 1* - The level of PI between firms is positively related to the level of CE in collaborative initiatives.

3.2.2 Collaborative Engagement

Zacharia et al. (2011) describes CE as the level of a "firm's involvement in a collaboration effort." CE can be strong or weak and is characterized high levels of commitment, knowledge transfer, consensus, frequency of interactions, and relationships that create or change interorganizational routines (Cheng, Yeh & Tu, 2008; Zacharia et al., 2011). The characteristics of strong CE are supported by the collaborative culture at each firm, internal and external trust, consensus, transparency and communication with understanding (Barratt, 2004).

Logsdon (1991) also suggests that the stakes at hand for each firm drive levels of CE between firms. When the stakes are high the collaborating firms will engage in more rigorous collective activity. In other words, when there are significant potential gains or losses, especially financial gains or losses, that may be brought about by the collaboration the firm(s) that may be impacted by the gains or losses will participate more aggressively in the collaboration.

Zacharia et al. (2011) found a significant and positive relationship between the levels of CE between firms in collaborative initiatives and the operational and relational outcomes of those initiatives. In support of the prior research and in order to provide a basis upon which to test the relationship of knowledge-based constructs with CE and ultimately operational and relational outcomes, the model tested in this paper proposes the following hypothesis:

Hypothesis 2a – The level of CE between firms in collaborative initiatives is positively related to the operational outcomes of the collaboration.

Hypothesis 2b – The level of CE between firms in collaborative initiatives is positively related to the relational outcomes of the collaboration.

3.2.3 Collaborative Process Competence

Unlike CE and PI, CPC is an *ability* to manage the process. It is a combination of skills that reside within individuals and is ultimately coordinated and executed at the organizational level. CPC "enables the process of sharing relevant information, managing conflict, assessing options, jointly making decisions, and combining resources to accomplish objectives in a collaborative way" (Zacharia et al., 2011). This concept is supported by theory, specifically the RBV and the RV insomuch as it asserts that a firm can leverage resources such as internal capabilities for competitive advantage.

This concept is similar yet more inclusive than the alliance competence described by Lambe, Spekman & Hunt (2002) or project management competence theorized by (Ethiraj et al., 2005). Alliance competence as conceptualized by (Lambe et al., 2002) and project management competence (Ethiraj et al., 2005) both include the ability to manage interfirm resources. While this is a component of CPC, there are more factors that come together to create a firm's ability to manage the entirety of the collaboration process, interactions and activities. Along with the ability to leverage and deploy interfirm resources a firm must also be able to:

- Recognize and support opportunities to collaborate with the right partners (Spekman et al., 1997; Zacharia et al., 2011; interviews);
- Ignite and support consensus of goals and processes between organizations (Barratt, 2004; Priem & Swink, 2012; interviews);
- Identify and remove barriers to collaborative efforts, as well as, recognize and resolve conflicts (Fugate et al., 2009; Li et al., 2012; Zacharia et al., 2011; interviews); and,
- Establish processes to monitor and manage collaboration efforts (Fugate et al., 2009; Li et al., 2012; Priem & Swink, 2012; Zacharia et al., 2011; interviews).

An important attribute of CPC is the effect of relational social capital (Nahapiet & Ghoshal, 1998). For example, in order to manage collaborative processes firms must have a level of relational competence (Priem & Swink, 2012) that allows them to understand and work toward shared values between firms (Li et al., 2012; Priem & Swink, 2012; interviews). The firm should also be able to recognize and manage conflicting interests, changed priorities or other dynamic types of issues that may plague collaborative activities (Larsson et al., 1998). When there is a high level of relational competence then CPC allows the firm that is managing the process to ensure that a high level of cooperation is promoted by creating a "safe environment" (10% of interviewees mentioned the need for a safe environment where the firms can operate together without fear of competition or finger pointing if the collaboration is not successful). Based on the results of the interviews it is proposed that relational social capital has a significant moderating effect on CPC. The effects of the three dimensions of

social capital (structural, cognitive and relational) (Nahapiet & Ghoshal, 1998) are proposed to have effects on more than just CPC within this model, however, testing the effects of social capital is beyond the scope of this paper. While testing this assertion is outside the scope of this paper it is, nonetheless, important to acknowledge the impact of social capital within the model and to suggest its importance in future research.

CPC allows a firm to manage and monitor collaborative activities (Priem & Swink, 2012; Zacharia et al., 2011). By creating an environment that is conducive to partnering, promoting consensus, addressing challenges and breaking down barriers firms can affect the levels of collaborative involvement engaged by all parties to the collaboration. It is clear that in a dyadic situation either of the firms involved could possibly provide the abilities that are necessary to ensure high levels of CPC. Based on the executive interviews, that are a part of this research, it is suggested that in order to promote efficiency and coordination one firm is generally in charge of ensuring that the collaboration is managed well. Although, CPC can reside in either party to the collaboration, this research assumes that the CPC resides within the source. Based on the preceding description it is hypothesized that

Hypothesis 3 – The source's level of CPC is positively related to the level of CE in collaborative initiatives.

Further, this research supports the proposition that CPC has a direct effect on performance outcomes (Zacharia et al., 2011; interviews). For example, Cao & Zhang (2011) found a positive relationship between collaborative competence and performance outcomes in supply chain collaborations. In addition, Zhu & Sarkis (2004) found a connection between green supply chain practices (collaboration and monitoring) and environmental and economic performance. These findings are in accordance with the assertions and earlier findings of Zacharia et al. (2011) regarding the effect of CPC on operational outcomes. In an attempt to replicate these findings, it is hypothesized that:

> *Hypothesis 4a* – The source's level of CPC is positively related to operational outcomes of collaborative initiatives.
>
> *Hypothesis 4b* – The source's level of CPC is positively related to operational outcomes of collaborative initiatives.

CPC as conceptualized in this paper is solely made up of abilities that promote the process of collaboration and with it the levels of engagement and related performance outcomes. It is separate and distinct from the organizational abilities that allow firms to manage knowledge and intellectual capital and successfully transfer knowledge. More specifically, CPC is made up of factors that promote management of the collaborative process while the AC of the recipient and the DC of the source are knowledge-based constructs that are enable the participant firms to share, transfer and pool knowledge in ways that create supernormal outcomes.

This is an important distinction as this research uncovered literature that seems to confound the constructs of CPC, AC and DC and their related antecedents. For example, Li et al. (2012) describes collaborative knowledge management. This construct includes components of both CPC and DC. For example, collaborative knowledge management is said to include disseminative capacity, barrier free knowledge access, knowledge generation and storage, and knowledge application (Li et al., 2012). Instead of idealizing these abilities as a single collaborative construct, it is proposed in this paper that there are three distinct abilities that work in unison to enable successful collaborative outcomes. For example, barrier free knowledge access was presented in this section to be a component of CPC. Knowledge generation, storage and dissemination will be presented in the next section as elements of DC. Finally, knowledge application is also presented in as a component of AC. Most importantly, the collaborative knowledge management practice construct presented in Li et al. (2012) seems to combine the abilities that are necessary of both parties to the collaboration. The survey items used in their research addressing this construct evidence this. Each of the survey items for collaborative knowledge management begins with the statement "Our firm ***and*** our trading partners…" (Li et al., 2012) This is further evidence of the "blurring of roles" that was described in the introduction to this paper.

This is only one example of how the roles of these related constructs seem to be confused in the literature. Another example is Fugate et al. (2009), in this paper the authors describe knowledge dissemination as "the timely sharing of knowledge of the business environment with appropriate [logistic partners] and other appropriate personnel." This definition combines elements that are associated with both CPC and DC. Specifically, the ability to disseminate information or knowledge is part of DC (as described in a later section) while activities such as choosing the appropriate audience and otherwise managing the process are components of CPC. Accordingly, Fugate et al. (2009) combines abilities of knowledge management and process management into one construct. This is problematic because these are two distinct capabilities within a firm and in order to assess, improve and monitor these abilities managers must distinguish between the two.

3.2.4 Knowledge-based Constructs

This paper provides a significant contribution to the literature by attempting to disentangle CPC, AC and DC and the roles of the parties within collaborations. The next section addresses the knowledge-based constructs in the proposed model, AC and DC, and attempts to clarify the roles of each within CE. This separation and clarification between the roles of each of the knowledge-based constructs is beneficial not only in the domain of supply chain collaboration, but

will also provide insights to managers and academics on how to advance our understanding of long-term strategic collaboration as well.

This paper endeavors to expand upon the model of Zacharia et al. (2011) by adding two knowledge based constructs to the model namely, the AC of the recipient and the DC of the source. Knowledge management theory suggests the importance of both the source and recipient of knowledge in knowledge transfer transactions (Davenport & Prusak, 1998; Easterby-Smith et al., 2008; Szulanski, 1996). It is theorized here that these are necessary but insufficient conditions for knowledge transfer and each moderate the affect of the other on knowledge transfer (see Figure 3-3). It is in this context that they are proposed to affect interfirm collaboration. Additionally, this paper assumes a specific domain for the knowledge-based constructs presented in the theorized model: for the purposes of this research, the AC of the recipient and the DC of the source are proposed to affect interfirm collaboration in the context of a specific variety of complex commercial knowledge existing within supply chains.

Before continuing, it is important to clarify why two components of knowledge transfer are being proposed to affect the interfirm workings associated with collaboration. It is well accepted that collaboration is a strategic cooperation between firms during which the resources of one or more firms is made available to another in order to derive mutual benefit (Astley & Van de Ven, 1983; Gray, 1989). As presented earlier in this paper, these resources include, but are not

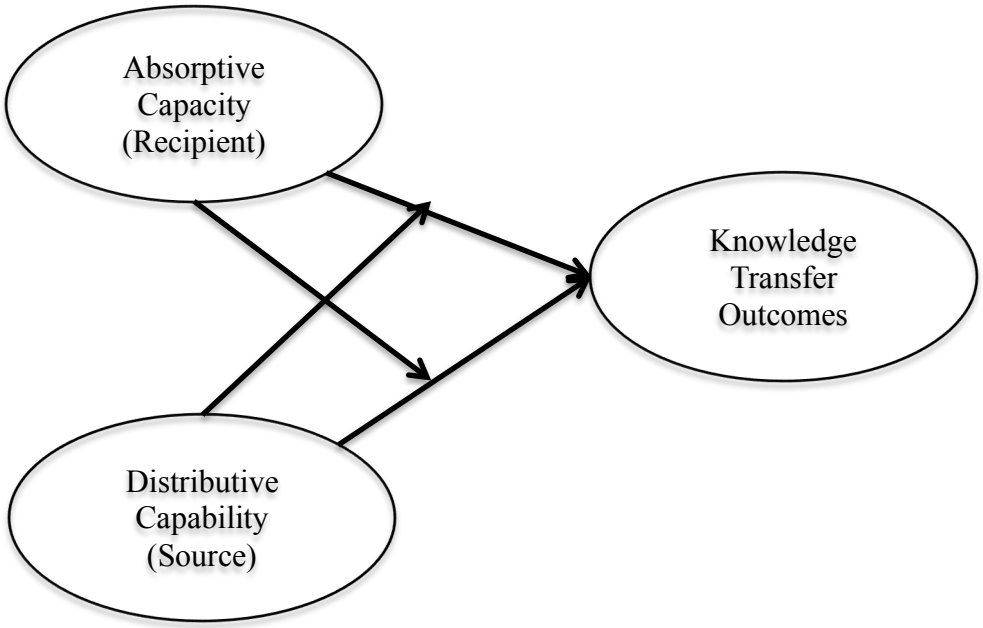

Figure 3-3 Conceptual Model of Knowledge Transfer

limited to, intangible resources, such as experience, skills and knowledge. Knowledge sharing, pooling and transfer are activities that allow firms to communicate the experience skills and knowledge that are necessary for collaboration to occur (Huber, 1991; Cao & Zhang, 2011). Without the movement of knowledge from one firm to the other for mutual benefit, there is arguably no collaboration taking place at all. Accordingly, it is imperative to view supply chain collaboration not only as knowledge integration, but also through a lens of knowledge-based organizational skills (Priem & Swink, 2012).

Collaborations present seemingly loose couplings and are thus less obvious learning entities than individual firms (Larsson et al., 1998). However, it

has been shown that supply chain collaboration allows firms to learn by changing interorganizational routines via direct knowledge transfer or even by knowledge spillover (Cohen & Levinthal, 1990; Huber, 1991; Larsson et al., 1998). Interorganizational knowledge sharing within a supply chain has thus become a common practice, because it enhances the competitive advantages of the supply chain as a whole (Cheng et al., 2008). A collective strategy such as collaboration is a means to acquire knowledge and increase the competences within organizations (Argote, 1999; Huber, 1991). When organizational learning takes place, knowledge is transferred and the recipient understands that knowledge in such a way that they can assimilate and apply it for economic purposes (Argote 1999; Barrett, 2004; Cohen & Levinthal, 1990; Ko, Kirsh & King, 2005). Vachon & Klassen (2008) showed that "effective collaboration requires organizations' respective know-how and technologies to, first, be shared, and second, to be integrated."

The next two sections introduce the AC of the recipient and the DC of the source respectively. Prior to moving onto those sections, this section will continue by discussing and clarifying the concept of knowledge, its characteristics and how they are conceptualized in both organizational and supply chain management research.

3.2.4.1 Knowledge

Knowledge itself is a difficult to define term and it is beyond the scope of this research to identify the minute idiosyncrasies of the term. For the purposes of this paper definitions that have been adopted in related literature streams will be adopted. Notably, knowledge is generally accepted to be "justified true belief" Nonaka (1994). It is subjective and based on personal beliefs and experiences (Grant, 1996; Nonaka, 1994). In this way it is different than mere data (discrete objective facts) or information, which is, contextualized data (Grant, 1996). Raisinghani & Meade (2005) provided a simple graphic that illustrates the transition necessary for data to transform into knowledge-based action and results, see Figure 3-4. Nonaka (1994) concludes "information is a flow of messages, while knowledge is created and organized by the very flow of information, anchored on the commitments and beliefs of its holder."

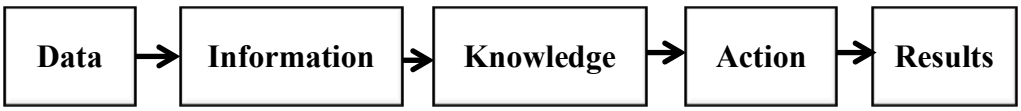

Figure 3-4 Data Transformation (Raisinghani & Meade, 2005)

Knowledge is by definition subject to context and personal belief (Grant, 1996; Nonaka, 1994; Huber, 1991). It is created by individuals (Simon, 1991) and is transformed and organized by firms (Nonaka, 1994). Organized knowledge increases an organization's capacity for effective action (Huber, 1991; Nonaka, 1994). For the purposes of this research knowledge is specifically

considered to be a synthesis of supply chain knowledge that has been collected and coordinated at an organizational level over time (Levinthal & March, 1993). These knowledge building, multiplying and organizing attributes are key components within the foundational capabilities of a firm (Zander & Kogut, 1995). Additionally, knowledge that is collected and coordinated at the organizational level creates organizational memory that is evidenced in organizational routines (Huber, 1991). These routines survive the exit of individuals through whom components of the organizational knowledge may have been generated.

It is argued here that competitive advantage, driven by uniqueness and the ability to execute and retain that uniqueness is strategically dependent upon an organization's ability to manage knowledge (Spender & Grant, 1996). Knowledge is the organizational resource most frequently associated with overall firm performance (Sarkis & Reyes, forthcoming). Primarily informal communities of social interactions share knowledge and these interactions may spillover firm boundaries to include supply chain partners (Kotabe, Martin & Domoto, 2003; Nonaka, 1994; Spender, 1996). Knowledge transfer occurs at multiple levels, for example, they can occur between individuals, individuals to groups, groups to groups, across groups, group to organization and across organizations (Alavi & Leidner, 2001). Knowledge is transferred from

organization to organization when the routines of one or more firms are changed in a way that affects performance outcomes (Inkpen & Tsang, 2005). Interorganizational knowledge transfer is also an iterative process (see Figure 3-5) where the experience of one firm is affected by the experience of another (Argote & Ingram, 2000). The iterative nature of knowledge transfer is important to apply to collaborations, especially episodic collaborations wherein firms are working together in many cases to fill a need at one of the organizations, which is one characteristic of this type of collaboration that differentiates it from long term strategic alliances (interviews). Knowledge that is transferred must be de-contextualized by the source and re-contextualized by the recipient (Cummings & Teng, 2003), this makes it ever more clear that the abilities of the source and the recipient are necessary for effective knowledge transfer. This will be discussed further in the sections that address AC and DC directly. There are four factors that contribute to the ability of firms to transfer knowledge; they include the characteristics of the source, characteristics of the receiver, the relationship between the two and characteristics of the knowledge itself (Simonin, 1999; Szulanski, 1996). The characteristics of knowledge will be addressed first, the following sections will then address the source and recipient characteristics that affect knowledge transfer and, in this case, supply chain collaboration.

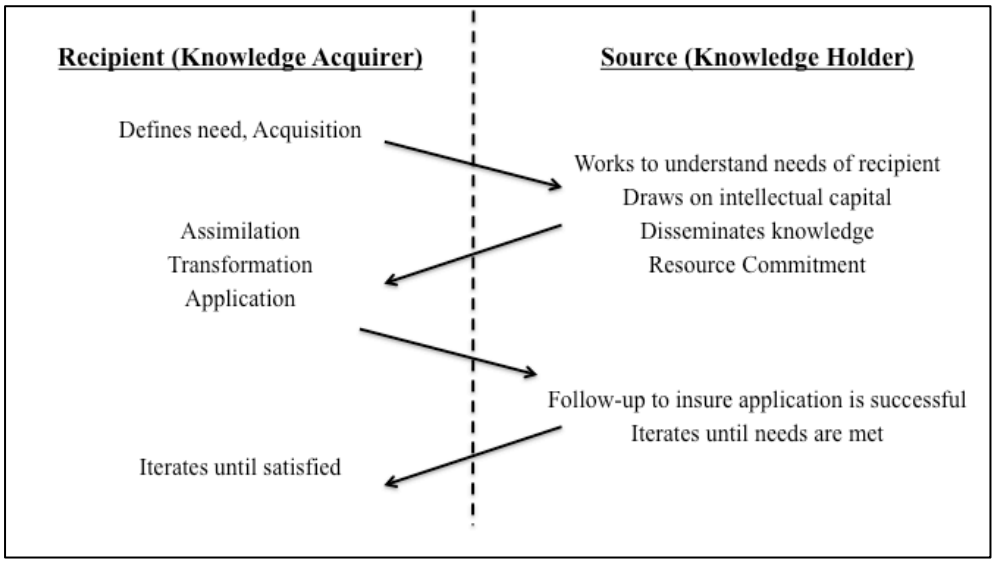

Figure 3-5 Iterative Process of Knowledge Transfer

(Adapted from Von Hippel, 1994)

3.2.4.1.1 Tacit knowledge The transferability and accessibility of knowledge is affected by the type of knowledge to be shared in collaborative activities (Grant, 1996; Nonaka, 1994; Szulanski, 1996). There are two types of knowledge, tacit knowledge and explicit knowledge (Nonaka, 1996). Tacit knowledge is the type of knowing that is embedded in an individual or organization that is difficult to articulate. Polanyi described this idea in 1966, when he stated that individuals know more than they can describe.

Tacit knowledge stocks are often embodied in individual education, abilities, experience, patents, and awareness of other tacit knowledge (Grant, 1996, Polyani, 1966; Szulanski, 1996; Von Hippel, 1994). Tacit knowledge is

often elusive and has been described as having causal ambiguity (e.g. reasons for success or failure cannot be identified and may lie within tacit competencies in the organization) (Szulanski, 1996) also described as "irreducible uncertainty" (Polanyi, 1966).

Due to its lack of transferability and accessibility, tacit knowledge is difficult to transfer from one individual or organization to another. Szulanski (1996) notoriously describes tacitness as a quality of "sticky" knowledge. Sticky knowledge is difficult to transfer between firms or even within firms (Szulanski, 1996). This is important to acknowledge because, as was stated earlier, the characteristics of knowledge can either support or deter successful knowledge transfer. Practices and routines are uses of knowledge that often have a tacit component (Nelson & Winter, 1982; Kogut & Zander, 1992). Often, these tacit components are embedded in individual skills and collaborative social engagements (Nelson & Winter, 1982; Kogut & Zander 1992). If tacit knowledge is required to be shared, pooled or transferred in CEs in order to meet needs or support performance outcomes, then firms would be wise to acknowledge the difficulty to share that knowledge and make plans with their supply chain partner to proactively address this potential hindrance. Also, knowing the tacitness of the knowledge to be shared, firms could include an understanding of the AC and DC of their potential partners in order to best choose firms with whom to collaborate.

The ambiguity of knowledge and lack of transferability are embedded in its context and its idiosyncrasy (Simonin, 1999). Like tacitness, the complexity and novelty of knowledge also deter from its accessibility and transferability between parties (Von Hippel, 1994; Lippman & Rumelt, 1982; Simonin, 1999; Szulanski, 1996). Each of these contributes to the stickiness of knowledge and that is then reflected in the incremental cost of transfer (Von Hippel, 1994; Szulanski, 1996). Collaboration is an important method that firms can use to manage the costs of transfer for tacit knowledge. Joint problem solving executed through collaboration promotes transfer of tacit, complex and difficult to codify knowledge (McEvily & Marcus, 2005).

3.2.4.1.2 Explicit knowledge Explicit knowledge is that which can be easily conveyed in words or in writing (Nonaka, 1994). It does not have the same subjective qualities as tacit knowledge (Nonaka, 1994). Instead it is easily codifiable and can reside within multiple types of media (Nonaka, 1994). Additionally, explicit knowledge is usually context free (Nonaka, 1994).

3.2.4.1.3 Knowledge types and transfer in supply chain management Figure 3-6 illustrates how knowledge types affect the accessibility and transferability of knowledge. As knowledge moves from individual-tacit knowledge to organizational-explicit knowledge it becomes more accessible and transferable across both intra- and inter-firm boundaries. Accessibility refers to how easily knowledge can be accessed within the supply chain (O'Reilly, 1982;

Spender, 1996). Transferability refers to the ability for knowledge to be easily shared between supply chain partners (Spender, 1996). Following Figure 3-6 is a description of each quadrant and examples of supply chain knowledge that may fall into each quadrant.

Quadrant I represents individual-tacit knowledge. This type of knowledge resides in the individual and is difficult to articulate verbally or in writing (Nonaka, 1994). This type of knowledge is generally contextually based and unique (Nonaka, 1994). Szulanski (1996) referred to this type of knowledge as "sticky." The ability to manage a long-term relationship between a certain individual buyer and a particular supplier that is replete with historical knowledge and relational elements, such as trust, is an ability that is based on individual-tacit knowledge.

In this case the idiosyncrasies of the relationship and how to manage the relationship would be difficult to codify. For example, if this buyer would decide to leave the company it would be difficult to write down the historical events that have led to the current status of the relationship in order to give context to the current status of pricing, length of contracts, forecasting and other such understandings.

Quadrant II represents individual-explicit knowledge. This type of knowledge resides in the individual yet is codifiable or able to be stored in written

form or in other media (Nonaka, 1994). An executive that was interviewed shared a story about a newly hired salesman that has been hired with his

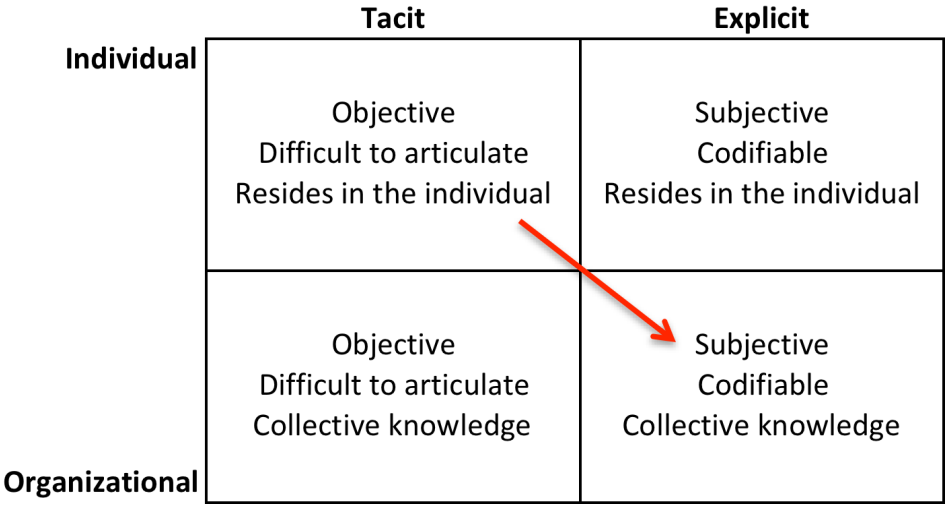

Figure 3-6 Accessibility and Transferability of Knowledge

The accessibility and transferability of knowledge increases as the characteristics of the knowledge move from individual-tacit knowledge to organizational-explicit knowledge. This figure is based roughly on tables and figures found in Niedergassel, 2011; Spender, 1996.

multi-national company to take their business to South America, Saudi Arabia and the North Seas area of Europe. The salesman is involved in many tasks while trying to establish new business in each assigned country. The knowledge that he has about the businesses that he has contacted, their responses and the next steps to take with those companies is codifiable, however, it lies within a single individual and would be a large and complex task to actually articulate to someone else. This is an example of the type of supply chain knowledge that may fall into Quadrant II.

Quadrant III represents organizational-tacit knowledge. This type of knowledge is objective and difficult to articulate, however, it resides at the organizational level (Nonaka, 1994). An example of this type of organizational knowledge is specialized expertise that is difficult to codify, such as engineering expertise that is the result of an engineering team that has been working together for many years. In this situation, the makeup of their knowledge base is path dependent and could be influenced by changes in personnel that may upset the balance of skills that reside within the team.

Quadrant IV represents the most easily accessible and transferable knowledge, organizational-explicit knowledge. This type of knowledge is easily stored within written or audio media, electronic or otherwise. An example of knowledge that is organizational-explicit knowledge could be patents for specialized products. A firm can choose to share this type of information with supply chain partners or not for collaborative activities such as new product development.

These characteristics of knowledge are presented to give insight into the difficulties that must be addressed to understand the complexities that these characteristics may cause to affect the CPC, the AC of the recipient and the DC of the source. These characteristics could also affect the impact of CPC, AC or DC on CE or performance outcomes, however, testing those effects is beyond the scope of this paper and is an opportunity for future research.

Collaborative activities between firms are affected by the characteristics of the firms in the relationship and as well as the intangible characteristics of the knowledge being shared, pooled or transferred between partners (Van Wijk, Jansen & Lyles, 2008; Llorens-Montes & Ruiz-Moreno, 2007). In CEs, firms often seek answers to specific questions or seek out information that meets a specific need of the organization (McFadyen & Cannella, 2004).

Knowledge and knowledge-based constructs such as knowledge management, knowledge sharing, knowledge transfer, AC and CPC have been studied in supply chain management literature. Table 3-2 is a representative sample of supply chain management articles that each addresses at least some aspect of knowledge using knowledge-based constructs. The table is organized by year of publication and then by author. The sample is representative of the literature stream that discusses knowledge management within the supply chain. The pattern that is seen shows that the study of knowledge management within the supply chain is becoming more frequently studied. Although, the primary focus has been on integration Priem & Swink (2012) suggest that supply chain research should go beyond knowledge integration and study the knowledge-based constructs that affect knowledge integration and management within the supply chain. As can be seen in the table, there are few articles that have addressed lower level knowledge constructs such as AC (Li et al., 2012; Wagner, 2012; Zacharia et al., 2009).

Table 3-2 Representative Sample of Knowledge-Based Supply Chain Research

Authors	Year	SCM Topic	Knowledge-Based Focus	Findings
QUANTITATIVE STUDIES				
Barratt	2004	SCM	Knowledge transfer	Knowledge transfer is a key component of collaborative activities within the supply chain.
Hult et al.	2004	Supply chain performance	Knowledge development	The authors found confusing results with most of their hypotheses proving insignificant. For example, AC related activities such acknowledge acquisition was not found significant to shared meaning nor cycle times. DC related activities such as information distribution was found to be fully mediated by shared meanings with regard to its effect on cycle time. Both AC and DC related activities were measured as characteristics of the focal firm.
Malhotra, Gosain & Sawy	2005	SCM	AC	Developed supply chain partnership configurations based on the AC of the firm. Links AC to the operational efficiency and the market knowledge creation abilities of the firm.

Table 3-2 – Continued

Authors	Year	SCM Topic	Knowledge-Based Focus	Findings
QUANTITATIVE STUDIES				
Raisinghani & Meade	2005	SCM	Knowledge management	Showed that knowledge transfer is the most impactful element of a company's knowledge management system. The other knowledge based constructs that were tested were knowledge application, knowledge creation and knowledge storage.
Hult, Ketchen & Arfelt	2007	SCM	Knowledge development	Found that knowledge development, composed of knowledge acquisition, information distribution, shared meaning and organizational memory, promoted improvements in cycle time. The elements of AC and DC that were tested here were one sided and only applied to the focal firm.
Modi & Mabert	2007	Supplier development	Knowledge transfer	Knowledge transfer leads to value creation by improving supplier performance.

Table 3-2 – Continued

Authors	Year	SCM Topic	Knowledge-Based Focus	Findings
QUANTITATIVE STUDIES				
Cheung et al.	2008	Green supply chain management	Knowledge sharing	Participation, trust, resource fitness and communication play a role in increasing knowledge sharing between firms, while shared values and learning capacity did not have the same significant findings.
Craighead et al.	2009	Supply chain innovation	Knowledge accessibility and transferability, intellectual capital and organizational memory	The influence of knowledge on cost and strategy innovation is a function of the strategy characteristics of the supply chain. Intellectual capital alone did not affect action nor performance. Instead knowledge development capacity was found to support performance outcomes. Knowledge development capacity was composed of elements from AC and DC as described in this paper.
Fugate et al.	2009	Logistics	Knowledge management	Higher levels of knowledge generation, dissemination, interpretation and responsiveness are associated with higher levels of organizational performance.

Table 3-2 – Continued

QUANTITATIVE STUDIES				
Zacharia et al.	2009	SCM	Interdependence of knowledge	Found that interdependence of knowledge and process drove levels of supply chain collaboration and thus lead to positive performance and relational outcomes. They also found that supply chain partner insight was insignificantly related to collaborative engagement.
Autry, Grawe, Daughterty & Richey	2010	SCM	Absorptive capacity	Found that high levels of absorptive capacity had a positive effect on adoption of supply chain technology.
Azadegan & Dooley	2010	Supplier innovation	Learning styles, AC	First large scale empirical research to study the impact of a supply chain partner's learning characteristics on supply chain innovation. The authors found that inter-organizational learning promotes external innovation. AC was assumed to be a characteristic of the manufacturer.

Table 3-2 – Continued

QUANTITATIVE STUDIES				
Cheung et al.	2010	Supply chain management (SCM)	Relationship learning	Heterogeneous resources, environmental uncertainty and organizational fit lead to relationship learning within global supply chains.
Cao & Zhang	2011	SCM	Knowledge transfer and joint knowledge creation	Supply chain collaboration leads to collaborative advantage. Additionally, they were able to provide evidence that information sharing, goal congruence, resource sharing communication and joint knowledge creation lead to positive collaborative rents.
Gavronski et al.	2011	Green supply chain management	Internal and external knowledge transfer	Intangible resources such as internal and external knowledge transfer are related to the creation of green manufacturing while tangible environmental investments were not.

Table 3-2 – Continued

QUANTITATIVE STUDIES				
Zacharia et al.	2011	SCM	Absorptive capacity and collaborative process competence	The authors found that the CPC of the focal firm has a positive direct effect on levels of collaborative engagement and performance and relational outcomes. Their hypothesis that AC would have a direct and positive effect on collaborative engagement was not supported. However, they found that the AC of the focal firm as fully mediated by the CPC of the focal firm.
Grimm, Hofstetter & Sarkis	2012	Sub-supplier management and sustainability	Knowledge transfer	Found fourteen critical factors to the transfer of sustainable supply chain knowledge throughout the value chain. These fourteen factors can all be classified within CPC, AC or DC (as these components are described in this paper), however, in this paper they are categorized only as internal or external critical factors.

Table 3-2 – Continued

QUANTITATIVE STUDIES				
Li et al.	2012	SCM	Knowledge management	Collaborative knowledge management practices promote supply chain knowledge quality and supply chain integration. Collaborative knowledge management practices include knowledge generation, storage, barrier free access, dissemination and application. These are all components that fit within the current model in CPC, AC or DC.
Wagner	2012	Supplier innovation	Absorptive capacity	The research supported the idea that firm boundaries should be open and facilitation of collaboration with suppliers promotes new product development. However, the author's hypotheses that AC would promote positive new product development outcomes were not supported.
Sarkis & Reyes	Forth - coming	Radio frequency identification (RFID)	Knowledge management	Knowledge management systems can mediate the role of RFID adoption and overall supply chain performance.

Table 3-2 – Continued

QUALITATIVE STUDIES				
Becker & Zirpoli	2003	New product development	Knowledge integration	AC was found to be a boundary spanner between internal departments and to other organizations. The more heterogeneous the knowledge to be transferred the more important is absorptive capacity. Their research suggests that AC is required to translate cognitive models.
Lee	2004	SCM	Knowledge management and sharing	Efficiencies in knowledge flow and sharing across supply chain partners leads to agility, adaptability and alignment.
Barratt & Oke	2007	SCM	Knowledge sharing	Found that information sharing and external ties lead to distinctive supply chain visibility.

The next two sections in this chapter address AC and DC respectively. These sections will describe AC as it is developed in the literature beginning with the seminal work of Cohen & Levinthal (1990). It will additionally, discuss how AC has been studied in supply chain management and organizational collaboration research. DC is a new construct that is being introduced in this paper. Accordingly, DC will be described and supported by prior research and the critical incident technique interviews with 43 executives performed as part of this research. These sections also develop the hypotheses that address the roles of AC and DC in the model that is the subject of this paper shown previously in Figure 3-2.

3.2.4.2 Absorptive capacity

AC is a complex knowledge-based construct steeped in strategic organizational management history. Organizational AC is loosely based upon an idea in macro-economic theory that talks to the ability of an economy to utilize and absorb external information and resources (Adler, 1990). Cohen & Levinthal (1990) conceptualized organizational AC as "the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends." Later, Zahra & George (2002) further suggested that it is a dynamic capability that supports knowledge creation and utilization such that a firm with high AC has an increased ability to gain and sustain competitive advantages.

AC has been shown to allow the firm access to external knowledge (Camison & Fores, 2010) and can extend a firm's internal formal and informal knowledge stocks (Matusik & Heeley, 2005). AC is a learning based construct (Cohen & Levinthal, 1990) that depends upon the existence of knowledge or a prior base or related knowledge and a need for that knowledge within the recipient firm (Grant, 1996). Although learning is generally accepted to take place at the level of the individual, organizational learning takes place when the firm accumulates, transforms and synergizes individual knowledge (Huber, 1991). Organizational level coordination of knowledge makes the individual's knowledge more than the sum of its parts and maintains knowledge within the firm through organizational memory and embeds that knowledge within the processes and routines of the firm (Zogut & Zander, 1995; Huber, 1991).

According to Lane, Koka & Pathak (2006), at the time of their writing the AC construct had been the subject of "over 900 peer reviewed academic papers." The wide acceptance and interest in this construct is due to its importance toward understanding the flow of information that makes up knowledge transfer and undergirds this key component of competitive advantage. Additionally, absorptive capacity crosses disciplines and is used in the study of such topics as strategic alliances (Larsson et al., 1998), supply chain collaboration (Zacharia, et al., 2011), new product development (Wagner, 2012), multi-national corporations (specifically expatriate communications) (Chang, Gong & Peng, 2012; Gupta &

Govindarajan, 2000), knowledge management (Szulanski, 1996), networks and social capital (Robert, Dennis & Ahuja, 2008) and information technology (Matusik & Heeley, 2005), to mention only a few.

The dimensions of AC are generally accepted to be the acquisition, assimilation, transformation, and exploitation of knowledge (Camison & Fores, 2010; Zahra & George, 2002). These dimensions are shown in summary in Table 3-3. A firm with high levels of AC is likely to recognize the value of new knowledge and understand how that new knowledge may be utilized within its routines and processes (Lane & Lubatkin, 1998). The ability to seek out new knowledge and exercise the four dimensions of AC is predicated on the firm's prior relevant knowledge (Cohen & Levinthal, 1990). This prior knowledge base not only consists of technical knowledge, but also knowing where knowledge resides within an organization (or accessing organizational memory) or in external resources.

An interviewee shared her experience with a multi-national advertising agency. She mentioned that she had only been at the firm for about 3 years, which is relatively a short time in her firm. A significant challenge for her firm is finding historical information and knowledge about clients and the prior campaigns designed for their clients. There is one person on-site in her office that has been with the firm for 30 years. When she is not in the office, many programs are stalled because she is the only one that knows where certain knowledge

Table 3-3 Dimensions of Absorptive Capacity

Dimensions	Definition	Components	Citations
Acquisition	Ability of a firm to seek out, recognize, value, and acquire external knowledge that can be used for economic purposes.	Prior knowledge Prior investments Intensity Speed Direction	Camison & Fores (2010); Cohen & Levinthal (1990); Lane & Lubatkin (1998); Zahra & George (2002)
Assimilation	Ability of a firm to absorb external knowledge. The leveraging of processes and routines to allow new knowledge to be analyzed decoded and understood.	Understanding Interpretation Comprehension	Camison & Fores (2010); Cohen & Levinthal (1990); Lane & Lubatkin (1998); Zahra & George (2002)
Transformation	Ability of a firm to develop and refine the acquired external knowledge to fit within current processes or to transform current routines. Transformation may include interpreting and combining new knowledge in new ways.	Internalization Conversion Recodification Synergy	Camison & Fores (2010); Cohen & Levinthal (1990); Kogut & Zander (1992); Lane & Lubatkin (1998); Szulanski, (1996); Zahra & George (2002)
Application	Ability of a firm to incorporate new knowledge into their processes and routines. This also includes the abilities of a firm to exploit new knowledge to create new competences, innovation or processes.	Use Implementation Harvesting resources	Camison & Fores (2010); Cohen & Levinthal (1990); Lane & Lubatkin (1998); Szulanski, (1996); Zahra & George (2002)

resides, whether that is within a person, some type of media, or resides outside the firm. The inability to access the organizational memory within their firm or with external sources is a significant hindrance to the AC of the firm.

As previously mentioned, when a firm has a high level of AC it is more likely to recognize and value new knowledge (Lane & Lubatkin, 1998). Additionally, it has been shown that a "firm's perception of the incentives for learning available in their environment affects their willingness to invest in the AC necessary" to harvest the knowledge available in the environment (Lane et al., 2006). When a firm values new knowledge, is able to recognize sources of relevant knowledge and is able to understand that knowledge and how to apply it, the firm is more likely to aggressively engage in collaborative activities. AC has also been found to improve operational and relational outcomes (Patel et al., 2012; Zacharia et al., 2011) and higher levels of AC have been associated with higher levels of spillover and relational rents from collaboration activities (Cao & Zhang, 2011). Accordingly, it is hypothesized that:

> *Hypothesis 5* – The recipient's level of AC is positively related to the level of engagement in collaborative initiatives.
>
> *Hypothesis 6a* – The recipient's level of AC is positively related to the operational outcomes of collaborative initiatives.
>
> *Hypothesis 6b* – The recipient's level of AC is positively related to the relational outcomes of collaborative initiatives.

(This research tests the impact of AC to the model of supply chain collaboration by considering AC to be a first order construct that is measured by its component dimensions shown in Table 3-3 (Camison & Fores (2010); Cohen & Levinthal (1990); Lane & Lubatkin (1998); Zahra & George (2002); Zacharia et al., 2011). This is in lieu of an alternative view that AC may be a second order latent construct made up of these four items as individual first order constructs.)

A transfer begins when both a need for knowledge and the knowledge to meet the need coexist within an organization or collaboration. In a transfer situation, knowledge resides within a source and the need for knowledge resides within the recipient. It is important to differentiate between the two parties in dyadic knowledge transfer because it is posited in this paper that the supply chain management literature that has incorporated AC has incurred spurious results due to the entanglement of AC and DC in the models (e.g. Hult et al., 2004; Wagner, 2012; Zacharia et al., 2011).

For example, Lane & Lubatkin (1998) reconceptualized AC as "relative AC." This was done, in part to acknowledge that AC is a dyad level construct. In addition, the idea of relative AC is based on the assertion that AC is a product of characteristics associated with both the source and the recipient in knowledge exchange activities. Although, Lane & Lubatkin (1998) provide an insightful

analysis of AC and adds new understanding to the construct, this research suggests that AC is *not* a product of characteristics of *both* the source and recipient. Rather, it is proposed here that the original conceptualization of AC as an ability of solely the recipient of knowledge, as described in Cohen & Levinthal (1990), be accepted. AC is a characteristic of the receiving party involved in a knowledge transfer, sharing or pooling scenario, such as supply chain collaboration. However, this research agrees with Lane & Lubatkin (1998) in the sense that attributes and abilities of the source and the recipient are both important to promoting supernormal results in collaborative activities. To be clear, a firm can be both a sender and receiver of information simultaneously. AC is a capability that is enacted during the act of *receiving* knowledge; while other capabilities are leveraged by the firm during the act of sending knowledge.

Supporting the idea that both the source and the recipient need to be considered in models of collaboration and dyadic activities, Cohen & Levinthal (1990) add context to their conceptualization of AC by suggesting that a "sufficient level" of knowledge homogeneity must exist between firms in order for knowledge transfer to be effective. They go on to say that beyond having a base of homogeneous knowledge that firms involved in knowledge sharing should also have a divergent knowledge base from on another in order to promote novel linkages and associations in order to drive innovation (Cohen & Levinthal, 1990;

Lawrence & Lorsch, 1967; Szulanski, 1996). There is an unstated assumption in these assertions that there is a source of knowledge stocks (without which the knowledge transfer could not occur) from which the firm will draw upon when enacting its AC.

The multinational corporation (MNC) literature stream is more mature in the study of knowledge transfer than the supply chain management literature. This statement is based, in part, on the fact that MNC literature has traditionally accepted the importance of the source in knowledge transfer situations, specifically the role of the expatriates as the source of knowledge (Gupta & Govindarjan, 2000; Minbaeva & Michailova, 2004). MNC literature acknowledges that the source must have the ability to share knowledge and that the recipient must have a corresponding ability to absorb knowledge (Gupta & Govindarajan, 2000; Minbaeva & Michailova, 2004; Tsang, 1999). Chang et al. (2012) studied the ability of MNC expatriates to transfer knowledge and found that AC moderated the effect of the expatriate's (source) disseminative abilities on knowledge transfer. It was shown that expatriates were more like to engage in knowledge transfer behaviors when they see that the subsidiary had high levels of AC.

In addition, a lack of AC and, importantly, the lack of prior knowledge exacerbate the stickiness of knowledge (Argote & Ingram, 2000; Szulanski, 1996; Tu, Vonderembse, Ragu-Nathan & Sharkey, 2006). In other words, when a firm

lacks AC it is less likely to be able to absorb sticky knowledge (Argote & Ingram, 2000). The recipient with low levels of AC is less likely to recognize, understand or apply knowledge that is tacit, unique, or complex (Szulanski, 1996). During his interview, a supply chain expert described this phenomenon as "in one ear and out the other." He shared an experience where he was consulting with a manufacturing organization about how to utilize certain components of their ERP system to improve supply chain management. When he was first engaged for the consulting project, there was an employee in charge of the project that did not have the background necessary to understand the basics of the ERP system and how it could be leveraged to improve current processes. He simply did not have the requisite prior knowledge to be able to absorb the new knowledge that was being presented. The executive shared: "In the UK we have an expression – in one ear and out the other – do you understand that in America? No matter the information I shared, the fellow could not understand what I was saying. When I realized the problem, only a few days into the engagement, I found it necessary to tell management that this project was not going to succeed and I was not willing to continue in the engagement at the expense of management for a failing project." After this engagement was cut short, the executive was called back to the firm one year later. At that time, management had recruited a new employee for the supply chain position. The executive said that the employee was well

versed in ERP capabilities and how to use this type of technology. The second engagement with the firm was a tremendous success.

The AC of the recipient is theorized to have a moderating effect on the DC of the source based on the stream of logic presented in the preceding paragraphs and summarized below:

1) Knowledge transfer, sharing and pooling are dependent on the characteristics of both the source and recipient (Easterby-Smith et al., 2008, Grant, 1996; Gupta & Govindarajan, 2000);
2) The lack of AC deters from a firm's ability to absorb sticky knowledge (Cohen & Levinthal, 1990; Szulanski, 1996); and,
3) The lack of AC, specifically the ability to absorb and apply knowledge, has been shown to moderate the effect of the source's ability and willingness to share knowledge on knowledge transfer outcomes (Chang et al., 2012; Gupta & Govindarajan, 2000; Minbaeva & Michailova, 2004; Tsang, 1999; interviews).

Based on these assertions it is posited that:

Hypothesis 7a – The recipient's level of AC has a moderating effect on the ability of the source's DC to positively affect the operational outcomes of collaborative initiatives.

Hypothesis 7b – The recipient's level of AC has a moderating effect on the ability of the source's DC to positively affect the relational outcomes of collaborative initiatives.

This paper and the current model refer to the AC of the recipient of knowledge or the focal firm. AC is conceptualized as the ability of the focal firm to acquire, absorb, assimilate and apply knowledge (Zahra & George, 2002). For example, a typical example of supply chain collaboration is the interaction between a focal firm and their supplier to develop a new product. In this case the need for expertise or knowledge resides within the focal firm, the company that wants to create a new product. The expertise or new knowledge resides within their supplier (otherwise the focal firm would not be working on new product development with this supplier; they would either complete the project internally or partner with a different firm). Accordingly, the focal firm would be the recipient of knowledge and the supplier would be the source of knowledge. In the proposed model, AC is theorized as a characteristic of the focal firm and CPC and DC are theorized as characteristics of the supply chain partner.

3.2.4.3 Distributive capability

Argote (1999) describes four factors of knowledge transfer: organizational characteristics, relationship between organizations, transfer process and the knowledge transferred. In the context of supply chain collaborations, the proposed model addresses each of these sets of characteristics as follows:

1. The characteristics of the organizations: AC (recipient), CPC (source) and DC (source);
2. The relationship between organizations (PI);

3. The characteristics of the knowledge as tacitness, accessibility and transferability;

4. The transfer process itself is operationalized as supply chain collaboration.

To this point, this paper has addressed all of these factors with the exception of DC. Distributive capability is conceptualized as the ability of a knowledge holder to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes. While the idea of DC is new, academic acknowledgement of the role of the source in knowledge transfer is not new. Szulanski (1996) defined knowledge transfer in terms of a source and recipient – "a dyadic exchange of organizational knowledge between a source and a recipient unit in which the identity of the recipient matters."

Additionally, management scholars argue for the importance of the source in the context of knowledge sharing, transfer and pooling (Cohen & Levinthal, 1990; Davenport & Prusak, 1998; Dyer & Singh, 1998; Gupta & Govindarajan, 2000; Husted & Michailova, 2002; Minbaeva & Michailova, 2004; Oppat, 2008; Teece, 1977). Table 3-4 provides a sampling of studies that address the characteristics of the source in knowledge transfer transactions. As can be seen in Table 3-4, these studies have little overlap in their proposals of the behaviors and abilities that characterize a successful source of knowledge.

This paper draws on a review of the current literature and the results of 43 executive interviews to develop a list of proposed characteristics of a successful

Table 3-4 Representative Sample of Management Studies on Source Capabilities

Study	Year	Context	Source Capability	Conceptualization
Reagans & McEvily	2003	Social networks	Ability to codify	The ability of a source to reduce tacit and explicit knowledge to writing.
			Frame language	The ability of a source to choose the right diction and context in which to present information to a recipient.
			Provide multiple perspectives	The ability of the source to understand and provide multiple perspectives in order to facilitate the transfer of knowledge.
			Common knowledge base	The source and recipient should share some common knowledge base in order for the source to be able to transfer knowledge to the recipient.
Minbaeva & Michailova	2004	MNC	Willingness	Proposes that the disseminative capability of a source to provide knowledge to another party is dependent on their willingness to share.
			Communication	Proposes that the disseminative capability of a source is dependent upon the source's ability to communicate knowledge to another party.

Table 3-4 – Continued

Study	Year	Context	Source Capability	Conceptualization
Gupta & Govindarajan	2000	MNC	Value of knowledge stocks	The ability of a source to be successful depends at least in part on the value of its knowledge stocks.
			Heterogeneous knowledge with recipient	The source must have some unique knowledge to share with the recipient.
			Motivational disposition	The source must have a motivational disposition in order to be willing to share knowledge.
			Channel selection	A successful source will choose the best channel with which to share knowledge.
De Vries et al.	2006	Team Performance	Make knowledge available	The source must make efforts to share knowledge by creating the right atmosphere, level of availability and providing or seeking out opportunities to share.
			Eagerness to share	The willingness and motivation of a source to share knowledge will affect their success.
			Use of tools and technology	The source should seek out and utilize the right tools and technology to assist in sharing the knowledge with the recipient.
			Ability to codify	The ability of a source to reduce tacit and explicit knowledge to writing.

Table 3-4 – Continued

Study	Year	Context	Source Capability	Conceptualization
Martin & Salomon	2003	MNC	Ability to understand recipient	The source must be able to understand the needs of the propose recipient.
			Decontextualizing and encoding knowledge	The ability of the source to articulate knowledge in a way that the recipient can understand and assimilate the knowledge into their organization.
			Channel selection	A successful source will choose the best channel with which to share knowledge.
			Partner selection	A successful source will ensure that they have targeted the "right" recipient.
Oppat	2008	NPD	Knowledge selection	The source must understand the needs of the recipient in order to choose the correct knowledge to share in order to address the recipient's needs.
			Decontextualizing and encoding knowledge	The ability of the source to articulate knowledge in a way that the recipient can understand and assimilate the knowledge into their organization.
			Transfer approach	The channel and method that is selected by the source affect the ability of the source to be successful.
			Partner support	The ability of the source to support the recipient by follow-up and ensuring that they have been able to successfully apply the new knowledge.

Table 3-4 – Continued

Study	Year	Context	Source Capability	Conceptualization
Jasimuddin et al.	2012	Databases	Personalization	The ability of the source to personalize knowledge for the recipient will affect the recipient's ability to successfully apply the knowledge.
			Ability to codify	The ability of a source to reduce tacit and explicit knowledge to writing.
Stock & Tatikonda	2000	Technology Transfer	Communication	The source must choose the best method by which to communication with the recipient.
			Coordination	The source must coordinate the knowledge transfer with the recipient.
			Cooperation	There must be a level of cooperation and willingness on the part of the source to participate in the knowledge transfer.
Craighead et al.	2009	SCM	Learning progression	The extent to which an organization is a "learning organization" that constantly innovates and acquires new knowledge.
			Knowledge use	The ability of the source to choose the proper application for knowledge to be shared.
			Organizational memory	Stored representation of supply chain learning.
			Intellectual capital	Credible information or experience that resides within the organization in individuals, processes or infrastructure.

Table 3-4 – Continued

Study	Year	Context	Source Capability	Conceptualization
Chang et al.	2012	MNC	Ability to transfer	The source has the ability to transfer knowledge in terms of communication abilities.
			Motivation to transfer	The extent to which a source has a motivation to transfer knowledge will affect their ability to be successful.
			Opportunity seeking	The extent to which a source seeks out opportunities to share knowledge will affect their ability to be successful.
Park et al.	2012	IJV	Ability to codify	The ability of a source to reduce tacit and explicit knowledge to writing.
			Channel selection	A successful source will choose the best channel with which to share knowledge.
			Opportunity	The extent to which a source seeks out opportunities to share knowledge will affect their ability to be successful.

Table 3-4 – Continued

Study	Year	Context	Source Capability	Conceptualization
Sarker et al.	2005	Virtual Teams	Technical ability	Technical knowledge and expertise.
			Project management ability	Ability of the source to manage the project in which knowledge transfer is a part.
			Communication extent	The level of communication from the source to the recipient in terms of intensity and frequency.

Abbreviations:

GSCM	Green supply chain management
IJV	International joint ventures
MNC	Multi-national corporations
NPD	New product development
SCM	Supply chain management

source of knowledge. This list of characteristics is then categorized into proposed factors that together represent the proposed construct of DC. DC is developed from referential relationships to disseminative abilities (Minbaeva & Michailova, 2004), absorptive capacity (Cohen & Levinthal, 1990) and knowledge transfer (Grant, 1996). It is the outcome of conceptual connections with prior constructs and unexpected results in related empirical research (Hult et al., 2004; Wagner, 2012; Zacharia, 2011).

3.2.4.3.1 Conceptual distinctions As mentioned earlier, the study of the source in knowledge transfer is not new. However, this area of research is relatively little studied and is therefore still in its infancy in management literature and likewise in supply chain management research (Kuiken & van der Sijde, 2011). Prior research has conceptualized the ability of the source to send knowledge as *disseminative capability* (Gupta & Govindarajan, 2000; Minbaeva, 2007; Minbaeva & Michailova, 2004; Mu et al., 2010; Oppat, 2008; Parent et al., 2007). Generally, disseminative capability (DsC) is defined as the ability of an organization to accumulate, translate and transform knowledge in order to disseminate that knowledge to other known or unknown actors in its network (Gupta & Govindarajan, 2000; Minbaeva, 2007; Minbaeva & Michailova, 2004; Mu et al., 2010; Oppat, 2008; Parent et al., 2007).

Although DsC is a component of successful knowledge transfer, it is suggested here that DsC alone it is not sufficient to describe the characteristics of

a successful source of knowledge. Rather, a successful source of knowledge is indicated by three sets of characteristics, which together make up DC, namely:

1) The ability to accumulate, translate, transform and transmit knowledge (DsC) (Gupta & Govindarajan, 2000; Minbaeva, 2007; Minbaeva & Michailova, 2004; Mu et al., 2010; Oppat, 2008; Parent et al., 2007; interviews).
2) Access to knowledge stocks and other knowledge-based resources either internal or external to the firm (including but not limited to human resources and organizational memory) (Craighead et al., 2009; Gupta & Govindarajan, 2000; Stewart, 1994; interviews).
3) The ability to access, accumulate, assess and apply knowledge regarding the recipient of knowledge (or, in this case, collaborative partner) – this will be referred to as partner knowledge for the purposes of this research (Oppat, 2008, Jasimuddin et al., 2012; Zacharia et al., 2009; interviews).

For ease of reference, DC is contrasted to DsC in Table 3-5.

In addition to differentiating DC from DsC, it is important to point out further aspects of DC that make it different from other concepts that have been discussed in the literature. The use of the term "distributive" in the name of the new construct is intentional. It is used to denote the idea that DC is enacted by a source for a purposeful, distinct and controlled transfer of knowledge to a known

Table 3-5 Distributive Capability vs. Disseminative Capability

	Distributive Capability (DC)	**Disseminative Capability (DsC)**	**Comments**
Participant	Source	Source	Both are qualities of the source in knowledge transfer.
Primary focus	Transfer	Diffusion	DC culminates in the transfer of knowledge. This exceeds mere diffusion of knowledge because it involves routing knowledge (selective distribution). Knowledge that is transferred is selected, prepared and presented in a manner that is partner specific.
Associated assets and abilities	Intellectual capital Partner knowledge Disseminative capability	Accumulation Translation Transformation Transmission	DC is hypothesized to include DsC that represents the accumulation, selection, translation, and communication of knowledge. DC also includes the intellectual capital of the firm (internal and external knowledge resources), and the ability of the firm to acquire, apply and exploit partner knowledge (information about the recipient's needs, abilities, culture, plans, expectations, strengths, weaknesses, industry, environment, history and other such characteristics).

recipient (Huber, 1991; Szulanski, 1996). In other words, DC is not associated with a gradual diffusion of information or knowledge to known or unknown recipients. Szulanski (1996) describes knowledge transfer in and between organizations as a distinct experience where the identity of the recipient matters.

Further, the idea of distribution is embedded in the conceptualization of DC. For the purposes of this defining this idea, "distribution" is not the idea of merely moving tangible or intangible resources from place to place. Instead, the idea of *distributing* knowledge here is idealized based on the description of distribution in Hult et al., (2004). Hult et al. (2004) describes the distribution of information between supply chain nodes. They suggest that disseminating or diffusing information does not lead to action (Hult et al., 2004). Instead, they say that information must be specifically distributed to each supply chain node, in a way that the act of distribution is specific to each supply chain partner (Hult et al., 2004).

Additionally, they go on to suggest that distributing information involves ensuring that the information is applied within the supply chain partner's organization for commercial purposes (Hult, et al., 2004). Lin, Geng & Whinston (2005) support this idea, the authors find that the value of knowledge is not realized until the recipient has assimilated it and put it to use. The concept of DC embraces this idea by including the necessity of partner knowledge as a key antecedent. In order to ensure that the recipient is able to assimilate and apply the

knowledge, the source must understand the needs, culture, prior knowledge base and other key aspects of the organization (Martin & Salomon 2003 and interviews). "Exchange partners exerting the greatest influence on a firm's acquisition of capabilities are those that are most knowledgeable of a firm's operations and able to reduce uncertainty about how to implement a capability" (McEvily & Marcus, 2005).

Two-way interaction is also important for transferring the tacit knowledge underlying many capabilities. Recipients rarely assimilate the knowledge completely in a single interaction but require multiple interactions (McEvily & Marcus, 2005). This supports the findings in the executive interviews that emphasize the importance of joint problem solving, the source seeking and accepting feedback and providing a safe environment for the recipient to participate in vigorous two-way communications. This supports the idea of distribution with deliberate and specific recipient contact and feedback versus dissemination without specific and deliberate recipient contact and feedback loops. DC as developed in this paper adopts the qualities and ideas of distribution supported described above and supported by Hult et al. (2004), McEvily & Marcus (2005), Lin et al. (2005), and the executive interviews detailed in Appendix B.

It was argued earlier in this paper that the characteristics of the source in knowledge transfer (DC) were often confused with those of the recipient (AC) in

these transfer situations. Table 3-6 includes a summary of the distinctions between AC and DC. On its most basic level, AC represents qualities associated with the recipient in knowledge transfer transactions. While, DC represents the qualities associated with the source. This simple distinction is clouded by the fact that an organization can be both a sender and a receiver of knowledge simultaneously in the same collaboration. In fact, this plurality of roles is common and causes difficulties for organizations and managers to bifurcate the characteristics of the source and recipient. This research presents findings that will assist managers and academics to be able to better differentiate these roles and to understand what it takes to ensure successful knowledge transfer.

3.2.4.3.2 Hypothesis development Higher levels of DC are proposed to effectuate higher levels of CE and collaborative performance outcomes. DC is a capability of an organization that allows it to successfully transfer knowledge to another party toward commercial ends. This capability is made up of competences that allow the organization to positively influence levels of engagement in CEs and performance outcomes. More specifically, one component of DC is DsC. DsC allows the organization to tap into its internal and external knowledge stocks in order to accumulate, transform, translate and transmit knowledge it supply chain partners (Gupta & Govindarajan, 2000; Minbaeva, 2007; Minbaeva & Michailova, 2004; Mu et al., 2010; Oppat, 2008; Parent et al., 2007; interviews). DsC includes being able to choose the correct channel and media for sharing

Table 3-6 Distributive Capability vs. Absorptive Capacity

	Distributive Capability (DC)	**Absorptive Capacity (AC)**	**Comments**
Participant	Source	Recipient	DC and AC are associated with different roles in knowledge transfer, either transferring or receiving knowledge respectively. These capacities are easily confused because one firm can fill both of the role of a source and a recipient in a single knowledge transfer simultaneously. This typically happens when knowledge is being shared and there is a two-way flow of knowledge between exchange partners. These are distinctly different abilities, however, that can be executed simultaneously in complex knowledge sharing or knowledge pooling situations.

Table 3-6 – Continued

	Distributive Capability (DC)	**Absorptive Capacity (AC)**	**Comments**
Primary focus	Transfer	Application	DC's primary purpose is to enable the firm to select, transform, and transfer knowledge from the source to a known recipient. AC's primary purpose is to enable the recipient to acquire, assimilate, transform and apply new knowledge to the firm's routines and processes.
Associated assets and abilities	Intellectual capital Partner knowledge Disseminative capability	Prior related knowledge Prior investments Comprehension	The assets and abilities associated with DC undergird the firm's ability to access, select, and transfer relevant knowledge stocks in order to meet a partner specific need. AC is different because it utilizes assets and abilities that allow the firm to seek out and bring new knowledge into the firm.

knowledge along with ensuring that the knowledge is partner specific (Gupta & Govindarajan, 2000; Martin & Salomon, 2003; interviews). The more a firm is able to target knowledge for its partner the more involvement each party will have in the CE.

Additionally, DC also includes the intellectual capital of the firm and its ability to leverage that intellectual capital to benefit an external partner (Craighead et al., 2009 and interviews). When a partner is given access to needed intellectual capital that is not available within their own organization there will necessarily be higher levels of CE between firms.

Finally, in support of DC contributing to higher levels of CE, DC includes the ability of the firm to acquire, assess and apply partner knowledge to the selection, personalization and transmission of knowledge to the recipient (Jasimuddin et al., 2012; Martin & Salomon, 2003; Zacharia et al., 2009; interviews). The more partner knowledge that a firm has the more likely they are to vigorously engage in collaborative activities. Based on these three attributes of DC it is hypothesized that

> *Hypothesis 8* – The source's level of DC is positively related to the level of engagement in collaborative initiatives.

The success of a source to transfer knowledge within CEs is a necessary pre-requisite to the successful absorption and, ultimately, application of

knowledge by a recipient. Accordingly, it is proposed here that DC is a necessary but insufficient condition for knowledge transfer. As AC has been found to improve performance outcomes (Cao & Zhang, 2011; Patel et al., 2012), it is proposed here that DC also has a direct effect on the operational and relational outcomes of collaborative activities. Based on these assertions it is hypothesized that

> *Hypothesis 9a* – The source's level of DC is positively related to the operational outcomes of collaborative initiatives.
>
> *Hypothesis 9b* – The source's level of DC is positively related to the relational outcomes of collaborative initiatives.

Based on the discussions in this paper, in order for it to be true that knowledge has transferred between supply chain partners it must also be true that:

a. The recipient had some level of absorptive capacity; and
b. The source had some level of distributive capability.

To state that knowledge transfer occurred implies that each of these predicates is true. However, neither DC nor AC alone is a sufficient condition for the consequent knowledge transfer. Each of these capacities appears to be necessary but not sufficient by itself for knowledge transfer; that is, both of these factors appear required at least at minimum levels for knowledge transfer to take place. Accordingly, it is hypothesized that

> *Hypothesis 10a* – The source's level of DC has a moderating effect on the ability of the recipient's AC to positively affect the operational outcomes of collaborative initiatives.

Hypothesis 10b – The source's level of DC has a moderating effect on the ability of the recipient's AC to positively affect the relational outcomes of collaborative initiatives.

Chapter 4

Research Methodology

The focus of this research is to better understand knowledge transfer within and between firms, especially as knowledge transfer applies within the supply chain. It is proposed that SCM literature has overlooked an important element of knowledge transfer, specifically, the ability of a source of knowledge to share that knowledge with other firms in such a way as they are able to assimilate, absorb and apply that knowledge toward improved commercial performance outcomes. Because there is little research with regard to the source in knowledge transfer transactions (Kuiken & van der Sijde, 2011; Tang et al., 2010), this research began with a qualitative study. This study involved 50 interviews with high-ranking executives in which they were asked to describe successful and unsuccessful collaborations in which they were personally involved. The interviews followed a critical incident technique (CIT) methodology and are described in detail in Appendix B. These surveys resulted in 43 usable interviews and 86 unique observations of inter-firm collaboration. The observations detailed 43 successful and 43 unsuccessful collaborations through first person recollections of events.

The CIT interviews were the first step in construct validation for the survey that is used in this paper. This step was taken in order to uncover the potential empirical indicators for the constructs DC and CPC. Unexpectedly, the

interviews suggested a new construct that has been titled "fertile ground." Although, fertile ground is an interesting and potentially important element of knowledge transfer the investigation of its validity is beyond the scope of this paper. (There is a detailed discussion of fertile ground in Appendix B.) Indicators must be shown to have an empirical assessment of content validity, or that they are logically and theoretically associated with one another and applicable to a single construct (Nunnally, 1978; O'Leary-Kelly & Vokurka, 1998). Accordingly, the measurement items supported by the CIT analysis were further analyzed as the next step in scale development.

4.1 Scale Development

In order to explore knowledge transfer and specifically the roles of both the source and recipient in these transactions, the input from executives collected through the CIT methodology was used to create empirical indicators that were used to create a survey so that the concepts could be further studied using a quantitative survey methodology. This research was an iterative triangulation to study the potentiality of DC. Next, several steps were taken in order to create the scales necessary to develop the necessary measurement instrument (survey) to collect data.

First, categorization of executive comments into potential measurement items was completed and then the measurement items were grouped into potential constructs. Both academics (3) and practitioners (3) reviewed the categorization

and groupings. They were asked to provide their comments, insights and suggestions (Li, Rao, Nathan & Nathan, 2005). See Appendix B for details of this analysis and validation of results. These steps lead to the development of measurement items to be used to test hypotheses regarding the newly proposed construct distributive capability. Additionally, this analysis suggested that CPC be measured and tested as a characteristic of the source vs. the recipient. Earlier literature has studied CPC as a primary characteristic of the recipient (e.g. Zacharia et al. (2011)).

The next step involved establishing measurements for each of the remaining constructs in the proposed model. As this study proposed to expand on the research of Zacharia et al. (2011), the measurement scales that were used in their research were used a launching point for constructing scales for each construct: PI, AC, CE, operational outcomes (OO), relational outcomes (RO) and CPC (note that CPC in the Zacharia et al. (2011) article was that of the respondent firm). Additionally, an in-depth literature review was performed in order to confirm the proposed scales for these items. These measurement items along with those for DC are shown in a table attached as Appendix C. They are grouped by hypothesized construct, given reference labels and supported by citations.

The measurement items were grouped together in a spreadsheet and were reviewed again by two academics and 5 executives that were interviewed as part of the CIT process. Based on their comments the items were reworded or

removed to improve the scales and the applicability of each item to the proposed construct (Li et al., 2005).

4.2 Measurement Instrument

A survey was then constructed using these empirical indicators as representative items for each construct. Each of these indicators was measured using a seven-point scale. Additionally, several control measures were captured:

a) Duration of collaboration;
b) Number of collaborations with this partner;
c) Size of company – by employees and revenue;
d) Type of organization; and,
e) Respondent's job title, years of experience and years of experience in their current position.

A pilot test was conducted by sending an email with an electronic link to the survey to 75 high level executives. Forty-five of these executives participated in the earlier CIT interviews and the researcher personally knew the remaining 30. Of these 75 respondents approximately 85% of them are supply chain executives or have a C-level positions within their organizations.

The survey was posted on-line in February 2014 using Qualtrics software Version 2013 of the Qualtrics Research Suite copyright © 2013. Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA. http://www.qualtrics.com.

There was a 93% response rate to the requests that were emailed to executives as the pilot test for this survey. The survey was well received during the pilot-test. However, at the beginning of the survey the respondent is asked to share one to two sentences that describe the collaboration. The pilot test showed that respondents were hesitant to provide a response to this question and may abandon the survey. Accordingly, the question was changed to read as follow: "Please tell us in a couple of sentences the nature and scope of the collaboration. You do not need to answer this question in order to complete the survey. This is helpful information – but completely optional." This change increased the likelihood that respondent's would continue past this item. The final survey is attached as Appendix D.

4.3 Sample

4.3.1 Unit of Analysis

The unit of analysis for this paper is the firm. In order to examine the macro elements of supply chain collaboration and performance this research uses organizational antecedents and knowledge sharing outcomes (Foss et al., 2010). The knowledge-based constructs that are used in this study are operationalized at the individual level. However, they are utilized with the understanding that organizations are made up of the collective skills of individuals in such a way as the collective exceeds the abilities of the individuals (Nonaka, 1994; Spender, 1996).

In order to study supply chain collaboration from the perspective of the individual applied to the unit of analysis, the firm, this research required that key informants from each organization be selected to participate in the survey (Hewett & Bearden, 2001; Ring and Van de Ven, 1994, p.95; Zacharia et al., 2011). It is acceptable practice in operational research to use key informants to provide information about firm level ideas and constructs (Zhao et al., 2011). There are studies that promote a single key informant in order to study organizations (e.g. Hewett & Bearden, 2001; Zacharia et al., 2011; Zhao et al., 2011) and those which promote multiple informants (e.g. Bruggen, Lilien & Kacker, 2002) For the purposes of this research a single key informant was chosen to provide information regarding the organization and collaborative activities. This decision was made based on the initial interviews and comments from academic and practitioner reviewers of the survey. Accordingly, individuals involved in supply chain management collaborations, namely purchasing managers were selected as the sample set for this survey research because of their involvement in the supply chain and, specifically, their role in inter-firm collaborations.

4.3.2 Sample Set

A list of 5,000 purchasing managers was obtained from Dun & Bradstreet. The 5,000 purchasing managers were chosen at random by Dun & Bradstreet using only the criteria that the company SIC code was manufacturing and that the companies were based in the United States. The list included names, titles (all

purchasing managers) and company names, addresses, and SIC codes. This list was used to send letters to each purchasing manager via the U.S. Postal service. A copy of the letter is attached as Appendix E. The purchasing managers were asked to participate in a survey regarding supply chain collaborations and were assured that they could take the survey anonymously. The letters included a website address for the managers to use to access the survey which was made available through Qualtrics software. Many purchasing agents gave their email address at the end of the survey, in order to have a chance at winning an I-pad mini. Additionally, many managers left their contact information in order to receive an executive summary of the results of this study.

A second group of respondents was also asked to participate in this survey. 300 purchasing managers from state and local government were contacted via email (with an electronic link to the survey). The survey information was captured under a separate and distinct Qualtrics survey website address so that the responses could be differentiated from the 5,000 purchasing managers working in for-profit entities. The names of the government purchasing managers were attained by a web search using Google to find requests for proposals (RFP) that were posted on-line. The RFP's were selected based on their ordered appearance on the Google search results in an attempt to make the selection as random as possible. Each RFP was reviewed in order to attain contact information for the purchasing manager that was responsible for the posting. In each case, the

purchasing managers provided their email contact information on the RFP. The suggestion that they could be involved in a drawing was removed. This was done because most governmental employees, especially purchasing managers, are not allowed to accept gifts or awards of this sort.

4.3.3 Response Rate

Governmental responses yielded 92 (30.6% of 300) website hits each from a unique IP address. Many of the respondents did not answer any questions to the survey after they read the informed consent at the beginning of the survey. Accordingly, the request netted 32 usable survey responses providing a net 10.7% response rate.

The 5,000 letters (15 were returned noting the employee no longer worked for the company) that were mailed to purchasing managers along with the 70 pilot-test results yielded a gross of 506 (9.98% of 5,070 requests) website hits. 109 of these respondents, all with unique IP addresses, did not proceed to complete any questions on the survey after reading the informed consent document. Accordingly, there was a net yield of 397 responses from this group of key informants providing an initial response rate of 7.8%.

In total, 5,360 requests for participation were distributed. From these requests, there were 598 unique IP addresses that visited the website or 11.2%. Of this gross 598 hits, there were 429 respondents that responded to the survey or an acceptable response rate of 8% (Li et al., 2005). A hurdle for organizational

research is persuading managers to respond to surveys (Li et al., 2005). Managers have a limited amount of time and even on-line surveys can seem time consuming without a reward or benefit for the manager.

These responses were examined for missing data and outliers. After the elimination of surveys with greater than 10% missing data (113) or were determined to be outliers (6) the net number of usable surveys was 310 or 5.8% of the total distributed requests for participation. This number of observations is supported for this analysis of 42 empirical indicators based on references that suggests between 4 (Hair, Anderson, Tatham & Black, 1992) and 10 (Kerlinger, 1986) observations per indicator (O'Leary-Kelly & Vokurka, 1998) for structural equations modeling. The response rate results are shown in Table 4-1.

Table 4-1 Response Rate

	Pilot Study	Mailed - Post Pilot Study*	Totals	% of Gross Requests
Gross Requests	75	5285	5360	
Gross Website Hits	70	528	598	11.2%
Responses	70	359	429	8.0%
Removed - Missing Data	0	113	113	2.1%
Removed - Outliers	0	6	6	0.1%
Usable Responses	70	240	310	5.8%

*Does not include 15 returned letters

Responses that had more than 10% missing data were removed from the sample set. The 9 responses with less than 10% missing data were examined to determine whether or not the missing data was missing at random (Hair et al., 2010, p 49). Using Little's MCAR methodology (Hair et al., 2010, p. 49) an analysis of missing data was created using SPSS 22 (IBM, 2013). The Little's MCAR provided the following results: $\chi^2 = 580.482,\ d.f. = 70$ with a significance of 1.0. The test rejected the hypothesis that the values were not at random. Accordingly, it was decided that values for these missing data points could be imputed. The expectation maximization (EM) method of imputation (Hair et al., 2010) using SPSS 22 (IBM, 2013) was undertaken to impute values for missing data in these surveys. According, to Hair et al. (2010, p. 57) any methodology of imputation is valid when replacing missing data that represents less than 10% of the total values per response.

Casewise diagnostics (Hair et al., 2010, p. 70) were run using SPSS 22(IBM, 2013) were used to determine if there were any outliers in the remaining 316 responses. The analysis suggested 6 cases as outliers. These cases were reviewed and each answered the question that asks about the success level of the collaboration as a 1 or highly unsuccessful. However, all of the remaining answers signified that the collaboration was highly successful, even answering the questions regarding the performance outcomes as high performance. Accordingly, the respondent may have miscoded these cases as unsuccessful.

They were removed from the analysis. The remaining 310 cases were used for testing the hypothesized constructs and structural model. These 310 responses represent 5.8% of the total requests that were sent to purchasing managers and 72.26% of the total responses received.

4.3.4 Sampling Bias

There is a potential for selection bias in the survey responses received because of the various groups of respondents that were asked to participate in this research. Specifically, there were purchasing managers from state and local government and from the private sector. Additionally, there were 70 responses from high-level executives that represented the pilot study. The combination of all of the responses from the various types of respondents totaled 310 usable responses. In order to address this potentiality of bias, response bias on the 310 usable cases was tested in three different ways. First, ANOVA (Armstrong & Overton, 1977) was run using SPSS 22 (IBM, 2013) to look for potential differences between the governmental and private sector responses. There were no significant differences ($p \leq .01$). Next, the pilot test was compared to the remaining cases using the same methodology. There were no significant differences found in this first wave of responses ($p \leq .01$). Finally, the demographics of the respondents including years of experience, firm size (by employees and revenue), type of company and level of responsibility by title (C-level, vice-president, director, manager and not disclosed) were used to examine

differences between responses. There were no significant differences ($p \leq .01$). The demographics of the respondents are shown in Tables 4-2 through 4-6.

The job titles of the respondents were much different than expected. See Table 4-2. Notably, only 154 or 50% claimed manager titles and only 55% of these stated that they were specifically purchasing managers (though the remaining managers were working in some role related to operations such as logistics, engineering, inventory management or new product development). 46 or 15% of the responses were from C-level executives primarily CEOs, 35 or 11.2% of responses were at the VP level, 53 or 17% were received from respondents with director level titles and 12 or 3.8% did not report their title. The range of titles for respondents is unexpected and it can only be supposed why there was such a range. Upon consultation with other academics and practitioners it is suggested that perhaps the purchasing managers had been promoted to new roles and/or they did not feel comfortable completing the survey and they gave it to their supervisor. Nonetheless, the large range of titles and demographics of the respondents remains centered on professionals in the operations and supply chain arena that were highly experienced in collaborative activities, including CEOs that would be responsible for the overall operations of the organization. It is suggested here that the large range of titles and demographics adds to the strength and generalizability of the results of this study.

Table 4-2 Self-reported Job Titles

	Responses
C-Level	46
CEO	19
CFO	4
COO	5
Marketing	1
Other	1
Owner	2
Principal	2
Purchasing	7
Not Disclosed	5
Director	53
Logistics	1
Materials	1
New Product Development	1
Operations	6
Other	9
Purchasing	12
Supply Chain	10
Not Disclosed	13
VP	35
Finance	2
Marketing	1
New Product Development	1
Operations	5
Other	4
Purchasing	6
Supply Chain	6
Not Disclosed	10

Table 4-2 – Continued

	Responses
Manager	154
Engineering	3
Finance	6
Inventory	1
Logistics	9
Marketing	4
Materials	8
New Product Development	2
Operations	6
Other	14
Project	5
Purchasing	86
Supply Chain	3
Not Disclosed	7
Not Disclosed	12
Not Disclosed	12
Grand Total	310

Table 4-3 Years of Experience

	Total Experience	In Current Area of Responsibility
Average	23.2	11.2
Std. Deviation	9.5	8.6
Median	25.0	9.0
Mode	30.0	10.0
Max	48.0	40.0
Min	1.0	0.5
Responses out of 310	293	293
% of Total	95%	95%

Table 4-4 Company Annual Revenue

	Responses	% of Total Responses
<10 Million	60	19.4%
10-99 Million	70	22.6%
100-999 Million	94	30.3%
1-5 Billion	41	13.2%
> 5 Billion	36	11.6%
Blank	9	2.9%
Total Responses	310	100.0%

Table 4-5 Size of Company in Terms of Employees

	Responses	% of Total
<100	62	20.0%
101-500	68	21.9%
501-1000	30	9.7%
1001-5000	64	20.6%
5001-1000	14	4.5%
10000 or more	59	19.0%
Blank	13	4.2%
Total Responses	310	100.0%

Table 4-6 Type of Company

	Responses	% of Total
Manufacturer	144	46.5%
Service Company	60	19.4%
Government	36	11.6%
Retailer	27	8.7%
Other	29	9.4%
Blank	14	4.5%
Total Responses	310	100.0%

The first wave of responses notably the pilot test responses (70) was compared to the final wave of responses (70) utilizing ANOVA. There were no significant differences ($p \leq .01$). Additionally, the final wave of responses was compared to the remaining total responses (240), no significant differences were found ($p \leq .01$). There is always a potential for non-response bias, however, based on these tests it is proposed that the significance of any non-response bias is low and therefore the cases are acceptable to use in the analysis (Armstrong & Overton, 1977).

Another type of bias is potentially harmful to this type of analysis, common method bias. Common method variance (CMV) is possible when a single key informant is asked to self-report on a survey such as the one used in this research (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Actions were taken to address the potentiality of common method bias such as reverse coding

some of the questions to break up the similarity between answers to questions. Additionally, the questions were broken into blocks such that they had different instructions and they were segregated so that they were not seen on the same screen in the on-line survey. The demographics of the respondents were also chosen partially to inhibit common method bias. For example, the respondents were experienced managers and high-level executives within their organizations with an average of 23.2 years of experience supporting high levels of knowledge regarding supply chain collaboration.

CMV was further assessed by using Harman's (1967) one factor test (Podsakoff et al., 2003) of common method bias applied to the constructs included in the proposed structural model for supply chain collaboration. This test is intended to determine if a single factor will include the majority of the variance in the sample data (Podsakoff, et al., 2003; Podsakoff & Organ, 1986). This test was exercised by performing an exploratory factor analysis (EFA) in SPSS 22 (IBM, 2013). The EFA was run without rotation and resulted in the first factor explaining 37% of the total variance. Accordingly, it is shown that a single factor does not explain the majority of the total variance. This result is an acceptable level (37%) because this study assumes both empirical and conceptual correlation exists between the constructs.

CMV was additionally tested using a common latent factor analysis using AMOS 7 (Arbuckle, 2006). A common latent factor was added to the CFA model and a path was added from that factor to each measurement item (Podsakoff et al., 2003). All paths were constrained to be equal. The variance in the common latent factor was constrained to have an error equal to one. The resulting loadings from each of the measurement items to the common latent factor resulted in a value of .39. The loading value of .39 was squared in order to get the CMV value of 15%. Acknowledging that there will be some CMV due to the sampling process utilizing a single respondent from each organization, this is an acceptable level of CMV for this research (Podsakoff et al., 2003).

Chapter 5

Analysis

The primary purpose of this research is to investigate the existence and validity of a proposed new construct DC. This research is considered at least partially exploratory. Accordingly, after an initial test of the assumptions of normality which showed the data to be approximately normal, an EFA was run using the sample data in order to determine if the proposed measurement items would group into categories that would support the proposed constructs. The goal was to determine if the sample data provided a sufficient amount of convergent validity to support a two-step structural equations modeling analysis (Anderson & Gerbing, 1988) of the data and the proposed structural model.

5.1 Exploratory Factor Analysis

A data reduction technique called EFA was run using SPSS 22 (IBM, 2013). The goal of this step in the process is to condense the set of empirical indicators into groups that represent the underlying factors (Hair et al., 2010, p. 96). The data was loaded into SPSS and an EFA was run using a principle components method with varimax rotation with Kaiser normalization (Loehlin, 1998). The intention is to group the measurement items in such a way as to minimize the loss of information (Hair et al., 2010, p. 96). This is accomplished by reviewing the resulting standardized loadings with a minimum loading of .3. Reviewing standardized loadings of each measurement item within groups tests

the convergent validity of the items on a variate or factor composed of multiple measurements.

The initial EFA dropped out several measurement items at the +/- .3 level. This is not unexpected in an exploratory analysis. Additionally, there were several empirical indicators that had significant cross loadings on multiple variables. Both of these types of items were removed from the model. The EFA was run again without these items. The exploratory nature of this research supports the exploratory steps taken while reviewing the EFA.

The final EFA supported the unidimensionality of 8 constructs. These constructs vary slightly from the constructs that were proposed in the original structural model. See Table 5-1 for a list of measurement items and constructs that remained in the model as a result of the EFA. Specifically, DC did not present as a single factor in the EFA. Instead, DC is clearly presented as two separate constructs. The first one includes measurement items that support the ability of a firm to distribute knowledge to a known collaborative partner and the second construct supports the ability of a firm to understand its collaborative partners.

Table 5-1 Descriptive Statistics for Measurement Items

Constructs	Items	Mean	Std. Dev.
Perceived Interdependence			
	PI1	5.81	1.25
	PI2	6.01	1.05
	PI3	5.72	1.34
	PI4	5.95	1.16
Collaborative Engagement			
	CE1	5.28	1.44
	CE2	5.03	1.59
	CE3	5.20	1.48
	CE4	5.66	1.16
	CE5	5.01	1.36
	CE6	5.35	1.31
Distributive Capability Knowledge Transmission			
	DC1	5.80	0.87
	DC2	5.77	0.98
	DC3	5.59	1.11
	DC4	5.25	1.29
	DC5	5.64	1.03
Distributive Capability Partner Knowledge			
	DC16	5.52	1.28
	DC17	4.96	1.55
	DC18	5.09	1.45
	DC19	5.77	1.19
Collaborative Process Competence			
	CPC1	5.39	1.21
	CPC2	5.57	1.20
	CPC3	5.54	1.21
	CPC4	5.38	1.26
	CPC5	5.43	1.23
	CPC6	5.67	1.10

Table 5-1 – Continued

Constructs	Items	Mean	Std. Dev.
Operating Outcomes			
	OO1	4.82	1.64
	OO2	5.40	1.41
	OO3	5.39	1.36
	OO4	5.57	1.43
	OO5	5.38	1.35
	OO6	5.39	1.42
Relational Outcomes			
	RO1	5.45	1.22
	RO2	5.51	1.22
	RO3	5.48	1.23
	RO4	5.58	1.25
	RO5	5.62	1.23
Absorptive Capacity			
	AC1	5.65	1.11
	AC2	5.73	1.06
	AC3	5.67	1.14
	AC4	5.57	1.13
	AC5	5.52	1.21
	AC6	5.62	1.16

The following DC related measurement items loaded together:

1. *Distribution of knowledge to a known recipient* included the following measurement items that clustered together with a range of loadings from .562 to .698, respectively, and a Cronbach alpha of .850 (Cronbach, 1951; Nunnaly, 1978). The abilities to
    a. "Clearly express complex ideas in writing"

b. "Select the best method to share knowledge (e.g. in writing)"
c. "Explain why practices should be adopted"
d. "Express ideas in a way that was easy for us to understand"
e. "Make clear verbal presentations of complex information"

2. *The ability to understand collaborative partners* in order to successfully distribute knowledge was represented by the following measurement items that clustered together with a range of loadings from .597 to .819, respectively, and a Cronbach alpha of .839 (Cronbach, 1951; Nunnaly, 1978). Our collaboration partner asked for or otherwise acquired information about our:
    a. Goals
    b. Strengths and weaknesses
    c. Organizational culture
    d. Organization

Convergent validity for the resulting 8 factors is supported by standardized loadings that range from .431 to .865. The lowest loading .431 was associated with the construct CE. It was considered acceptable because it was key to support a later test of discriminant validity with PI. The constructs also presented with strong Cronbach alpha values ranging from .733 to .953. Additionally, the EFA

model resulted in a KMO of .925, $\chi^2 = 9{,}668.916$, d.f. = 861 and $pr \leq .0000$. The results of the EFA including standard loadings and Cronbach alphas are shown in Table 5-2. All constructs had a Cronbach alpha of .7 or higher which is considered adequate (Cronbach, 1951; Nunnaly, 1978). EFA generated components 1-8 are shown in Table 5-2.

The resulting 8 factors included six of the proposed constructs: AC, PI, CPC (source), CE, RO and OO. Additionally, two constructs, as described above, were suggested by data reduction to represent two elements of DC. For purposes of this research they have been named distributive capability knowledge transmission (DCT) and distributive capability partner knowledge (DCP). These 8 constructs were used to further examine the sample data utilizing confirmatory factor analysis (CFA).

5.2 Confirmatory Factor Analysis

EFA results are based on statistical values derived from relating all measured items to every factor providing a standardized load value (Hair et al., 2010, p. 670). In fact, the results of EFA analysis allows for a previously undetermined number of factors to be derived from the underlying statistical

Table 5-2 EFA Results

	1	2	3	4	5	6	7	8
AC6	0.865							
AC3	0.86							
AC2	0.857							
AC1	0.857							
AC5	0.849							
AC4	0.83							
CPC4		0.775						
CPC5		0.754						
CPC2		0.671						
CPC3		0.664						
CPC1		0.66						
CPC6		0.646						
RO1			0.795					
RO2			0.788					
RO3			0.744					
RO4			0.721					
RO5			0.714					
OO1				0.73				
OO2				0.719				
OO3				0.689				
OO4				0.683				
OO5				0.669				
OO6				0.613				
DC3					0.698			
DC1					0.664			
DC2					0.646			
DC5					0.61			
DC4					0.562			

Table 5-2 – Continued

	1	2	3	4	5	6	7	8
DC16						0.819		
DC17						0.808		
DC18						0.8		
DC19						0.597		
PI2							0.747	
PI1							0.741	
PI3							0.7	
PI4							0.679	
CI1							0.537	0.431
CI6								0.716
CI3								0.62
CI2								0.601
CI5								0.564
CI4							0.425	0.531
Cronbach Alphas	0.953	0.902	0.942	0.872	0.850	0.839	0.733	0.853
Means	33.76	32.98	27.65	31.95	28.05	21.34	23.49	31.52
Variables	6	6	5	6	5	4	4	6

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 7 iterations.

relationships between the empirical measures. However, this is not sufficient to support theory. If there is no theoretical justification for items to converge into a single factor the existence of a construct made of those measurements is not supportable (O'Leary-Kelly & Vokurka, 1998). Accordingly, the next step in this research was to perform a CFA.

In a CFA a researcher has to specify the factors and on which measurement items they will load (Hair et al., 2010, p. 671). The factors and component measurements must have a theoretically supported relationship and evidence unidimensionality. This process provides statistical support for how well theorized constructs match the sample data (Hair et al., 2010, p. 671). CFA also provides researchers a tool to evaluate the model's fit to the data by providing fit statistics including, but not limited to, χ^2 (O'Leary-Kelly & Vokurka, 1998). The overall fit of the model is not provided through EFA (O'Leary-Kelly & Vokurka, 1998). This element of the analysis (CFA) was undertaken with LISREL9 (Jöreskog & Sörbom, 2006) software. Each of the eight constructs, namely: PI, CE, AC, DCT, DCP OO and RO were tested for construct validity and the group of constructs were together tested to determine model validity.

Construct validity is composed of several steps taken within a CFA analysis. The first of these is to determine the convergent validity of the measurement items on the theorized constructs (Hair et al., 2010, p. 686). This is similar to the steps that were taken in EFA. They are repeated here to support the theorization of the constructs proposed to make up the structural model that is the focus of this research. The first step in convergent validity testing is to analyze the factor loadings that resulted from the CFA. Each of the measurement items

loaded significantly on the theorized constructs. The standardized factor loadings range from .61 to .91.

The next step in testing convergent validity was to examine the average variance extracted (AVE) for each construct. This is calculated by averaging the squared standardized loadings and is calculated separately for each construct (Fornell & Larcker, 1981). The results ranged from .4126 to .7652. The AVE should be higher than .5 to evidence that "on average more error remains in the items than variance explained by the latent factor structure imposed on the measure" (Hair et al., 2010, p. 687). One construct did not meet this criterion (AVE>.5). PI resulted in an AVE of .4126. This was overlooked and the construct was assumed to have convergent validity because: 1) this construct is established in the literature with measurement items that were used in this research (Zacharia et al., 2011); 2) this construct resulted in factor loadings that exceeded .6 for each empirical indictor; 3) the EFA resulted in a Cronbach alpha of .733 and it further passed the tests of construct reliability (.74) and discriminant validity that will be described in the next sections.

Construct reliability was used as a final step in assessing convergent validity. Construct reliability indicates whether or not the empirical indicators consistently represent the same underlying latent construct (Hair et al., 2010, p. 687). It is calculated using the factor loadings and the error variance terms for each individual construct. A value greater than .7 is considered good reliability

(Fornell & Larcker, 1981 and Hair et al., 2010, p. 687). In this analysis each of the constructs provided a construct reliability value higher than .7. Notably, even though the AVE for PI was only .4126, it supported a construct reliability value of .74 indicating good reliability.

The factor loadings and construct reliabilities are shown in Table 5-3.

Table 5-3 CFA Results and Construct Reliability

	PI	CE	DCT	DCP	CPC	OO	RO	AC
PI1	0.627							
PI2	0.651							
PI3	0.637							
PI4	0.654							
PI5		0.672						
CE1		0.715						
CE2		0.606						
CE3		0.715						
CE4		0.789						
CE5		0.745						
DC1			0.644					
DC2			0.735					
DC3			0.824					
DC4			0.774					
DC5			0.699					
DC16				0.799				
DC17				0.784				
DC18				0.817				
DC19				0.631				
CPC1					0.727			
CPC2					0.737			
CPC3					0.709			
CPC4					0.803			
CPC5					0.845			
CPC6					0.854			

Table 5-3 – Continued

	PI	CE	DCT	DCP	CPC	OO	RO	AC
OO1						0.621		
OO2						0.790		
OO3						0.716		
OO4						0.771		
OO5						0.767		
OO6						0.721		
RO1							0.873	
RO2							0.903	
RO3							0.855	
RO4							0.878	
RO5							0.864	
AC1								0.822
AC2								0.840
AC3								0.909
AC4								0.887
AC5								0.893
AC6								0.891
Construct Reliabiity	0.74	0.86	0.86	0.85	0.90	0.90	0.94	0.95

Performing a CFA on the proposed constructs also allows a researcher to assess discriminant validity (Hair et al., 2010, p. 687). Discriminant validity can be ascertained by comparing the AVE of two constructs to the squared correlations of those constructs (Fornell & Larcker 1981). This comparison determines whether the construct explains more of the variance in its empirical measures than its shares with another construct. In this analysis, each of the constructs passes this test (Hair et al., 2010, p. 688). All of the constructs have an

AVE higher than any squared correlation with any other construct in the model. See Table 5-4 for the construct correlations and Table 5-5 for the comparison of the squared correlations and AVE values. The two constructs that have the least difference between the AVE and their squared correlation are OO and RO. This is not unexpected as these performance outcomes are expected to be correlated.

Table 5-4 Construct Correlations

	PI	CE	DCT	DCP	CPC	OO	RO	AC
PI	1							
CE	0.593	1						
DCT	0.227	0.665	1					
DCP	0.190	0.511	0.565	1				
CPC	0.292	0.625	0.725	0.446	1			
OO	0.314	0.622	0.630	0.470	0.651	1		
RO	0.349	0.593	0.645	0.348	0.727	0.712	1	
AC	0.216	0.560	0.447	0.248	0.479	0.472	0.494	1

Table 5-5 Squared Correlations and AVE Values

	PI	CE	DCT	DCP	CPC	OO	RO	AC
PI	1							
CE	0.352	1						
DCT	0.052	0.442	1					
DCP	0.036	0.261	0.319	1				
CPC	0.085	0.391	0.526	0.199	1			
OO	0.099	0.387	0.397	0.221	0.424	1		
RO	0.122	0.352	0.416	0.121	0.529	0.507	1	
AC	0.047	0.314	0.200	0.062	0.229	0.223	0.244	1
AVE	41.3%	50.3%	54.4%	58.0%	61.0%	53.7%	76.5%	76.4%

Finally, the CFA provided evidence of an acceptable overall model fit to the data ($\chi^2 = 1922.68$, d.f.=794, p<0.000, GFI=.774, CFI=.968, NNFI=.965, and RMSEA=0.068). CFA is the first step of the two-step method, structural equations modeling, advocated by Anderson & Gerbing (1988). CFA provides statistical results such that the adequacy of the measurement model can be assessed. That is, the relationship of the constructs to their empirical measurement is assessed as adequate. Once this is established, the second step in this methodology is to determine the relationship among the constructs in the proposed structural model. The results of testing the proposed structural model and competing models is presented in the next section.

5.3 Structural Model

5.3.1 Testing Model Fit

An analysis of the proposed model was undertaken utilizing LISREL9 (Jöreskog & Sörbom, 2006) software. Testing the fit of a structural model is the second step in a two-part analysis where the first step is assessing the unidimensionality of the constructs data and then the sufficiency of the model fit to the data (Anderson & Gerbing, 1988). Testing the original proposed structural model necessitated that DCT and DCP, the two DC constructs suggested by the EFA, be combined into a single first order construct. Although, the EFA and CFA provided evidence that DC was not a single functioning latent construct it

was necessary to test the original model to confirm the initial analysis that suggests that the model would not have a good fit to the data.

The original model that includes DC as a single first order construct and interaction between DC and AC was tested. The model provided an acceptable fit with the data ($\chi^2 = 1335.98$, d.f.=536, p <0.000, GFI=.802, CFI=.97, NNFI=.967, and RMSEA=0.069), however, the proposed interaction was found to be insignificant. Additionally, the paths DC to RO; AC to OO; AC to RO and CE to RO were insignificant. Despite the acceptable fit statistics, this model was determined to be an unacceptable representation of the data and was therefore rejected. Accordingly, the hypotheses related to the interaction of AC & DC were rejected (H7a, H7b, H10a and H10b).

A competing model was examined without the proposed interaction and DC was treated in the model as a second order latent construct (DCALL) made up of DCT and DCP. The resulting model reduced the fit statistics (e.g. RMSEA increased to .076) and DCALL was not significant along the proposed paths to RO and had a negative relationship to CPC. Additionally, other proposed structural paths were found to have low or negative standardized loadings and the paths from CE to RO and OO and AC to RO were shown to be insignificant.

A second competing model was examined to test the possibility that DCALL was an appropriate construct in the model. This model was built without direct effects from DCALL and AC on performance outcomes (OO and RO).

That is, it was proposed in this model that AC and DCALL were fully mediated as to their affect on performance outcomes (OO and RO). The fit statistics deteriorated as compared to the earlier two models (e.g. RMSEA=.079). All path weights were found to be significant, however, the single path representing the role of DCALL in the model (DCALL to CPC) was negative along with the effects of CPC to OO and RO. Accordingly, the remaining hypotheses that suggested the existence of a single construct for DC were also rejected (H8, H9a and H9b).

A final model was tested utilizing two unique single order latent constructs (DCT and DCP). These constructs are made up of empirical indicators related to the source's ability to transfer knowledge to a known recipient by utilizing knowledge transmission skills and understanding the collaborative partner, respectively. This model was built utilizing the results of the EFA and CFA, which suggest two separate constructs for DC related characteristics. Additionally, as suggested by the earlier competing models, this model eliminated any direct effects from AC or DCT/DCP to the performance outcomes. The model provided a good fit to the data ($\chi^2 = 1965.63$, d.f.=802, p <0.000, GFI=.769, CFI=.967, NNFI=.965, and RMSEA=0.0684). Additionally, all of the proposed structural paths were found to be significant. This model provided support for the remaining hypotheses H1, H2a, H2b, H3, H4a, H4b and H5. All

of these hypotheses are supported at the $p<.001$ level with the exception of H2b ($p<.05$).

5.3.2 Competing Models

The final model was chosen as the most appropriate fit for the data using an exploratory technique, assessing competing models. Viewing competing models is supported in the literature as a way to clarify the function of the constructs within the model and the overall model fit (Bollen & Long, 1992; Kelloway, 1998; Paulraj et al., 2008; Zacharia et al., 2011).

In this case, as discussed in the previous section, first model was a test of the originally hypothesized structural model. It was reviewed in spite of the contradictory results shown in the EFA and CFA that suggested that the empirical indicators proposed for a single measure of DC in fact belonged to two separate constructs (DCT and DCP). This was done to confirm the prior results and test the proposed model fit to help understand the relationships of the constructs to one another and provide a beginning point for exploring the affect of DCT and DCP on the model.

The next two models testing the idea that perhaps DCT and DCP made up a single second order construct, which has been dubbed DCALL for the purposes of this analysis. These models did not support the existence of this second order construct. Rather, they suggested that the knowledge management constructs in

the model have indirect effects (paths) on the performance constructs (OO and RO).

Utilizing the insight from these three competing models the final model was tested. This model includes the constructs DCT and DCP, as suggested and supported by the EFA and CFA respectively. This model is also modified from the originally hypothesized structural model by removing all interaction effects and removing any direct effects from the knowledge transfer related constructs (AC, DCT and DCP) to the performance outcomes (OO and RO).

In order to determine the model that best fits the data, the criteria used by Paulraj et al. (2008) and Zacharia et al. (2011) are used. These criteria are also shown comparatively in Table 5-6. Specifically, the overall model fit was examined using a basis of analysis NNFI>.90, CFI>.90, RMSEA<.08. Parsimony was judged based on RMSEA<.08 and PNFI (which is better at values closer to 1). Finally, Akaike's information criterion was reviewed to determine the model that had the lowest value (lower values are better) and the models were examined for the statistical significance of the parameters specified in each model.

The final model provides the best fit among the competing models and provides strong evidence to suggest the importance of the source in supply chain inter-firm collaboration. The results of the final model are discussed in more detail in the next section.

Table 5-6 Competing Models

	Proposed Model Fully Mediated Model 1		Hypothesized Model Model 2 Includes DC		Rival Direct Model DCALL 2nd Order Construct Model 3		Rival Direct Model DCALL 2nd Order Construct Model 4	
PI to CE	0.41	***	0.45	***	0.36	***	0.57	***
AC to CE	0.26	***	0.29	***	0.18	***	0.46	***
DCP to CE	0.15	**						
DCT to CE	0.39	***						
DCT to CPC	0.76	***						
CE to OO	0.39	***	0.23	**	0.13	ns	0.33	***
CE to RO	0.13	*	0.09	ns	0.11	ns	0.14	*
CPC to OO	0.43	***	0.35	***	-0.21	***	-0.51	***
CPC to RO	0.42	***	0.41	***	-0.38	***	-0.46	***
OO to RO	0.36	***	0.37	***	0.37	***	0.32	***
AC to OO			0.09	ns	0.08	ns		
AC to RO			0.10	ns	0.10	*		
DCALL to CE			0.41	***	0.58	***		
DCALL to OO			0.18	**	0.45	***		
DCALL to RO			-0.03	ns	-0.01	ns		
DCALL to CPC					-0.81	***	-0.85	***
DCAC to CE			-0.05	ns				
DCAC to OO			-0.05	ns				
DCAC to RO			-0.07	ns				

Table 5-6 Continued

	Proposed Model Fully Mediated Model 1	Hypothesized Model DCALL 1st Order Construct Model 2	Rival Direct Model DCALL 2nd Order Construct Model 3	Rival Mediated Model DCALL 2nd Order Construct Model 4
Model fit statistics				
χ^2	1965.63	1335.98	2224.75	2401.85
d.f.	802	536	801	806
CFI	0.967	0.970	0.96	0.955
NNFI	0.965	0.967	0.957	0.952
RMSEA	0.0684	0.0694	0.076	0.079
PNFI	0.881	0.857	0.873	0.874
AIC	2115.63	1485.98	2374.77	2551.85
CAIC	2470.87	1841.22	2730.01	2907.09

ns Non- Significant ** t-Values significant at p≤.01

* t-Values significant at p≤.05 *** t-Values significant at p≤.001

5.4 Results

The final proposed structural model produced fit statistics that support the relationships between constructs and the imposed paths and relationships being tested: ($\chi^2 = 1965.63$, d.f.=802, p <0.000, GFI=.769, CFI=.967, NNFI=.965, and RMSEA=0.0684). The resulting structure along with standardized regression weights and standardized error terms is shown in Figure 5-1.

The interviews, which were the genesis of this study, suggested that supply chain collaboration is growing and the need for resources both tangible and intangible from partnering firms. The model of supply chain collaboration reported by Zacharia et al. (2011) provides an enlightening view of supply chain collaboration. This research builds upon that model and introduces a new direction, specifically, the affects of a source of knowledge on collaboration activities.

The hypotheses in this research expanded on the Zacharia et al. (2011) model by adding DC and CPC (source) to their structural model of supply chain collaboration. These constructs were proposed to increase the explained variance in the model and parse out the differences between the affects of the source and the recipient in the knowledge transfer transaction(s) taking place in the collaborative activities. Both the proposed model and the model reported by Zacharia et al. (2011) begin by suggesting that the collaboration between firms is predicated upon a level of PI (Mentzer et al., 2000). The data in this research

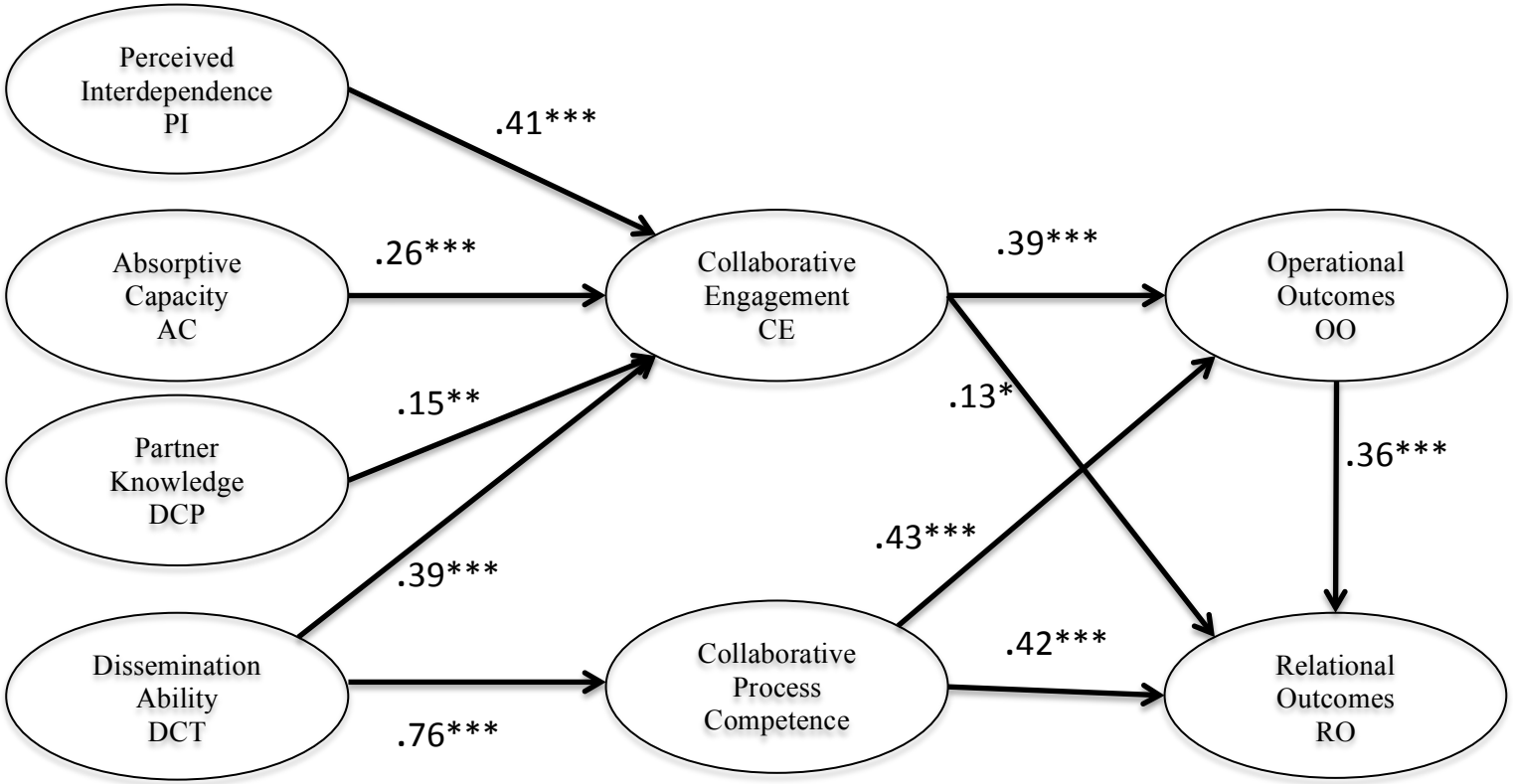

Figure 5-1 Proposed Final Structural Model Representing Supply Chain Interfirm Collaboration

Notes: ***t-values are significant at p<.001; **t-value is significant at p<.01; *t-value is significant at p<.05

supports the direct effect of PI to CE, as PI increases the level of CE also increases. The regression weight of PI on CE is .41 and is statistically significant at $p<.001$. Accordingly, hypothesis (H1) is supported by the data.

Knowledge transfer has been shown to influence relationships and couplings between organizations (Cohen & Levinthal, 1990; Huber, 1991; Larsson et al., 1998). This type of interorganizational knowledge sharing enhances the competitive advantages that a firm can leverage within their supply chain (Cheng et al., 2008). Viewing the supply chain through the lens of knowledge based organizational skills (Priem & Swink, 2012), this research proposed that AC has a direct effect on the levels of CE within interorganizational collaboration. The data supports this hypotheses (H5), specifically that as AC increases the level of CE increases. The path weight is .26 and is statistically significant at $p<.001$. This is different than the results of Zacharia et al. (2011), in their study the authors found no significant direct effect to support the proposed influence of AC on CE. It is proposed that AC is found to be significant in this data as a result of disentangling AC from DC by introducing the affects of the source on the collaboration. Additionally, this result shows AC to have a significant indirect effect on both performance outcomes (OO and RO) through a path fully mediated by CE.

AC was also hypothesized to have direct effects on both OO and RO. These hypotheses were not supported by the data. Accordingly, H6a and H6b

were rejected. Additionally, AC was hypothesized to have interactive effects with DC within the model, as AC would influence the level of DC on RO and OO. These hypotheses (H7a and H7b) were not supported in the model and were therefore rejected.

Supported by the literature and the executive interviews, DC was introduced as the abilities associated with a source to transfer knowledge to a known recipient (Cohen & Levinthal, 1990; Davenport & Prusak, 1998; Dyer & Singh, 1998; Szulanski, 1996). In this research, DC is hypothesized to be a single first order latent construct that makes up these source characteristics. However, the data does not support the idealized DC as a single factor. The data suggest that the abilities of the source to transfer knowledge to a known recipient are represented by two distinct constructs. Based on the empirical indicators that make up each of these constructs they have been named DCT and DCP in the newly proposed version of the structural model.

Accordingly, the hypotheses introduced in this paper that suggest DC is a single construct are rejected (H8, H9a, H9b, H10a and H10b). Instead the final proposed model indicates significant paths from DCP to CE (regression weight .15 at $p<.01$) and DCT to CE (regression weight .39 at $p<.001$) and CPC (regression weight .76 at $p<.001$). This is a clear indication that the characteristics of the source in supply chain collaboration are important to levels of CE and CPC. Additionally, this also implies that DCT and DCP have fully

mediated indirect effects on both performance outcomes (OO and RO) as CE and CPC are both shown to have significant roles in increasing OO and RO.

Four distinct constructs are shown to have significant statistical influence on the levels of CE within supply chain collaboration (PI, AC, DCT and DCP). CE has been shown in the literature to increase performance outcomes such as OO and RO within these types of collaborative engagements (Zacharia et al., 2011). The data in this research confirm prior results and show CE to have a significant influence on both OO and RO. The path weights are respectively .39 at $p<.001$ and .13 at $p<.05$. Accordingly, the hypotheses regarding the influence of CE on OO and RO are supported (H2a and H2b). While the affect of CE on OO is greater than on RO it is notable that the levels of engagement between the organizations influence both tangible operational outcomes and intangible relational outcomes. It is understandable that the results may show less significance from CE to RO as intangible outcomes are difficult to articulate and measures may vary more from firm to firm than operational outcomes. Zacharia et al. (2011) also found a lower regression weight between CE and RO than between CE and OO. This research confirms the results in prior literature (Zacharia et al., 2011).

CPC is hypothesized to be the ability of the source to manage the transfer process (e.g. collaboration interaction and activities, management of inter-firm resources, management of knowledge and intellectual capital) (Fugate et al.,

2009; Priem & Swink, 2012; Spekman, et al., 2007). The data support the existence of CPC (source) and supports the hypotheses that CPC has a direct and significant influence on the results of performance outcomes OO and RO. Notably, the regression weights are almost identical (.43 at $p<.001$ and .42 at $p<.001$ respectively). The significant influence of CPC within the model and its role as a mediator for DCT supports the proposition that the abilities of the source to transfer knowledge play an integral role in successful supply chain collaboration.

Finally, the final structural model (as also shown in the original proposed structural model) shows a significant relationship between OO and RO. Specifically, OO have a significant influence on relational outcomes. That is, as OO increases RO also increases. The resulting path weight is .36 at $p<.001$. This result also confirms the results found in Zacharia et al. (2011). The path standardized errors and direct, indirect and total effects of the final proposed model of supply chain collaboration are shown in Tables 5-7 and 5-8 respectively.

Table 5-7 Path Standardized Errors

	CE	CPC	OO	RO
DCT	0.105	0.125	-	-
DCP	0.047	-	-	-
PI	0.068	-	-	-
AC	0.047	-	-	-
CE	-	-	0.086	0.074
CPC	-	-	0.082	0.076
OO	-	-	-	0.074

Table 5-8 Direct, Indirect and Total Effects

	CE	CPC	OO	RO
AC				
Total	0.260	-	0.101	0.071
Direct	0.260	-	-	-
Indirect	-	-	0.101	0.071
DCT				
Total	-	0.760	0.475	0.540
Direct	-	0.760	-	-
Indirect	-		0.475	0.540
DCP				
Total	0.15	-	0.059	0.059
Direct	0.15	-	-	-
Indirect	-	-	0.059	0.059
PI				
Total	0.41	-	0.160	0.112
Direct	0.41	-	-	-
Indirect	-	-	0.160	0.112
CPC				
Total	-	-	0.430	0.420
Direct	-	-	0.430	0.420
Indirect	-	-	-	-
CE				
Total	-	-	0.390	0.130
Direct	-	-	0.390	0.130
Indirect	-	-	-	-

Chapter 6

Discussion

6.1 Overview

Supply chain collaboration is more than just the sum of its parts. The collaborative process is an opportunity for organizations to work together toward outcomes that far exceed what each firm could achieve alone (Patel et al., 2012). This type of synergy is created when the strengths of both firms are shared and are ultimately united, stronger than they were before. This sharing of strengths is not magic. Firms must come together with a willingness to share and have mutual goals. Also, PI must exist between the firms along with complementary resources, both tangible and intangible (Craighead et al., 2009).

Supply chain literature has addressed this type of collaboration and has borrowed theory from other disciplines to advance collaboration research (Hult et al., 2004). Specifically, the literature has adopted and applied theory regarding knowledge transfer to help better understand how firms share knowledge in collaborative environments and activities (e.g. Hult et al., 2004; Wagner, 2012; Zacharia et al., 2011). Supply chain management literature has traditionally used knowledge related theory to study the characteristics of a recipient of knowledge (AC) to study how firms seek out

innovation and how they assimilate and apply that knowledge within the firm (Barratt, 2004; Cao & Zhang, 2011; Fugate, Stank & Mentzer, 2009). This single focus, singling out one party in the knowledge transfer transaction, stunts the ability of researchers to have a holistic view and understanding collaborative activities. This paper suggests that the characteristics of the recipient of knowledge (AC) are only one-half of the dyad that must be studied in order to have a holistic view of collaboration. Specifically, the characteristics of the source are also important for collaborative outcomes.

This research rigorously pursued an understanding of the role of the source in knowledge transfer transactions. Following the recommendation of Ketchen & Hult (2011), this undertaking began by asking, "what do we know" about the source in knowledge transfer and "what do we need to know" about the source? In order to address these questions, this research began with a literature review that uncovered a significant body of knowledge about the recipient and absorptive capacity. The review also uncovered that there is little written about the source (Kuiken & van der Sijde, 2011; Tang et al., 2010). While it is theorized and seems intuitive that any transfer of knowledge must have a source and a recipient (Nonaka, 1994; Szulanski, 1996), the literature seems to confound the two unique roles within a transfer dyad into a single characteristic primarily contributed to

the recipient (Ardichvilli, Page & Wentling, 2003; De Vries et al., 2006; Spekman et al., 1997). Accordingly, this research has undertaken to investigate the role of the source in knowledge transfer and specifically in supply chain collaboration ("what we need to know").

The results of this research clearly show the importance of the source in collaborative activities. Through both qualitative and quantitative empirical research this study has developed conceptual definitions that address the characteristics and the role of the source in knowledge transfer, notably the distributive capabilities of DCT and DCP. Further, domain limitations and relationships were established and tested between these distributive capabilities and other knowledge transfer constructs (AC and CPC). Finally, the predictive ability of these constructs was tested through structural equations modeling.

50 executive interviews were done order to investigate the characteristics of successful and unsuccessful collaborative activities. These interviews provided insight into both the roles of the source and recipient. Additionally, the interviews shed light on the environmental and other necessary antecedents for successful collaborative outcomes. It was clear from the interviews that the executives all perceived collaboration as a give and take of knowledge from one firm to the other where one party was

generally seen as the source and the other the recipient of knowledge. It was also apparent that it is easy to confuse the two roles because many collaborations require that firms occupy both roles at the same time. Nonetheless, they are two separate and distinct roles within the collaboration.

The interviews provided the necessary descriptions and definitions needed to develop an idealized construct to represent the characteristics of a successful source of knowledge. The construct was called DC and was theorized to encapsulate the ability of the firm to act as a successful source of knowledge. In order to test the construct, this research proposed adding DC to a supply chain collaboration model presented by Zacharia et al. (2011). This model utilized knowledge based constructs that represented the recipient (AC and CPC), but did not include such constructs to represent the source. This paper hypothesized that the addition of the source to the model would allow the disentangling of the roles of the recipient and source and AC and DC. Using a survey of purchasing managers, this research found support for the importance of the source in collaborative activities.

While focusing on the source, this research was also able to confirm the results found in Zacharia et al. (2011). Specifically, the role of PI and levels of CE on OO and RO were found significant along the same paths as

shown in the Zacharia et al. (2011) model. Most notably, however, this research provides insight into the role of the source and provides support for constructs that represent the characteristics of the source within a supply chain domain. And, provides insight into how these constructs interact and relate to other knowledge based constructs in collaboration.

It was hypothesized that the characteristics of the source could be represented in a single first order construct (DC). Based on the analysis of the survey, the data suggest that the characteristics of the source cannot be represented by a single construct as hypothesized, but rather they reside within two separate and distinct constructs. These constructs are called DCT and DCP in this research. They represent the abilities of the source to transmit knowledge to a known recipient and the level of knowledge a source has about the recipient, respectively. These constructs were uncovered through EFA and supported with CFA. They survived a rigorous analysis of convergent and discriminant analysis and were operationalized within a structural model representing supply chain collaboration.

As a part of this research, a structural model was proposed that adds the source (DC) to the collaboration model presented by Zacharia et al., (2011). Upon review, the data did not support a single construct to represent the distributive capabilities of a firm. Accordingly, the model was

restated to include two separate constructs to represent the source (DCT and DCP). Upon testing both of these constructs were shown to be statistically significant and influential within the model.

DCT was shown to directly and significantly influence levels of CE and CPC. As the ability of the source to transmit knowledge increases so does the level of CE between the source and recipient also increases. This is important because the levels of CE have been shown to increase performance outcomes (Zacharia et al., 2011). If organizations can assess the level of DCT in a potential partner, they may be able to increase the likelihood of engaging with the right partners in order to promote successful performance outcomes. Additionally, if a firm desires to be engaged in knowledge transfer as a source, it would benefit them to understand their organizational abilities to transmit knowledge. This may be most important for those firms that are in the business of being a source of knowledge (e.g. big four accounting firms, engineering firms, third party logistics, consultants, and universities). If a firm wants to be considered a trusted source it should understand its own abilities as they relate to sharing knowledge. Importantly, DCT is shown to be more than just an ability to disseminate knowledge indiscriminately. Rather, it is the ability to share knowledge with a known recipient for

mutually agreed upon outcomes. This clearly differentiates DCT from the idea of knowledge dissemination in prior literature.

DCT is contingent on the source focusing the transmission of knowledge on a known recipient. Accordingly, DCP is crucial to the success of the transfer or collaboration. DCP is the level to which a source knows and understands the recipient. By understanding the recipient the source is able to personalize the knowledge and the type of transfer undertaken. For example, if a consulting firm is hired to assist with new product development, they must first understand what it is that the focal firm is trying to achieve. If the consulting firm does not understand the needs, environment or even the culture of its partner the collaboration is likely to have a dismal outcome. This research suggests that as DCP increases CE also increases and in that way DCP has an indirect and significant influence on OO and RO.

6.2 Managerial Implications

This research was both rigorous and relevant. While a rigorous empirical study was undertaken, it was never forgotten that the research was seeking to investigate how firms can better understand and manage supply chain collaboration in order to optimize performance outcomes from those

activities. The results of this study provide insights to help managers better plan and execute supply chain collaborations.

First, when considering or planning collaboration with other firms, managers should have a clear understanding of what role they expect to play in the collaboration and also set their expectations for their partner. If a firm expects to be on the receiving end of knowledge, such as specialized knowledge from a consulting firm, they need to ascertain their level of AC. This study shows that higher levels of AC are associated higher levels of CE and CE leads to improved performance outcomes. Therefore, it is in the firm's best interests to understand their AC and work to increase it as it pertains to collaboration. For example, if a company wants to improve their supply chain by working with a consulting firm. It is not only important that the consulting firm be experienced in supply chain matters, but also that the firm itself be able to understand and implement the suggestions of the consultant. Otherwise, the firm will not be able to successfully execute the recommendations of the consultant. Many times lack of execution is blamed on unwillingness, however, this research suggests that the failure to execute may result from low levels of AC.

Likewise, if an organization plans to take part in a collaboration that calls on it to play the role of the source, managers should understand the AC

of their partner. This research shows that sources of knowledge are more effective in transferring knowledge when they understand their partner. If a firm understands the abilities of their collaborative partner, let's say in the case of being a supply chain consultant, they can personalize their recommendations to suit the needs of the recipient. Additionally, they can make recommendations to their partners that would improve their likelihood to assimilate and apply the knowledge to their businesses. In other words, a source could potentially improve the outcomes of the collaboration by addressing the weaknesses in their partner's AC.

Many times companies seek out supply chain collaboration to find resources that are not available within their own organization. These include both tangible (e.g. raw materials) and intangible (e.g. know-how) resources. Just as when a firm partners with another to attain raw materials, a firm that partners with another for know-how must ask the question: How will the resources be delivered? When contracting for raw materials, a firm must know if their partner is capable of attaining those materials, delivering them as promised and in the form that is requested. Along the same lines, when contracting for knowledge, a firm must ensure that their partner has the know-how, and then if they have the ability to deliver it to them as promised and in a form that will allow for them to assimilate and apply that knowledge.

Accordingly, understanding a potential partner's DCT is crucial to planning and engaging in supply chain collaboration. A supply chain manager would never hesitate to ask about the proposed delivery method for materials. This research also suggests that a manager should never hesitate to ask about the delivery method for know-how or knowledge. Delivery is one of the components of DCT. The ability of a partner to deliver knowledge in a form and manner that allows it to be used by the recipient is critical and managers should attempt to acquire as much information as possible about a potential partner's abilities in this area.

Understanding the other partner is a key element in supporting supply chain collaboration performance outcomes. This research theorized and operationalized that type of understanding as DCP or the ability of the source of knowledge to understand the firm to whom they are imparting knowledge. Managers of firms acting as the source should ensure that they are acquiring information about all aspects of their partner's organization in order to support better collaborative outcomes. Managers of firms acting as the recipient should proceed cautiously if their partner is not trying to get to know them before and during the collaboration. DCP is shown to lead to higher levels of CE and ultimately to better OO and RO. Accordingly, if a firm

is interested in partnering, but is not interested in learning about your company, then manager beware.

6.3 Academic Implications

This research has far reaching implications in academia. This research provides evidence for the role of a source and recipient of knowledge in supply chain collaboration activities. This is important because knowledge based organizational theory suggests that knowledge transfer is dependent on both the characteristics of a source and a recipient of knowledge (Nonaka, 1994 and Szulanski, 1996). Until now, the focus has been on the recipient of knowledge through studying the AC of a firm in supply chain collaborations. Additionally, this research supports the hypotheses that the role of both parties is statistically significant in promoting increases in OO and RO.

Notably, for the first time, this research theorizes and supports the importance of a source of knowledge in supply chain collaboration. With the understanding that a firm can play the role of the giver and receiver of knowledge at the same time in collaboration, this research substantiates the importance to isolate the functions of giving and receiving knowledge. Organizational research would benefit from acknowledging each of these

roles and the characteristics and functions of each (e.g. the source and recipient of knowledge).

The idea of including a source in a model of collaboration is strengthened due to its parsimony. If a firm sends/gives knowledge, then there must be one that absorbs/receives that knowledge. It is intuitive and easy to understand. It is also generalizable outside of the single domain of supply chain collaboration. Any type of knowledge exchange between organizations operates at a minimum in a dyadic exchange and is thus dependent on the firms to execute the roles of the source and recipient. DCT and DCP are the complements of AC in knowledge transfer transactions. The results of this study suggest that each of these constructs represents characteristics that are necessary, but not sufficient, to support positive knowledge transfer outcomes.

Chapter 7

Conclusion

7.1 Summary

The goal of this research was to study the knowledge-based abilities that support successful supply chain collaboration. A rigorous investigation of the topic was undertaken with a lens of triangulation including: an extensive literature review, qualitative executive interviews using a CIT technique and a quantitative survey methodology. Information was gathered on 86 multi-disciplinary critical incidents from which the characteristics of successful and unsuccessful collaborations were deciphered and developed into operationalizable constructs. These constructs, specifically DC and CPC (source), were reviewed by academics and practitioners and were refined for use in a survey within the supply chain management discipline.

Using 310 survey responses that outlined the characteristics of supply chain related collaboration activities, this study validated the importance of the source of knowledge in supply chain collaboration. Specifically, this study validated a model of supply chain collaboration that includes both the characteristics of the recipient (AC) and the characteristics of the source (DCT) and (DCP). Additionally, this research confirmed the earlier

collaboration related findings of Zacharia et al. (2011). This type of confirmatory research is not prevalent in the literature, but is important to continue to build upon prior research and expand our understanding.

This study contributes to the literature by introducing the importance of the source of knowledge in collaborative activities in the supply chain domain. Building upon knowledge based organizational strategy literature, this research proposed a complement to AC in knowledge transfer – DC. DC was hypothesized to be the characteristics that a source brings to a knowledge sharing opportunity between firms. Although, this exploratory analysis showed that DC is not a single construct, the analysis provided evidence to support the role of the source through two separate constructs namely, DCT and DCP. It was found that DCT and DCP both have statistically significant direct influences on CE and indirect influences on performance outcomes. Evidence suggests that the role of the source may be more influential in the model than the role of the recipient.

The source of knowledge has been largely overlooked in the literature and where it is acknowledged there is little consensus on its role as a dimension of knowledge transfer (Kuiken & Sijde, 2011; Oppat, 2008; Niedergassel, 2011). By theorizing and evidencing the importance of DCT and DCP, this research bridges the theoretical gap that separates the

concepts of absorptive capacity, disseminative capacity, collaborative process competence and organizational knowledge transfer. The role of the source and the recipient of knowledge have been blurred because organizations can perform both roles at the same time (Davenport & Prusak, 1998), however, it is important to bifurcate these characteristics each from the other and understand how they work alone and in conjunction with one another.

This research also adds to the body of knowledge by providing evidence that the role of AC in supply chain collaboration was more clearly identified when viewed through a holistic lens, which included looking at both the distributive capabilities of the source and the AC of the recipient. Prior supply chain research has provided insignificant results when testing the role of AC in the supply chain (e.g. Hult et al., 2004; Wagner, 2012; Zacharia et al., 2011). This study parsed out the idiosyncrasies that differentiate AC and distributive capabilities and in doing so enabled a clearer operationalization of AC. AC was shown in this research to have a direct and significant influence on collaborative engagement when before the results were not significant (Zacharia et al., 2011). These results suggest that in collaboration research that AC and the distributive capabilities of the source (DCT and DCP) should be studied in unison.

Finally, this research contributes to organizational theory by proposing and supporting two new knowledge-based constructs, DCT and DCP. These constructs allow for the characteristics of the source to be parsimoniously operationalized and tested in a myriad of different domains. The executive interviews that were used to develop the scale for DCT and DCP for this research were based on accounts from executives from over 40 industries and can be generalized to other disciplines and in other applications of knowledge transfer.

7.2 Future Research

This research leads to many areas of future research. In the area of supply chain collaboration, this research opens many doors for further investigation. First, there is a notable relationship between DCT and CPC (source) in the final proposed model of collaboration in this paper. The factor loading is greater than .7. Interestingly, Zacharia et al. (2011) operationalized CPC as an ability of the recipient of knowledge. In that case, the authors found a factor regression weight of AC → CPC to be over .7. The resulting relationships between DCT → CPC and AC → CPC are strikingly similar. These results seem to indicate that there is something about the relationships between DCT, CPC (source and recipient) and AC that remains to be uncovered. A study of these constructs with dyadic data would add

new understanding to these knowledge-based concepts and perhaps be generalizable beyond a supply chain application.

The scales that have been developed as part of this research for DCT and DCP are parsimonious and allow for these distributive capabilities to be easily generalized to other types of supply chain research including knowledge-based constructs and activities. Testing the role of the source in other supply chain and operational management domains would add to our understanding of how knowledge-based theory can improve supply chain and operational results. The scales are such that they can be applied to inter-firm or intra-firm knowledge transfers and varying types of collaboration.

Acknowledging and supporting the role of the source of knowledge in knowledge-based transactions can also be studied in organizational theory. Introducing DCT and DCP as the complements of AC can lead to new ways to view the organization as a manager of knowledge.

7.3 Limitations

This research is hampered by limitations that should be addressed in future research. One limitation is the use of the CIT method for executive interviews. Although, this method provided significant insights into the characteristics of successful and unsuccessful collaborations, the CIT asks participants to recall situations that occurred in the past. The process of

recollection can cause potential bias in the results. This could be overcome by deepening the research through case studies of collaborations that are underway in order to have direct and current results of current collaborative activities. Case study analysis would also allow the researcher to acquire input from multiple parties directly associated with the collaboration, whereas, the CIT only provided insight from a single respondent.

Second, this research focused on a single firm. Ideally, the study of knowledge transfer in collaborations would involve dyadic responses. The study of dyads in supply chain collaborations would add significant insight into how knowledge sources and recipients interact and how those interactions influence performance outcomes. The utilization of dyads in this area of research would give researchers added dimensions with which to study the interactions of knowledge-based constructs such as AC, CPC (source and recipient) and DCT and DCP. This could be studied from the perspective of multiple dyads including different pairs of companies with a survey or interview methodology. Or, this could be studied from the perspective of one company with many partners. For example, these knowledge based constructs could be studied from the perspective of a single consulting firm with many clients. The source of knowledge would be

controlled to be a single firm and the recipients and projects would all be different.

Third, this research did not capture the CPC of the recipient, instead focusing on the CPC of the source. This study theorized that CPC is primarily a contribution of the source of knowledge in collaboration. CPC should be the subject of future research to further differentiate between the CPC of the source and recipient. Further, as mentioned in the prior section, this research indicated that DCT had a strong relationship with CPC (source) and AC had a similarly strong relationship with CPC (recipient) in the study published by Zacharia et al. (2011). This is an interesting result and is a topic for future research.

Finally, this research did not capture the type of knowledge that was being transferred. This is a weakness in this study that could be overcome in future research. By capturing the type of knowledge (tacit vs. explicit) and even the stickiness of the knowledge, these knowledge transfer constructs could be tested in supply chain collaboration or other operations management domains. The role of the source and the recipient may vary greatly depending on the type of knowledge to be transferred.

7.4 Conclusion

Despite these limitations, this research provides compelling evidence to support the importance of the source in supply chain collaboration. In all, this research corroborates prior research regarding the role of knowledge-based constructs in supply chain collaboration and introduces the influence of the source of knowledge into a model of supply chain collaboration. Further, it presents empirical evidence to substantiate the influence of the source and the recipient on levels of collaborative engagement and ultimately collaborative performance outcomes.

Appendix A

Relationship Between Research Questions,

Theories And Hypotheses

Appendix A

Relationship Between Research Questions, Theories and Hypotheses

	Supporting Theories	Related Hypotheses
RQ 1 What characteristics constitute the ability of a source to successfully transfer knowledge?	RBV, KBV	Investigated qualitatively with no a priori hypothesis.
RQ 2 Is the source's DC related to increased levels of CE in supply chain activities between firms?	RBV, KBV and RV	H8
RQ 3 Is the source's DC positively related to operational and relational outcomes in supply chain collaborations?	RBV, KBV and RV	H9a and H9b
RQ 4 Does the source's DC play a moderating role on the affect of the recipient's AC within the collaborative model?	RBV, KBV and RV	H10a and H10b
RQ 5 Is the recipient's AC related to increased levels of CE in supply chain activities between firms?	RBV, KBV and RV	H5
RQ 6 Is the recipient's AC positively related to operational and relational outcomes in supply chain collaborations?	RBV, KBV and RV	H6a and H6b
RQ 7 Does the recipient's AC play a moderating role on the affect of the source's DC and collaborative operational and relational outcomes?	RBV, KBV and RV	H7a and H7b
RQ 8 Can the results of Zacharia et al., 2011 be replicated as they pertain to: PI, and CE?	RBV, KBV and RV	H1, H2a, H2b, H3, H4a and H4b

Notes: Resource based view (RBV), knowledge based view (KBV) and relational view (RV).

Appendix B

Executive Interviews Methodology And Results

APPENDIX B
EXECUTIVE INTERVIEWS METHODOLOGY AND RESULTS OVERVIEW

Methodology:	Critical Incident Technique
Research Question:	What are the characteristics of a successful source of knowledge in commercially based knowledge transfer transactions?
Sample:	50 executive level business professionals
Organization Types:	Public, private and governmental Small, medium and large with 20 to 280,000 employees
Results:	86 usable observations that describe 43 successful and 43 unsuccessful transactions. Analysis of these observations has resulted in the conceptualization of distributive capability (DC) and three proposed antecedents of DC that can be used to operationalize this new construct. The results also provided support for the role of competitive process competence (CPC), social capital, and the role of the recipient of knowledge (AC)
Figures:	Figure B-1 – Conceptual framework of supply chain collaboration
Tables:	B-1 – Sampling of CIT studies B-2 – Sample by industry B-3 – Sample by company size B-4 – Sample by title B-5 – Sample by years of experience B-6 – Observations by category B-7 – CPC definitions B-8 – CPC classifications B-9 – DC definitions B-10- DC classifications B-11 – Fertile ground definitions B-12 – Fertile ground classifications

Exhibits:

Exhibit 1 – Respondent informed consent example
Exhibit 2 – List of definitions and tickler list provided to respondents
Exhibit 3 – A copy of the primary and secondary questions asked of respondents

1. INTRODUCTION

This research was undertaken to investigate and better understand the role of the source in knowledge transfer transactions in a commercial context. Through qualitative analysis based in grounded theory, the objective of this research is to conceptualize the abilities of the source in knowledge transfer into a single construct that is parsimonious, generalizable and able to be operationalized within an operations management and supply chain context. DC is developed from referential relationships to disseminative capacity (Kuiken & von der Sijde, 2011 and Parent et al., 2007), absorptive capacity (Cohen & Levinthal, 1990 and Zahra & George, 2002) and knowledge transfer (Grant, 1996; Huber, 1991 and Nonaka, 1994). The proposed new construct is the result of conceptual relationships with each of these constructs that are defined in the main paper to which this document is an Appendix.

The critical incident technique (CIT) was chosen after considering a number of qualitative research methods. This is an exploratory study of a concept that has little mention in the organizational strategy or supply chain management literature, namely DC (Bitner, Booms and Tetreault, 1990). This is an appropriate method to explore this new construct as it does not restrict observations to a predefined list of variables (Walker & Truly, 1992) and is particularly effective to determine a conceptual structure to be tested later (Flanagan, 1954 and Walker & Truly, 1992). Additionally, this methodology answers a call for research using "narrative inquiry, micro-perspective questions such as 'tell me a story about how a client was successful with a knowledge management initiative'" (Raisinghani & Meade, 2005). Raisinghani & Meade (2005) suggested that

such a method might provide to revelations that would provide new perspectives for organizations that are having knowledge management problems.

This Appendix will provide a description of the CIT, support its use with examples from the literature, discuss the sample set and its selection, provide details of the procedures for data collection and analysis and present the results of the study.

2. THE CRITICAL INCIDENT TECHNIQUE

The CIT is a qualitative interview method first proposed by Flanagan (1954). It includes collecting direct observations of human and organizational behavior from a pre-qualified respondent. More specifically, this is an exploratory method (Bitner et al., 1990) that utilizes a set of tasks designed for collecting observations from the respondent about situations, events or incidents that took place in a context defined by the interviewer (Flanagan, 1954 and Bitner et al., 1990). The objective of this technique is to "gain understanding of the incident from the perspective of the individual" (Chell, 2004). Essentially, each respondent is asked to recall a story that pertains to an incident that pertains to the phenomenon of interest as specified by the interviewer (Bitner et al., 1990). The sampling unit is each individual observation (Stewart & Chase, 1999).

The CIT interview "stories" are collected and analyzed in order to gain insight into a specific phenomenon (Bitner et al., 1990 and Flanagan, 1954). Observations of human and organizational behavior are collected, grouped together and classified in order to make them useful for solving practical problems (Chell, 2004; Bitner et al., 1990 and Flanagan, 1954). The method is an "inductive grouping procedure" such as factor analysis or cluster analysis (Bitner et al., 1990; Hunt, 1983 and Strauss & Corbin, 1994. As such, the observations that are collected are recollections or incidents that either contribute or detract from some specified goal in a way that is significant and memorable (Bitner et al., 1990). For example, Miller, Craighead & Karwan (2000) used the CIT method in order to collect observations regarding service recovery. In their research,

Miller et al. (2000) asked the respondents to share personal stories about incidents regarding service recovery. Specifically, the respondents were asked to share a story about one experience when service recovery was successful and one when the service recovery was unsuccessful (Miller et al., 2000). From these interviews the authors were able to successfully decipher several tenets of effective service recovery management (Miller et al., 2000).

The following steps were taken to execute the CIT used in this research (adapted from Chell, 2004 and Gremler, 2004):

1. Draft the interview questions;
2. Validate the interview questions by utilizing outside reviewers or perspective interviewees;
3. Finalize the interview questions;
4. Select the sample;
5. Interview;
    a. Introduce the CIT method to the respondent.
    b. Focus the theme and provide introductions to the respondent.
    c. Control the interview and asking probing and clarifying questions;
    d. End the interview;
    e. Analyze the data;
    f. Perform validity and reliability tests on the results; and,
    g. Apply the results for practical purposes.

The CIT method is well suited for the research at hand because this paper is not trying to find a single truth, but rather trying to understand perspectives and behaviors

(individual and organizational) (Bitner et al., 1990 and Chell, 2004). Additionally, there is no preconception of what is important to the respondent (Bitner et al., 1990 and Chell, 2004). The interviewees are free to answer the question in any manner they choose; each interviewee is asked to recall specific events and they are able to use their own language and perspective to tell their story (Stauss & Weinlich, 1997). The literature provides several strengths and weaknesses of this interview procedure:

Strengths:

1. Context specific strategy can be related to outcomes in the search for patterns (Cassell & Symon, 2004 and Flanagan, 1954).
2. Results are context rich (Flanagan, 1954) because respondents determine which incidents are relevant (Bitner et al., 1990 and Chell, 1998).
3. The stories are told from the subject's perspective (Flanagan, 1954) and result in free-range responses within the research framework (Bitner et al., 1990 and Chell, 1998).
4. There is a focus and a theme, unlike unstructured interviews (Cassell & Symon, 2004 and Flanagan, 1954).
5. Commonalities among the incidents give rise to generality (Cassell & Symon, 2004 and Flanagan, 1954).
6. Works well to ferret out behaviors based on intuitions and/or tacit knowledge (Gremler, 2004).
7. The results provide unequivocal information because each interviewee is able to give a detailed description of their personal experiences (Bitner et al., 1990 and Chell, 2004).
8. No a priori hypotheses are necessary as the results are based upon patterns that emerge from the interview responses (Olsen & Thomasson, 1992 and Walker & Truly, 1992).
9. All respondents are qualified observers (Flanagan, 1954).

Weaknesses:

1. The recounted stories are always retrospective (Flanagan, 1954 and Gremler 2004).
2. Responses may be misinterpreted or misunderstood (Edvardsson, 1992 and Gremler, 2004)
3. Ambiguity of in classification of categories or coding could occur (Bitner et al., 1990 and Gremler, 2004).
4. The respondents may not tell the whole story (Bitner et al., 1990 and Gremler, 2004).

Despite an agreed upon list of weaknesses the literature supports this method as sound as it has changed little in the last fifty years (Gremler, 2004). This method has been used in many contexts and reported in a diverse set of literature streams (Gremler, 2004). It is important here to show that the CIT has been successfully used in operations management contexts. Table B-1 provides a sampling of research studies that have applied the CIT technique in operations management contexts.

Table B-1 Representative sample of operations management research that utilizes the critical incident technique

Authors	Year	Journal	OPMA Topic	Sample	Findings
Bitner et al.	1990	Journal of Marketing	Service Operations	Students collected 719 usable incidents	Respondents were asked to share service related experiences. 50% of the observations had favorable and 50% had unfavorable outcomes. The results provided a listing of employee behaviors that cause customers to distinguish very satisfactory service encounters from very dissatisfactory ones.
Blackhurst, Craighead, Elkins & Handfield	2005	IJPR	Supply Chain Disruptions	3 focus groups with 10-14 people	This paper used three methods to study the topic of supply chain disruptions: 8 semi-structured interviews; 1 case study and 3 focus groups using the CIT. They found items that were associated with supply chain disruption mitigation.
Chen & Hsu	2012	Tourism Economics	Service Quality	36 travel managers	The travel managers were asked to recall successful and unsuccessful incidents where tour guides addressed the service quality of a provider such as a restaurant. The respondents provided 793 criteria from which the authors developed a list of 8 service dimensions of tour quality.

Table B-1 – Continued

Authors	Year	Journal	OPMA Topic	Sample	Findings
Johnston	1995	International Journal of Service Industry Management	Service Quality	431 banking customers	The study asked banking customers for anecdotal recounts of experiences with banking services. They were asked to recall one favorable and one unfavorable banking experience. The 431 respondents returned 579 incidents. The analysis of these incidents found a listing of items that were considered to be elements of service quality that could be considered satisfiers and dissatisfiers.
Kaulio	2008	International Journal of Project Management	Project Management	48 project managers	Developed an overall project-leader-role framework based on the CIT responses from the respondents.
Miller et al.	2000	JOM	Service Operations	448 student reported incidents	Students were asked to relay experiences regarding service recovery measures taken by companies when they make a mistake. They were asked to recall two incidents one where service recovery was able to resolve the problem and one when it was not. The authors were able to create a list of behaviors that support successful service recovery.

Table B-1 – Continued

Authors	Year	Journal	OPMA Topic	Sample	Findings
Siemsen, Roth & Balasubram-anian	2008	JOM	Manufacturing	140 incidents	A modified critical incident technique was used in a pilot study to develop a questionnaire about knowledge sharing experiences within manufacturing. The results enabled the authors to construct a survey to address how motivation, opportunity and willingness address knowledge sharing in a manufacturing context.
Stewart & Chase	1999	POM	Service Operations	140 student reported incidents	Students were asked to relay stories about some error that had been made by a service provider, their analysis of recovery efforts and their level of dissatisfaction with the experience. The authors found 17 customer errors by mechanism and classified them into two categories: skill-based and rule-based errors.
Youngdahl, Kellogg, Nie & Bowen	2003	JOM	Service Quality	245 students	The respondents provided 490 critical incidents used in a modified CIT methodology. The authors were able to review these stories of successful and unsuccessful service incidents to determine the impact of culture to perceptions of quality satisfaction.

3. RESEARCH PROCEDURE

3.1 Sample Set

In this case, the CIT was used to find the underlying characteristics that define successful sources of knowledge in knowledge transfer transactions. The sampling unit for this research was an individual observation of a critical incident. For purposes of this research a critical incident is considered to be:

> *A knowledge transfer transaction that was perceived as either particularly successful or particularly unsuccessful in which the interviewee was directly involved as either the source or the recipient of knowledge.*

The intended elements of analysis were individual or organizational behaviors of a source of knowledge that contributed to the success of knowledge transfer transactions. The sampling frame for this research was professionals and executives with five or more years of managerial experience. The industries represented by these professionals were chosen to be purposefully diverse to maximize the generalizability of the results. Initially 63 executives were contacted via email or telephone and asked to participate in this research. The researcher personally knows each of these executives. All 63 executives responded and agreed to participate. The researcher chose to interview 50 of these executives. The adequacy of this sample size is addressed in the next section. Descriptive statistics for the executives are shown in Tables B-2, B-3, B-4 and B-5.

Table B-2
Sample by Industry

Industries	Sample Count
Business Consulting	1
Consumer Products Mfg.	11
Education	2
Entertainment	2
Executive Search and Recruiters	1
Finance and Operations Consulting	1
Health Insurance	1
Healthcare	1
Healthcare - Nursing	1
Healthcare Consulting	1
Investment Banking	3
Legal Services	2
Liability Insurance	1
Manufacturing	2
Marketing Services	1
Media	1
Motor Vehicle Parts and Accessories	1
Non-Profit Charitable Organization	1
Non-Profit Religious Organization	2
Professional Services	2
Public Finance, Taxation and Monetary Policy	1
Public Safety	1
Real Estate	1
Recruiting	1
Social Services	1
Grand Total	43

Table B-3
Size of company

Number of Employees	Sample Count
0-1,000	17
1,000-5,000	13
5,001-10,000	5
10,001-50,000	4
50,001-100,000	2
Over 100,000	2
Total Companies Represented	43

Table B-4
Sample by title

Titles in descending order of responsibility	Sample Count
CEO	6
CFO	1
Chief of Police	1
Partner	3
Managing Director	3
VP	8
Director	5
Senior Manager	3
Manager	13
Total Respondents	43

Table B-5
Sample by years of experience

Years of Experience	Sample Count
5-10	2
11-20	10
21-30	21
31-40	8
40-49	2
Total Respondents	43

A preliminary set of open-ended interview questions was developed and tested with five executives (Miller et al., 2000). These 5 executives were asked to give feedback as to the clarity of the questions and the face validity of the topic. Based on feedback from the initial 5 interviews, the questions were refined to be more easily understood. The interviewees all considered the topic plausible and valid. There were two interviews that were unusable due to the interviewees not providing adequate details in their responses. Accordingly, of the 50 interviews, 43 interviews with 86 observations were used for this analysis.

3.2 Interview procedures and questions

The interview questions were designed to prompt the interviewee to tell a story about their knowledge transfer experiences. The author of this paper executed all of the interviews reported in this research. In order to prepare the interviewees to answer the questions, the researcher took the following steps:

1. The researcher provided each interviewee with an informed consent document that was designed in conjunction with and approved by the

Internal Review Board of the University of Texas at Arlington and reviewed the document in detail with each interviewee. The interviewees were provided with a summary description of the research and its objectives and asked to sign the informed consent document. An example of the informed consent document is attached as Exhibit 1 to this Appendix.

2. Upon approval of the informed consent document the researcher received agreement from each interviewee to be digitally recorded.

3. The researcher reviewed a list of definitions with each interviewee. This list of definitions included definitions for concepts such as knowledge, and knowledge transfer. This list of definitions also included a tickler list of knowledge transfer transactions to give each interviewee an idea of the types of situations that are the focus of this research. A copy of the document provided to the respondents is attached Exhibit 2 to this Appendix.

4. Once items 1 through 3 were complete, the research questions were presented to the interviewees in the following order:

    i. *Describe a knowledge transfer transaction in which you participated that you would describe as particularly successful.*

    ii. *Describe a knowledge transfer transaction in which you participated that you would describe as particularly unsuccessful.*

The research questions were designed to be open-ended so that each interviewee would answer the questions with stories from their own experiences. The interviewees were told that they could share any experiences that they recalled no matter how long ago they occurred. Additionally, the interviewees were told that they could share stories where they were either the source or the recipient of knowledge.

The researcher also created a list of potential questions to ask during the interview in order to ensure that sufficient details were collected from each interview. These questions were sometimes needed, but not always. Some of the interviewees provided significant levels of detail. The only question that was asked in every interview besides the two primary questions was:

i. *What do you believe were the most critical components of the knowledge transfer transaction from your perspective?*

The primary and secondary questions are shown on Exhibit 3 to this appendix.

5. Each interview took from 45 minutes to 1 hour. After the interview questions were answered, demographic information was gathered from each interviewee, such as their years of experience by industry, their title, size of company, etc. All of these questions are shown on Exhibit 3 to this Appendix.

It is important to note here that the respondents were not specifically asked to discuss the causes of success or failure (Bitner et al., 1990). The interviewees were asked to focus on telling a story about a specific discrete incident. Instead it was the role of the interviewer to make "abstractions and inferences, not the respondent" (Bitner et al., 1990).

3.3 ANALYSIS AND REVIEW

3.3.1 Sample size

The interviews were stopped after 43 usable interviews were completed, netting 86 usable observations. The number of interviews chosen is based upon guidance from the literature. Specifically, Flanagan (1954) provides suggestions regarding the sample size. A sample size of 50-100 incidents is suggested for an uncomplicated behavior or set of behaviors. Flanagan (1954) additionally suggests that the sample size should be based on the utility or contribution of each additional incident. His example for this idea is: when 100 incidents only add 2-3 additional behaviors the sample is large enough. For the purposes of this paper, this idea was scaled back, it was decided that when each set of 5 incidents over 25 provided no new behaviors that the results would be considered saturated.

The sample size for this research was determined to be sufficient to provide evidence of source behaviors that support successful knowledge transfer. This is based partly on the guidance described in the preceding paragraph (Flanagan, 1954), partly based on from similar research in operations management and lastly because this research is being used in conjunction with a large scale empirical study in order to validate the proposed DC construct. Although, this methodology is not used in this exact same manner in the literature there are similar studies that provide additional guidance for sample sizes. For example:

1. Stewart & Chase (1999) used 134 students to describe dissatisfying service errors;

2. Blackhurst et al. (2005) used 8 semi-structured interviews, 1 case study and 3 focus groups with 10-14 people wherein CIT was used to study supply chain disruptions;

3. Kaulio (2008) used 48 critical incidents to study behaviors of project managers.

4. Speakman & Ryals (2012) used 29 respondents and 112 critical incidents to study the complex relationships associated with key account management.

5. Latham & Skarlicki (1995) used 47 faculty members and 47 critical incidents to study organizational citizenship behavior.

3.3.2 Data collection and coding

The interviews were digitally recorded. These audio recordings have been saved in redundant virtual locations to ensure a proper audit trail for this research. The audio recordings were transcribed word for word into Microsoft Word documents and are also stored in redundant virtual locations.

Once the transcriptions were completed, each of the interviews was analyzed using the CIT analytic induction process, which consists of "repeated, careful readings and sorting of the incidents into groups and categories according to the similarities in the reported experiences" (Bitner, et al., 1990). The interviews were read many times and compared to one another. The CIT includes this type of repetitive and iterative process whereby the incidents are repeatedly reviewed until any similarities and differences become apparent to the reviewer (Flanagan, 1954 and Bitner, et al., 1990).

The next step was to articulate the similarities and document each. The researcher used Microsoft Excel to log observations of characteristics of successful knowledge transfer events. Although the primary focus of this research was to learn more about the source of knowledge, the data collected included the characteristics of the source, the recipient of knowledge, types of knowledge, and characteristics of the environment (e.g. many interviewees mentioned executive support being critical to the success of their projects). The format of the data collected includes the interviewee identified by number, the line number of the transcription where the relevant comment resides, category of the comment, researcher comments and direct quotes.

Each observation made by the reviewer was categorized into measurements, proposed exogenous variables and proposed latent constructs, in that order. The reviewer made 652 observations based on the review of the transcribed interviews. Below is a sampling of observations from a single incident:

Observation examples:

Quote:	"She made assumptions about our knowledge base that were not correct."
Measurement:	Understands prior knowledge of recipient
Exogenous Variable:	Partner knowledge
Latent Construct:	Distributive capacity

Quote:	"We needed a face to face meeting to stop the madness."
Measurement:	Choose best channel for knowledge transfer

Exogenous Variable: Disseminative capability

Latent Construct: Distributive capability

The proposed categories for measurements, exogenous variables and latent constructs were based on a process of induction and supported the literature review described in the paper to which this is an Appendix. The primary focus of the analysis and coding process was to capture characteristics associated with the source in knowledge transfer situations. It quickly became apparent that the executives' stories provided characteristics of the source that fell into two distinct but related categories: process management and knowledge management. Examples of comments related to each are shown below from both the perspective of the source and recipient:

Knowledge Management:

> "Anticipate things they [the recipients of knowledge] haven't thought of because they don't know to ask. 'You don't know to ask this yet, but…'"
>
> "We identified what the recipient was looking for in terms of the product the price point and the program and we really did our homework before hand."
>
> "She had the ability to clearly articulate what she was trying to present but also make it personal and relate it back and say that this company is like company x and this is what they went through and this is like your business y."
>
> "[They made] sure that the knowledge was throughout the organization, through all layers of hierarchy."

Process Management:

> "Ultimately, we had to make sure that we had the opportunity to share."
>
> "[They] enabled us to work together as one team instead of two different teams."

> "[They] make sure everyone was on the same page and had buy-in from everyone."
>
> "They provided a clear plan and scope for the project."

Based on a detailed review of the interviews it is proposed that these two categories represent DC and CPC, respectively. For clarity the definitions for each, as developed in the paper, are repeated below:

> *Distributive capability* is the ability of a knowledge holder to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes.
>
> *Collaborative process competence* is the ability of the source that "enables the process of sharing relevant information, managing conflict, assessing options, jointly making decisions, and combining resources to accomplish objectives in a collaborative way" (Zacharia, et al., 2011).

As previously mentioned, there were a total of 652 comments that were extracted from the interviews and were coded and categorized as part of this analysis. 59.20% of those comments were categorized as DC and 15.34% were categorized as CPC. The remaining comments were categorized into groups labeled social capital (14.35%) and fertile ground (10.99%) (see Table B-6).

The model that was built using these categories as constructs is shown in Figure B-1. This model is adapted from Zacharia et al. (2011). More specifically, the addition of DC, fertile ground and the moderating effects of social capital have expanded the model. Each of these elements will be discussed in detail the next section.

Table B-6
Observations by category

Categories	Observations	% of Ttl
Collaborative Process Competence (Source)	100	15.34%
Distributive Capability (Source)	386	59.20%
Fertile Ground (Recipient)	72	11.04%
Social Capital	94	14.42%
Total Observations	652	100.00%

It is important to note here that the model shown in Figure B-1 is more comprehensive than the model that is being tested in this paper. The model generated from the CIT results is redacted for testing in order to promote parsimony and clarity. Most notably, the primary object of this paper is to study a hypothesized new construct, DC. In order to remain focused on DC and maintain a level of parsimony in this research, the proposed direct effect of fertile ground and the moderating effects of social capital have been removed from the proposed model. The redacted model is shown in the paper to which this is an Appendix as Figure 2. The constructs removed from the comprehensive model, namely social capital and fertile ground, are described in detail in this Appendix and are proposed to be tested in future research.

3.3.3 Construct development

This section describes how each construct was inductively defined from the executive interview comments and provides support from the literature for each

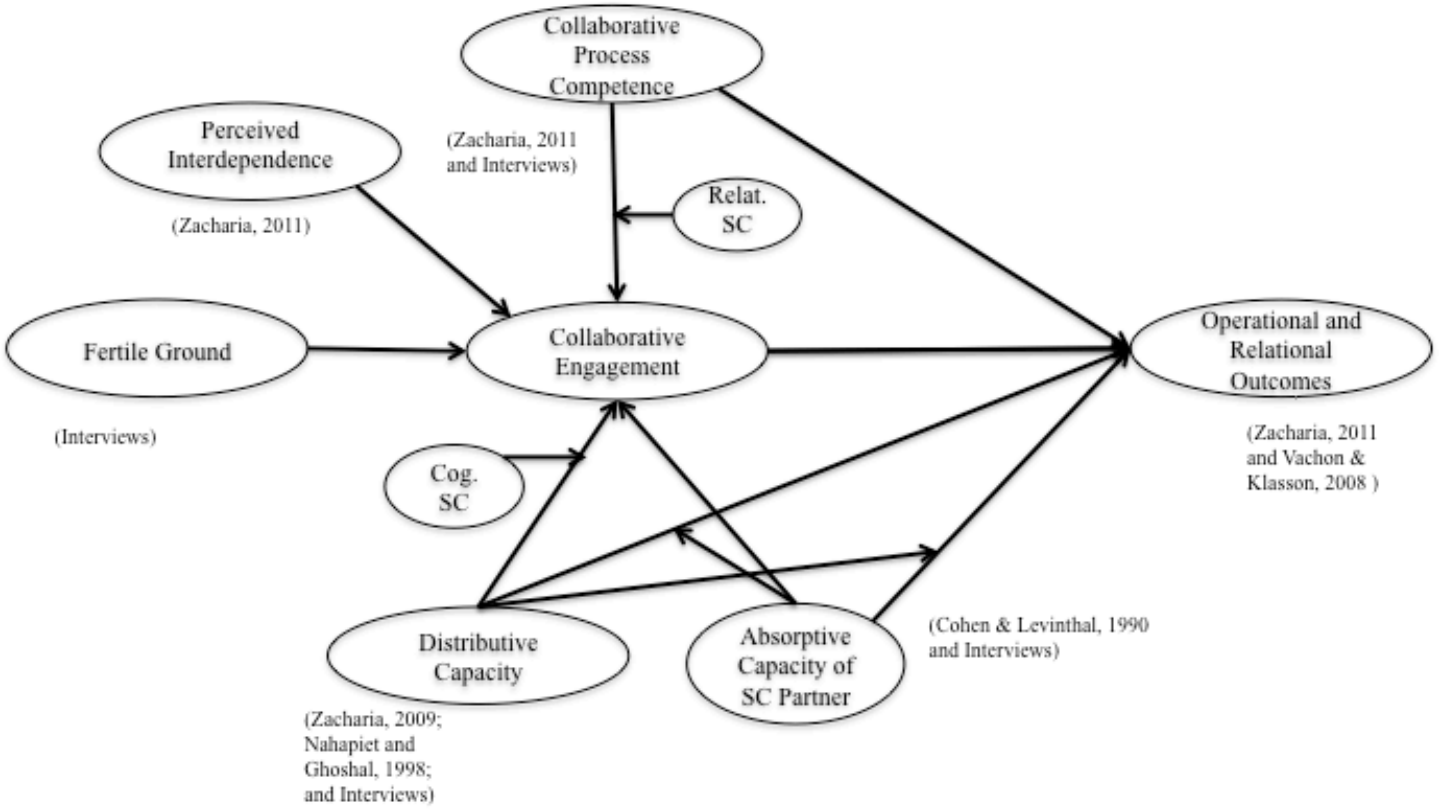

Figure B-1 Conceptual framework of supply chain collaboration

Notes: "Cog. SC" stands for Cognitive Social Capital and "Relat. SC" stands for Relational Social Capital

construct. Additionally, the proposed antecedents for each construct are described and supported from the interviews and literature.

3.3.3.1 Collaborative process competence

CPC is defined and operationalized in Zacharia, et al. (2011). Specifically, the authors operationalized this concept with the following abilities:

1. Recognize opportunities to collaborate.
2. Learn from prior collaboration experiences.
3. Select partners [they] can successfully collaborate with.
4. Recognize and resolve conflicts as they arise in collaboration efforts.
5. Select the "right" individuals for collaborative assignments.
6. Establish processes to monitor and manage collaboration efforts.
7. Management of a formal agreement governing the collaboration.

The interviews results supported the factors used by Zacharia et al. (2011). Based on the CIT results and the prior findings of Zacharia et al. (2011), these factors have been summarized into three categories: opportunity optimization, barrier removal and process management. Table B-7 provides definitions for each.

The comments from the executives were coded into classifications that make up the three categories collectively referred to as CPC. These classifications are shown in Table B-8, which also shows the frequency with which each was referenced within the 652 total observations made by the researcher.

Table B-7 CPC Definitions

Factors	Definitions	Source/Support
Collaborative Process Competence (Source)	"Reflects the firm's ability to select appropriate partners, establish processes to monitor and manage the initiative, and resolve conflicts and differences of opinions as they arise." Ability to synthesize relevant knowledge, overcome constraints and barriers, and enable the teams to come to mutual understandings and shared goals.	(Interviews and Zacharia et al., 2011)
Manage process	The ability to manage the interactions between firms in order to insure that roles and responsibilities are clear. This includes combining and synthesizing complementary knowledge and resources and monitoring the process in order to make adjustments where necessary. Additionally, this managing of the process includes the steps that the source takes to insure the knowledge transfer is successful after the collaboration is complete. For example, this includes following up with the recipient to insure that the new knowledge is being adapted and applied to the recipient's processes and culture.	(Interviews and Zacharia et al., 2011)
Opportunity optimization	Seeks out and acts upon opportunities to participate in knowledge sharing. The source actively provides the necessary tools, budget, executive support, and opportunities for collaboration and knowledge sharing. This includes creating physical or relational proximity in order to promote frequency of interactions between parties.	(Interviews, Peters and O'Connor, 1980; Argote, 2003; Szulanski, 2006 and Zacharia et al., 2011)
Remove barriers	Ability to identify and overcome current and potential constraints or barriers to a successful project or knowledge transfer. Ignites and supports consensus of goals and processes between organizations.	(Interviews and Zacharia et al., 2011)

Table B-8 CPC Classifications

Collaborative process competence classifications	Obs.	% of Ttl
Manage Process	**42**	**42.00%**
Provides safe environment for recipient	10	10.00%
Full disclosure - shares risks and rewards	9	9.00%
Manages expectations of recipient	7	7.00%
Follow-up on success of recipient after the knowledge transfer is complete	3	3.00%
Available for questions	2	2.00%
Insures clear expectations	2	2.00%
Source is consistent in the knowledge that they are sharing.	2	2.00%
Agreement between source and recipient as to knowledge transfer outcomes	1	1.00%
Assumes responsibility for actions	1	1.00%
Organized	1	1.00%
Provides measurements for success	1	1.00%
Opportunity Optimization	**30**	**30.00%**
Seeks and acts on opportunities to participate in knowledge sharing	13	13.00%
Source and recipient work physically close to each other	9	9.00%
Source is willing to give enough information (full disclosure)	7	7.00%
Makes Necessary tools available to perform knowledge transfer	1	1.00%
Remove Barriers	**28**	**28.00%**
Works to promote buy-in or agreement from recipient as to the value of the new knowledge	17	17.00%
Able to identify constraints to successful knowledge transfer	6	6.00%
Investigates and understands reasons for prior recipient failures of knowledge transfer	2	2.00%
Works as a team with recipient with agreed upon processes and outcomes	2	2.00%
Works to increase mutual objectivity	4	1.00%
Grand Total	**100**	**100.00%**

The category referred to as *manages process* includes items such as the most frequently mentioned idea, that a strong source of knowledge provides a safe environment for the sharing of knowledge. More specifically, the source ensures that competitive behaviors are controlled or not present in the collaboration and that the recipient of knowledge feels comfortable to ask questions and not be judged or intimidated by the source. The next most commonly mentioned idea in this category was that a strong source of knowledge ensures that there is full disclosure of information and makes the recipient comfortable that full disclosure has been made. For example, one executive commented that they wanted to know the "good and the bad." He explained that he wanted the expert to advise his company regarding both the potential good and bad outcomes of their collaboration. He said that his team did not have enough expertise to contemplate the potential poor outcomes, so he wanted the experts to be honest with him and provide what he called "full disclosure." This same type of idea was shared 9 times within the 86 critical incidents. This factor – process management - is also supported by the literature that suggests that CPC includes the ability to monitor and manage collaborative processes (Fugate et al., 2009; Li et al., 2012; Priem & Swink, 2012 and Zacharia et al., 2011).

There are several items that were referenced with notable frequency. The characteristic of the source most often discussed in the *opportunity optimization* category was the idea that a strong source of knowledge seeks out opportunities to participate in knowledge sharing. The way that this idea was communicated suggests that it transcends the idea of seeking out opportunities to collaborate, and also includes the behaviors of the

source to find opportunities to share knowledge during the collaboration. Executives also emphasized the importance of the source's ability and willingness to work proximally close to the recipient, which increases the frequency of and opportunity for knowledge transfer between parties. These ideals are supported by the literature. Obviously, knowledge transfer will not occur without an opportunity to engage in sharing activities (Spekman et al., 1997 and Szulanski, 1996). It has also been shown that environmental influences such as proximity, tools and equipment, materials and supplies and budgetary support all enhance the number of available opportunities for knowledge transfer and successful collaboration (Peters & O'Connor, 1980).

Within the category called *removes barriers* the most frequently mentioned concept by the executives was the idea that a strong source of knowledge works to promote buy-in or agreement from the recipient as to the value of the new knowledge. This idea includes igniting and supporting a consensus of goals and processes between organizations (Barratt, 2004 and Priem & Swink, 2012) and identifying and removing barriers and constraints to collaborative efforts, as well as, recognizing and resolving conflicts (Fugate et al., 2009; Li et al., 2012 and Zacharia, et al., 2011).

3.3.3.2 Distributive capability

DC is theorized as an ability that allows the source to effectively and efficiently manage the transfer of knowledge to a known recipient. This ability is supported by the observations and comments made by the executives interviewed for this research. This qualitative research was undertaken and based upon a literature review that found few

mentions of the source in knowledge transfer (Kuiken & van der Sijde, 2011 and Tang et al., 2010) and fewer empirical studies regarding the source or its characteristics (Fugate et al., 2009; Kuiken and van der Sijde, 2011; Reagans & McEvily, 2003, Tang et al., 2010 and Van Wijk et al., 2008). There were three categories of factors that were found in the executives' comments. These categories are disseminative capability, intellectual capital, and partner knowledge. These categories are shown and defined in Table B-9.

Disseminative capability is not a new concept. It has been used frequently in the MNC literature with regard to the capabilities of an expatriate to share best practices within their organization (Gupta & Govindarajan, 2000 and Minbaeva & Michailova, 2004). It is conceptualized in the literature as the ability of a source of knowledge to facilitate the logistical transfer of knowledge (Minbaeva, 2007). In other words, disseminative capabilities include skills such as clear communication and presentation, being able to reduce knowledge to writing, choosing the best channel of transfer and having strong teaching abilities. Disseminative capabilities are to DC as logistics are to supply chain management, the movement of intangible resources from one location to another. However, disseminative capabilities cannot be the end of the story for knowledge transfer, because, as we know from logistics, getting the resource to the right place at the right time is only part of the story. Knowledge transfer is not effectuated until it is received and applied for commercial purposes by the receiving party. This idea is more fully developed in the paper to which this is an Appendix.

Table B-9 DC Definitions

Factors	Definitions	Source/Support
Distributive Capability (Source)	The ability of a knowledge holder to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes.	(Whitehead, 2012)
Disseminative capability	The ability of the source "to contextualize, format, adapt, translate and diffuse knowledge through a social and/or technological network." In this case and more specifically, this is the ability of the source to "convincingly articulate and communicate, spread knowledge in a way that other people can understand accurately, and finally, tactically put the learning into practice."	(Mu et al., 2010 and Parent et al., 2007)
Intellectual capital	The level of intellectual capital held by the source. Intellectual capital is defined as the "credible information and/or experience, held by individuals and/or residing in the infrastructure of the firm which is converted into [collaborative] value. It can reside in one or more individuals or in one or more infrastructure systems." Intellectual capital includes access to external expert knowledge by network ties.	(Craighead et al., 2009)
Partner knowledge	The level of understanding that the source has of the recipient in multiple dimensions - their needs, emotions, culture, politics, goals and desired outcomes as they relate to the collaborative project and overall company strategy.	Interviews

Table B-10 shows the classifications that were categorized as disseminative capabilities and the frequency of their mention. The most often commented item with 26 mentions is the ability of the source to choose the best method of transfer. Seven of these comments specifically mentioned that their collaborations were successful because the source ensured that the project launch meetings were done in person and face to face with members from each organization. These comments also support the concept of proximity that was mentioned as part of CPC in the previous section.

Table B-10 DC classifications

Distributive capability classifications	**Obs.**	**% of Ttl**
Disseminative Capability	**222**	**57.51%**
Chooses best channel of transfer	26	6.74%
Personalization of knowledge for application and understanding by recipient	20	5.18%
Provides examples	18	4.66%
Seeks and accepts feedback	18	4.66%
Provides visual aids	13	3.37%
Promotes two-way communication	11	2.85%
Chooses best style of communication	10	2.59%
Provides insight into possible future outcomes	8	2.07%
Allows recipient to come to their own conclusions	7	1.81%
Confident	7	1.81%
Provides a single point of contact for recipient	7	1.81%
Source had a plan of action	7	1.81%
Ability to clearly communicate knowledge	6	1.55%
Ability to see that the knowledge transfer is not working	6	1.55%
Knowledge selection	6	1.55%
Quiz recipient to ensure knowledge transfer	6	1.55%

Table B-9 – Continued

Distributive capability classifications	Obs.	% of Ttl
Uses experience to answer unasked questions of recipients. Answers those questions they don't know to ask.	6	1.55%
Ability to reduce knowledge to writing in such a way that it is understandable to the recipient	5	1.30%
There is consensus among source as to the knowledge to be shared, methods, etc.	5	1.30%
Uses an appropriate physical cues to promote teamwork (tone of voice or body language)	5	1.30%
Provides demonstrations	4	1.04%
Provides written materials as support	4	1.04%
Has good presentation skills	3	0.78%
Anticipate questions of recipient	2	0.52%
Provide recipient with tools for the future	2	0.52%
Ability to decontextualize knowledge for application by recipient	1	0.26%
Able to help recipient articulate their goals	1	0.26%
Engages recipient in story telling	1	0.26%
Hands on teaching	1	0.26%
Manages expectations of the recipient	1	0.26%
Models behaviors	1	0.26%
Creative	1	0.26%
Engaging and interesting	1	0.26%
Thorough	1	0.26%
Uses appropriate communication style	1	0.26%
Intellectual Capital	**48**	**12.44%**
Technical Expertise	17	4.40%
Preparation (researches topic)	14	3.63%
Credible	9	2.33%
Low turnover rates at the source	6	1.55%
Able to answer questions	1	0.26%
Prior experience	1	0.26%

Table B-9 – Continued

Partner Knowledge	**115**	**30.05%**
Understands needs of recipient	26	6.74%
Evaluates recipient's base of prior knowledge in order to customize knowledge transfer	19	4.92%
Understands culture of recipient	19	4.92%
Asks questions to get to know recipient	12	3.11%
Evaluate the recipient's ability to absorb, assimilate and/or apply knowledge in order to customize knowledge transfer	12	3.11%
Understands emotions of recipient	8	2.07%
Understands business of recipient	7	1.81%
Understands external environment	5	1.30%
Understands the embeddedness of prior knowledge	5	1.30%
Ask questions of recipient at all levels of hierarchy	3	0.78%
Grand Total	**386**	**100.00%**

The next most notable ability in this category was the ability of the source to personalize knowledge in such a way that the recipient can both understand and apply it. One executive recounted a presentation by an expert to a group of regional CFOs at his organization. The expert was charged with explaining socially acceptable and unacceptable behaviors in different countries to a group of CFOs from different autonomous units within a multi-national company. She was successful because she brought examples of these behaviors from other organizations and told each CFO how these behaviors may specifically affect their unit because of the countries in which they are represented. She was able to personalize the knowledge in such a way that each CFO could easily apply it to their individual situations.

Intellectual capital is conceptualized here, in congruence with the relative literature (Craighead et al., 2009), as the knowledge resources both internally and externally available to the firm. As disseminative capability is the ability of the firm to share knowledge, the intellectual capital of the firm is the actual knowledge stocks that the firm has available either internally or externally through network ties (Craighead et al., 2009 and McEvily & Marcus, 2005). Based on the interviews, intellectual capital is theorized to include prior experience, technical expertise, research done to support collaboration, credibility, and elements of structural social capital such as low turnover rates and ties to external knowledge stocks.

Partner knowledge is the third category included in DC. This factor denotes the source's ability to understand the recipient of knowledge or collaborative partner (Zacharia, et al., 2009). This understanding is derived by "getting to know" the recipient by observation and asking questions from employees at all levels of the organization. The most often mentioned idea in this category was the ability of the source to understand the needs of the recipient that the new knowledge is intended to fill. This is among the most highly cited comments throughout the interviews. The next most cited comments regard the ability of the source to understand the culture of the recipient and the recipient's prior base of knowledge upon which the new knowledge must build. The executives also mentioned the ability of the source to understand and evaluate the recipient's ability to absorb knowledge, or in other words, to evaluate the recipient's AC.

3.3.3.3 Fertile ground

Fertile ground was a surprising idea that developed from the interviews. See Table B-11 for the definitions of the construct and the related proposed antecedents.

Table B-11 Fertile ground definitions

	Definitions	Source
Fertile Ground (Recipient Characteristics)	The characteristics of the recipient that enable promote and support collaborative activities within the firm. Fertile ground connotes the idea that the recipient is ready and willing to seek out, acquire and assimilate new knowledge.	Interviews
Consensus	The level of agreement amongst the recipient's team as to the scope of the project, expected outcomes and value of the project or collaboration.	Interviews
Executive support	The recipient's level of executive support for the collaboration.	Interviews
Willingness	The level of the recipient's willingness to participate in commitment and dedication to the knowledge transfer. And, level of willingness to ultimately act upon that knowledge by adopting, adapting and ultimately applying the new knowledge to the company's processes and culture.	Interviews

This concept arose from 71 comments (see Table B-12) within 86 observations that referenced the need for:

1. Consensus among the recipient's team as to the value of the knowledge and how it will be applied in the recipient's organization.
2. Support from the recipient's executive management team for the collaboration.

3. The recipient to be willing to participate in the knowledge transfer or collaboration.

4. The recipient to be open to new knowledge, sees that knowledge as valuable to its organization, and is willing to act upon that knowledge.

Table B-12 Fertile ground characteristics

Fertile ground classifications	Obs.	% of Ttl
Consensus - recipient	**4**	**5.56%**
Members of recipient team are all like minded	4	4.17%
Executive Support - Recipient	**23**	**31.94%**
Executive support at recipient	23	31.94%
Willingness of Recipient	**45**	**62.50%**
Recipient willing to act on knowledge	19	26.39%
Recipient cared about outcome(s)	8	11.11%
Dedication of recipient	4	5.56%
Recipient invested appropriate level of resource in process	4	5.56%
Recipient open to new knowledge	4	5.56%
Recipient saw value in knowledge	3	4.17%
Recipient willing to participate in transfer	2	2.78%
Recipient had a desire to learn	1	1.39%
Grand Total	**72**	**100.00%**

The idea is that if the recipient does not provide "fertile ground" the seeds of knowledge will not embed themselves and will not be applied to the processes or culture of the organization. This construct is different than absorptive capacity. This construct is a necessary pre-condition for the recipient to actively engage in collaborative activities and knowledge transfer. Accordingly, fertile ground is theorized to have a direct effect on levels of collaborative engagement. This is a new construct and is beyond the scope of this research. It is suggested that this construct be further tested in additional qualitative and future quantitative empirical research. Both the recipient and

source of knowledge would benefit by being able to evaluate and measure the potential for collaborative success based on the level of *fertile ground* at the recipient prior to the engagement between firms.

3.3.3.4 Social capital

Social capital is theorized in three types: cognitive, relational and structural (Nahapiet & Ghoshal, 1998). The executives mentioned each of these three types of social capital during their interviews. Social capital theory supports the importance of social capital to knowledge transfer (Bouty, 2000). Bouty (2000) suggests that social capital is a key success factor in the resource acquisition process by acquaintance and interaction. In this sense, social capital is a catalyst for opportunity (acquaintance) and collaborative engagement (interaction). Cognitive social capital was addressed by ideas such as: shared experiences and shared language. The executives expressed their opinion that cognitive social capital enhanced the ability of the source of knowledge to share knowledge more "smoothly" and with less "glitches" or misunderstandings. Accordingly, it is proposed here that cognitive social capital moderates the effect of DC on collaborative engagement.

The executives described relational social capital as the quality of the relationship between the parties. For example, the executives mentioned the frequencies of interactions between the parties, nurturing relationships and trust between the parties as important elements of successful knowledge transfer and collaboration. Accordingly, it is theorized here that relational social capital moderates the direct effect of CPC on

collaborative engagement.

The elements of structural social capital were also described in the executive interviews. These elements: access to experts through network ties and low turnover are both included as factors associated with intellectual capital following the direction in the literature that structural social capital is embedded within intellectual capital (Craighead et al., 2009 and Stewart, 1994).

3.4 Validity and reliability

This process was both rigorous (included first hand experiences of the respondents) and vigorous (included coding classification and reliability and validity are addressed) (Bitner et al., 1990).

The classifications in this study were assessed for validity and reliability following the suggested procedures in Cummings & Schwab (1973) and Weber (1990). Specifically, intercoder reliability was addressed by academic and practitioner review. Each reviewer was presented with a list of items and potential categories and asked to match each to the other. Based on the results of the review, several definitions were updated to provide additional clarity regarding which of the characteristics belonged to the source vs. the recipient. Additionally, one factor was removed and 7 measurements were consolidated with others. There was 82% agreement between the researcher and the reviewers.

The face validity of the measurements, exogenous and latent variables was tested with 3 executives. These executives were included in the original interviews and were

therefore familiar with the topic and basic definitions. Each of the executive reviewers was provided with the pre-coded list of items along with proposed definitions for each. They were asked to review and comment on the classifications and definitions. Definitions were rewritten based on their suggestions in order to better clarify the roles of the source and recipient in knowledge transfers. Additionally, their comments caused a reclassification of two measurements. There was 93% agreement amongst these reviewers and the researcher. Additional tests for reliability and validity will be taken as a component of the empirical research that is described in this dissertation proposal.

3.5 LIMITATIONS

The researcher knew all the executives in this research, although this may pose some advantages, there is the potential that the executives presented with some biases in their perspective due to some underlying commonality. The researcher attempted to compensate for these potential biases by including executives from a myriad of different industries and different positions within their organizations. This was also done to increase the potential for generalizability of the results.

Another potential limitation is that only one researcher was involved in the analysis of each individual interview transcription. There have been examples of CIT based research where there were multiple authors that were able to review the detailed interviews (Bitner et al., 1990; Blackhurst et al., 2005 and Stewart & Chase, 1999). This enabled those authors to provide an additional level of reliability.

A third potential limitation is in the use of CIT that includes weaknesses such as those described in section 2 of this Appendix. Most notably, the CIT asks the respondents to recall incidents and provide retrospective descriptions of each. This could be problematic as the respondents may discuss situations that occurred some time ago and their perceptions may be obscured by the passing of time (Miller et al., 2000). This phenomenon is partially removed by asking the respondents to recall a particularly memorable situation, insomuch as a particularly memorable experience may be more easily recalled in detail without obscuration.

Finally, the CIT does not attempt to determine causation. Accordingly, the paper to which this is an Appendix undertakes empirical survey research to attempt to better understand the relationships between these constructs.

Exhibit 1

UT Arlington
Informed Consent Document

PRINCIPAL INVESTIGATOR

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Arlington, TX 76019

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Email: kimberly.whitehead@mavs.uta.edu

FACULTY ADVISOR

Dr. Ann McFadyen
University of Texas at Arlington
Department of Management
701 West Street
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Telephone: 817-272-0214
Email: mcfadyen@uta.edu

TITLE OF PROJECT - - - Distributive Capacity

INTRODUCTION

You are being asked to participate in a research study about how knowledge is shared within and between people, groups and organizations. Your participation is voluntary. Refusal to participate or discontinuing your participation at any time will involve no penalty or loss of benefits to which you are otherwise entitled. Please ask questions if there is anything you do not understand.

PURPOSE

The purpose of this research is to better understand how knowledge is shared between individuals, groups and organizations in a commercial context (for business purposes). Specifically, this research is focused studying the roles of participants in situations when knowledge is shared between two or more parties. The participants in situations such as these include: 1) sources of knowledge – those participants that have knowledge that is desired or needed by another party for business purposes and 2) recipients of knowledge – those participants that desire or need commercially relevant knowledge that has been created or is held by another party (the source).

APPROVED

IRB Approval Date: MAR 2 3 2013

IRB Expiration Date: MAR 2 3 2014

Institutional Review Board

UT Arlington
Informed Consent Document

DURATION
Participation in this study will last approximately 45 minutes.

NUMBER OF PARTICIPANTS
The number of anticipated participants in this research study is 50.

PROCEDURES
The procedures that will involve you as a research participant include an interview during which we will discuss your work experiences involving knowledge transfer activities.

The interview will be audio recorded. After the interview, the audio recording will be transcribed, which means it will be typed exactly as it was recorded, word-for-word, by the researcher. The audio recording will be kept in a locked file after transcription for a period of at least three years in the Department of Information Systems and Operations Management at the University of Texas at Arlington. The recording and transcription will not be used for any future research purpose not described here.

POSSIBLE BENEFITS
You will have access to the results of this research. This information may provide you and your organization new insights into how to insure successful knowledge transfers within your organization and between your organization and its customers, vendors, and other stakeholders.

POSSIBLE RISKS/DISCOMFORTS
There are no perceived risks or discomforts for participating in this research study. Should you experience any discomfort please inform the researcher, you have the right to quit any study procedures at any time at no consequence.

COMPENSATION
No compensation is being offered for participation in this study.

ALTERNATIVE PROCEDURES
There are no alternative procedures offered for this study.

VOLUNTARY PARTICIPATION
Participation in this research study is voluntary. You have the right to decline participation in any or all study procedures or quit at any time at no consequence. Participation in this research will have no effect on your employment and your individual responses will remain anonymous.

APPROVED
IRB Approval Date: MAR 2 3 2013
MAR 2 3 2014
IRB Expiration Date:
Institutional Review Board

UT Arlington
Informed Consent Document

CONFIDENTIALITY
Every attempt will be made to see that your study results are kept confidential. A copy of this signed consent form and all data collected including transcriptions/audio recordings from this study will be stored at the College of Business at the University of Texas at Arlington, Department of Information Systems and Operations Management for at least three (3) years after the end of this research. The results of this study may be published and/or presented at meetings without naming you as a participant. Additional research studies could evolve from the information you have provided, but your information will not be linked to you in anyway; it will be anonymous. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the UTA Institutional Review Board (IRB), and personnel particular to this research have access to the study records. Your records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above. The IRB at UTA has reviewed and approved this study and the information within this consent form. If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, the University of Texas at Arlington will protect the confidentiality of those records to the extent permitted by law.

CONTACT FOR QUESTIONS
Questions about this research study may be directed to:

Kimberly Whitehead, Ph.D. Candidate
University of Texas at Arlington
Department of Information Systems and Operations Management
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Telephone: 214-592-6926
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Or

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IRB Approval Date: MAR 2 3 2013

IRB Expiration Date:

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MAR 2 3 2014
Institutional Review Board

3

UT Arlington
Informed Consent Document

Any questions you may have about your rights as a research participant or a research-related injury may be directed to the Office of Research Administration; Regulatory Services at 817-272-2105 or regulatoryservices@uta.edu.

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

_____

Signature and printed name of principal investigator or person obtaining consent **Date**

CONSENT

You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

_____

SIGNATURE OF VOLUNTEER **DATE**

APPROVED
MAR 2 3 2014
Institutional Review Board

IRB Approval Date: MAR 2 3 2013

IRB Expiration Date:

Exhibit 2

Knowledge Transfer (Critical Incident) Interview Template

DEFINITIONS

Knowledge = data and/or information that has been infused with meaning and value such that it impacts a recipient's judgement, behavior and actions.

Knowledge Types

Tacit Knowledge = is the type of knowledge that is difficult to express in words and is generally shared by experience between people. An example of tacit knowledge is knowing how to roller skate. An individual would find it hard to express in words how to counter-balance their weight in order to skate well, or at which angle they lean when turning, yet they are able to execute these actions while skating.

Explicit Knowledge = the type of knowledge that is easy to communicate either orally or in writing in a formal systematic language. It can be stored in many different forms of media (e.g. books, instructions, manuals, computer systems, etc.) and is not necessarily associated with individuals (e.g. can be associated with groups of people performing tasks).

Knowledge Transfer = transaction between two parties in which knowledge is conveyed from a source to a recipient. For this interview, knowledge transfer is considered sharing knowledge that is used for business purposes.

Examples of knowledge transfer transactions:

- Training
- Observation
- Technology transfer
- Sharing best practices
- Publishing patents
- Professional presentations
- Scientific or professional publications
- Consulting engagements
- Interactions with suppliers and customers
- Alliances and other forms of inter and intra-firm relationships

Source = an individual, group or organization that holds the knowledge to be transferred to another party.

Recipient = an individual, group or organization that acquires knowledge from another party.

Function = a functional area of your company such as marketing, manufacturing, accounting, finance, and so on.

Exhibit 3

ABOUT A SUCCESSFUL KNOWLEDGE TRANSFER TRANSACTION

Describe a knowledge transfer transaction in which you participated that you would describe as particularly successful.

Would you describe the transfer as primarily between individuals, groups (teams) or organizations?

Did you represent the source or the recipient in the knowledge transfer transaction?

Which business functions in your organization were involved?

Which business functions in the other organization were involved (if applicable)?

Was the knowledge transferred a type of tacit or explicit knowledge?

Briefly describe the specific business situation that led up to or caused the knowledge transfer transaction?

Approximately when did the transaction occur?

Approximately how long was the interaction between the parties (source and recipient)?

What particular result(s) made you feel the interaction was successful?

What aspects of the transaction that went particularly well?

What aspects of the transaction that went particularly poorly?

What do you believe were the most critical components of the knowledge transfer transaction from your perspective (examples may include things such as long-term relationships, trust, technology, complementary talents, motivated participants, specific capabilities, etc.).

ABOUT AN UNSUCCESSFUL KNOWLEDGE TRANSFER TRANSACTION

Describe a knowledge transfer transaction in which you participated that you would describe as particularly unsuccessful.

Would you describe the transfer as primarily between individuals, groups (teams) or organizations?

Did you represent the source or the recipient in the knowledge transfer transaction?

Which business functions in your organization were involved?

Which business functions in the other organization were involved (if applicable)?

Was the knowledge transferred a type of tacit or explicit knowledge?

Briefly describe the specific business situation that led up to or caused the knowledge transfer transaction?

Approximately when did the transaction occur?

Approximately how long was the interaction between the parties (source and recipient)?

What particular result(s) made you feel the interaction was unsuccessful?

What aspects of the transaction that went particularly well?

What aspects of the transaction that went particularly poorly?

What do you believe were the most critical components of the knowledge transfer transaction from your perspective (examples may include things such as long-term relationships, trust, technology, complementary talents, motivated participants, specific capabilities, etc.).

ABOUT THE COMPANY

Name of the company:

About how many employees does your company employ …

(a) … at your location? _____

(b) … in total (including headquarters and other locations)? _____

What were your approximate revenues during your last fiscal year…

(a) … for your location? _____

(b) … in total (including headquarters and other locations)? _____

What is your SIC Code? _____

Which activities do you consider your core competencies?

What are your main products/services?

ABOUT YOURSELF …

Participant ID #:_____

Position:_____

Contact information (e.g., email, phone):_____

Industry experience:

Industry	Years of Experience
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Appendix C

Empirical Measures Descriptive Statistics

Appendix C

Empirical Measures Descriptive Statistics

Item	Label		Development
The organizations involved:			
Were dependent on each other for an effective solution	PI1		Zacharia et al., 2011
Needed knowledge the other possessed	PI2		Zacharia et al., 2011
Needed skills the other possessed	PI3		Zacharia et al., 2011
Needed each other to reach their goals	PI4		Zacharia et al., 2011
The organizations involved:			
Make joint decision on most issues	CE1		Zacharia et al., 2011
Jointly set goals	CE2		Zacharia et al., 2011
Used intensive collaborative planning	CE3		Zacharia et al., 2011
Met often	CE4		Zacharia et al., 2011
Throughout the collaboration:			
There was a free flow of useful ideas	CE5		Zacharia et al., 2011
There was a free flow of novel ideas	CE6		Zacharia et al., 2011
There was an openness to new ways of thinking	CE7	x	Zacharia et al., 2011
There was an openness to discovering new knowledge	CE8	x	Zacharia et al., 2011
In general our partner had the ability to:			
Express ideas in language that was easy for us to understand	DC1		Interviews
Provide multiple perspectives	DC2		Interviews
Make clear verbal presentations of complex knowledge	DC3		Interviews
Clearly express complex ideas in writing	DC4		Interviews

Appendix C – Continued

Item	Label		Development
Select the best method to share knowledge	DC5		Interviews
Share knowledge with us both formally and informally	DC6	x	Interviews
Accept and respond to feedback	DC7	x	Interviews
Provide insight into possible future outcomes	DC8	x	Interviews
During the collaboration our partner's organization:			
Experienced employee turnover (reverse coded)	DC9	x	Interviews
Had the ability to attain 3rd party expertise when needed	DC10	x	Interviews
Exhibited high levels of technical expertise	DC11	x	Interviews
Was credible	DC12	x	Interviews
Was willing to share their knowledge with us	DC13	x	Interviews
Was protective of its intellectual capital (reverse coded)	DC14	x	Interviews
Was positive about sharing its expertise with us	DC15	x	Interviews
Our partner asked for or otherwise acquired information about our:			
Organization	DC16		Interviews
Organizational culture	DC17		Interviews
Strengths and weaknesses	DC18		Interviews
Long-term goals	DC19	x	Interviews
Objectives and expectations for the collaboration	DC20		Interviews
In general our partner had the ability to:			
Establish processes to monitor and manage collaboration efforts	CPC1		Interviews
Manage frequent interactions with our firm	CPC2		Interviews

Appendix C – Continued

Item	Label	Development
Abide by an agreed timeline	CPC3	Interviews
Manage our expectations	CPC4	Interviews
Recognize and resolve conflicts as they arise	CPC5	Interviews
Positively influence cooperation between our organizations	CPC6	Interviews
In general our company has the ability to:		
Identify and adopt new and useful ideas	AC1	Cohen & Levinthal (1990)
Seek out new and useful knowledge	AC2	Cohen & Levinthal (1990)
Take advantage of new knowledge to improve performance	AC3	Cohen & Levinthal (1990)
Understand the impact of new knowledge	AC4	Cohen & Levinthal (1990)
Change processes based on new knowledge	AC5	Cohen & Levinthal (1990)
Use new knowledge in response to competitive changes	AC6	Cohen & Levinthal (1990)
This collaboration resulted in our two organizations having:		
Greater commitment to each other	RO1	Zacharia et al., 2011
An improved level of trust	RO2	Zacharia et al., 2011
More open sharing of information	RO3	Zacharia et al., 2011
An enhanced commitment to work together in the future	RO4	Zacharia et al., 2011
A feeling of partnership and solidarity between us	RO5	Zacharia et al., 2011
This collaboration resulted in our company experiencing:		
Lower costs	OO1	Zacharia et al., 2011
Improved quality	OO2	Zacharia et al., 2011
Better customer service	OO3	Zacharia et al., 2011
Better safety, environmental or regulatory performance	OO4	Zacharia et al., 2011

Appendix C – Continued

Item	Label		Development
Improved value to its customers	OO5		Zacharia et al., 2011
Overall improved organizational performance	OO6		Zacharia et al., 2011
Improved profitability	OO7	x	Zacharia et al., 2011

Note: x denotes items that were removed from the final model.

Appendix D

Measurement Instrument

Appendix D

Default Question Block

Informed Consent Form

Identification of Investigator and Purpose of Study
You are invited to participate in a research study, entitled "It's a matter of give and take: A study of knowledge transfer in the supply chain." The study is being conducted by Kimberly Whitehead and Dr. Edmund Prater of The University of Texas at Arlington, 701 West Street, Arlington, Texas 76019 | 817-272-3502.

The purpose of this research study is to examine **how firms collaborate and work toward successful performance and relational outcomes.** Your participation in the study will contribute to a better understanding of how two firms exchange information and knowledge in collaborative projects **.** You are free to contact the investigator at the above address and phone number to discuss the study. You must be at least 18 years old to participate.

If you agree to participate:
- The **survey** will take **approximately 15 minutes** of your time.
- You **will not** be compensated.
- You will be entered into a drawing to be held on April 1, 2014 for an I-Pad mini or one of ten copies of An Introduction to Supply Chain Management: A Global Supply Support Perspective by Dr. Edmund Prater and Ms. Kimberly Whitehead.

Risks/Benefits/Confidentiality of Data
There are **no known risks.** There will be no costs for participating. Your name and email address **will not** be kept during the data collection phase. A limited number of research team members will have access to the data during data collection.

Participation or Withdrawal
Your participation in this study is voluntary. Your participation will not affect your employment nor your relationship with the University of Texas at Arlington. You may decline to answer any question and you have the right to withdraw from participation at any time. Withdrawal will not affect your relationship with The University of Texas in anyway. If you do not want to participate either simply stop participating or close the browser window.

Confidentiality
Every attempt will be made to see that your study results are kept confidential. A copy of this signed consent form and all data collected from this study will be stored in the office of Information System and Operations Management, College of Business Administration Room 535 at the University of Texas at Arlington for at least three (3) years after the end of this research. The results of this study may be published and/or presented at meetings without naming you as a participant. Additional research studies could evolve from the information you have provided, but your information will not be linked to you in anyway; it will be anonymous. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the UTA Institutional Review Board (IRB), and personnel particular to this research have access to the study records. Your records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above. The IRB at UTA has reviewed and approved this study and the information within this consent form. If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, the University of Texas at Arlington will protect the confidentiality of those records to the extent permitted by law.

Contacts
If you have any questions about the study or need to update your email address contact the researcher **Kimberly Whitehead** at **817-272-3502** or send an email to **kkwhite@uta.edu.** This study has been reviewed by The University of Texas at Arlington Institutional Review Board**.**

Questions about your rights as a research participant.
If you have questions about your rights or are dissatisfied at any time with any part of this study, you can contact, anonymously if you wish, the Institutional Review Board by phone at Office of Regulatory Services, 817-272-3723 or regulatoryservices@uta.edu.

I have read and understood the above consent form and desire of my own free will to participate in this study. Please print a copy of this informed consent for your records.

- ◯ Yes
- ◯ No

Block 1

Instructions. Please consider a recent collaboration that came about because your company found itself in need of knowledge, technical expertise, or other resources that were not available within the company itself.

For example a company may collaborate with other companies by:

1) Working with vendors to design new products or pick the best materials;

2) Working with transportation companies to distribute goods;

3) Work on projects with customers to help fulfill customer requests for goods or services;

4) Work with outside marketing or merchandising companies to help market their products; or

5) Work closely with service providers like: auditors, software firms, janitorial services, etc.

As you respond to the following questions, think about your **most recent collaboration effort with another firm** that ***best*** meets the following criteria:

- You were highly involved.
- The collaboration is complete or near completion so you can reasonably assess whether the collaboration was successful or unsuccessful (we are interested in both).

Block 5

Please tell us in a couple of sentences the nature and scope of the collaboration.

You do not need to answer this question in order to complete the survey. This is helpful information - but completely optional.

Please indicate in general the degree to which this collaboration effort has been unsuccessful or successful.

	Highly Unsuccessful	Unsuccessful	Somewhat Unsuccessful	Neither Successful nor Unsuccessful	Somewhat Successful	Successful	Highly Successful

	○	○	○	○	○	○	○

Block 3

This collaboration was:

- ○ A recurring collaboration - ex. a construction company who repeatedly works with your organization.
- ○ A unique, one-time collaboration - ex. an organization working with a marketing firm to design a new product.

Please answer the following with regard to the timing of the collaboration:

	0	12	24	36	48	60	72	84	96	108	120
How long ago (in months) did the collaboration take place?											
How long (in months) did the collaboration take place?											

Block 4

To what extent do you agree with the following statements about the collaborative effort?

The organizations involved:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
were dependent upon one another for an effective solution	○	○	○	○	○	○	○
needed knowledge that the other possessed	○	○	○	○	○	○	○
needed skills that the other possessed	○	○	○	○	○	○	○
needed each other to reach their goals	○	○	○	○	○	○	○
made joint decisions on most issues	○	○	○	○	○	○	○
jointly set goals	○	○	○	○	○	○	○
used intensive collaborative planning	○	○	○	○	○	○	○

met often	○	○	○	○	○	○	○

Block 5

Throughout this collaboration:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
there was a free flow of useful ideas	○	○	○	○	○	○	○
there was a free flow of novel ideas	○	○	○	○	○	○	○
there was an openness to new ways of thinking	○	○	○	○	○	○	○
communication was initiated by both parties	○	○	○	○	○	○	○

Block 6

Our organization supported the collaboration through:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
executive participation in meetings	○	○	○	○	○
encouraging employees to participate	○	○	○	○	○
providing incentives	○	○	○	○	○
allowing employees to dedicate time to the project	○	○	○	○	○
the willingness to share sensitive information that could impact our collaborative efforts	○	○	○	○	○

The members of our organization agreed concerning:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
the desired outcomes for the collaboration	○	○	○	○	○	○	○
the need for collaboration	○	○	○	○	○	○	○
the choice of our collaboration partner	○	○	○	○	○	○	○

Block 7

The following section focuses on the skills, knowledge and expertise brought to the project by your collaboration partner.

In general our collaboration partner had the ability to:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
express ideas in a way that was easy for us to understand	○	○	○	○	○	○	○
explain why practices should be adopted	○	○	○	○	○	○	○
make clear verbal presentations of complex information	○	○	○	○	○	○	○
clearly express complex ideas in writing	○	○	○	○	○	○	○
select the best method to share knowledge (i.e. in writing, face-to-face, etc.)	○	○	○	○	○	○	○
share knowledge with us both formally and informally	○	○	○	○	○	○	○
accept and respond to feedback	○	○	○	○	○	○	○
provide insight into possible future outcomes (i.e. outcomes that may result from choosing between strategies)	○	○	○	○	○	○	○

Block 8

During the project our collaboration partner:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
experienced employee turnover	○	○	○	○	○	○	○
had the ability to attain 3rd party expertise on our behalf, when needed	○	○	○	○	○	○	○
exhibited high levels of technical expertise	○	○	○	○	○	○	○
was credible	○	○	○	○	○	○	○
was willing to share their knowledge with us	○	○	○	○	○	○	○
was protective of their intellectual capital	○	○	○	○	○	○	○
was positive about sharing its expertise with us	○	○	○	○	○	○	○

Our collaboration partner asked for or otherwise acquired information about our:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
industry	○	○	○	○	○	○	○
organization	○	○	○	○	○	○	○
organizational culture	○	○	○	○	○	○	○
strengths and weaknesses	○	○	○	○	○	○	○
goals	○	○	○	○	○	○	○
objectives for the collaboration	○	○	○	○	○	○	○

Block 9

In general our collaboration partner had the ability to:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
establish processes to monitor and manage collaboration efforts	○	○	○	○	○	○	○
manage frequent interactions with our organization	○	○	○	○	○	○	○
abide by an agreed timeline	○	○	○	○	○	○	○
manage our expectations	○	○	○	○	○	○	○
recognize and resolve conflicts as they arose	○	○	○	○	○	○	○
positively influence cooperation between our organizations	○	○	○	○	○	○	○

Block 10

Please share with us information about some of the outcomes of this collaborative effort.

This collaboration resulted in:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
lower costs	○	○	○	○	○	○	○
improved quality	○	○	○	○	○	○	○
better customer service	○	○	○	○	○	○	○
reduced cycle or lead time	○	○	○	○	○	○	○
better safety, environmental or regulatory performance	○	○	○	○	○	○	○
improved value to our customers	○	○	○	○	○	○	○

overall improved organizational performance	○	○	○	○	○	○	○
improved profitability	○	○	○	○	○	○	○
increased revenue	○	○	○	○	○	○	○

The collaboration resulted in our two organizations having:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
a greater commitment to each other	○	○	○	○	○	○	○
an improved level of trust	○	○	○	○	○	○	○
more open sharing of information	○	○	○	○	○	○	○
an enhanced commitment to work together in the future	○	○	○	○	○	○	○
a feeling of partnership	○	○	○	○	○	○	○

Reflecting on this collaboration overall:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
we are satisfied with the economic benefits	○	○	○	○	○	○	○
we are satisfied with the non-economic benefits	○	○	○	○	○	○	○
our expectations were fulfilled	○	○	○	○	○	○	○

Block 11

As you answer the following questions think about your general perceptions of your organization.

In general my organization has the ability to:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
identify and adopt new and useful ideas	○	○	○	○	○	○	○
seek out new and useful knowledge	○	○	○	○	○	○	○
take advantage of new knowledge to improve performance	○	○	○	○	○	○	○
understand the impact of new knowledge	○	○	○	○	○	○	○

change processes based on new knowledge	○	○	○	○	○	○	○
use new knowledge in response to competitive changes	○	○	○	○	○	○	○

Block 12

The following items provide a bit more detail about your organization and yourself. This information will be used only for classification purposes.

Approximately how many collaboration projects has your organization been involved in with this partner?

- ○ 1
- ○ 2-3
- ○ 4-5
- ○ 6 or more

How many years has your organization had some involvement with this partner?

- ○ less than 1 year
- ○ 1-5 years
- ○ 5-10 years
- ○ 10-20 years
- ○ 20 or more years

Block 13

Your organization is best characterized as a:

- ○ Manufacturer
- ○ Service Company
- ○ State or Local Government
- ○ Retailer
- ○ Other

What is your job title?

How many years of experience do you have in total?

How many years of experience do you have in your current area of responsibility?

The approximate number of employees in your organization is:

- <100
- 101-500
- 501-1,000
- 1,001-5,000
- 5,001-10,000
- 10,000 or more

Approximately what is your organization's annual revenue?

- <$10 Million
- $10-99 Million
- $100-999 Million
- $1-5 Billion
- >$5 Billion

Block 14

Thank you for your time. If you would like to receive an executive summary of this research please provide your email address below. Additionally, by providing your email address or physical address you will be entered to win an Apple I-Pad Mini or one of ten copies of An Introduction to Supply Chain Management: A Global Supply Chain Support Perspective by Dr. Edmund Prater and Kimberly Whitehead. The drawing will be held on April 1, 2014 and you will be notified at the address you submit below - no later than April 2, 2014.

Appendix E

Letter To Purchasing Managers

Appendix E

UNIVERSITY OF TEXAS ARLINGTON

Dear Purchasing Professional:

I am a Ph.D. candidate at the University of Texas at Arlington (UTA). In an effort to learn more about how companies collaborate within the supply chain, I am conducting a research study with a select group of purchasing professionals. You have been selected to participate in this research.

The survey **will take less than 15 minutes of your time** and will provide UTA with significant insight into how companies work together. Without the help of people like you, research on the supply chain could not be conducted – your input is highly valued by our university.

In order to access the survey please enter this URL into your browser:

http://bit.ly/UTAsurvey

There are benefits for you for participating: 1) you will receive the results of the research being performed at UTA; 2) you and your company can use this research to benchmark your procedures against others in the nation; 3) each participant will have a chance to win an I-Pad mini. The drawing will be held on April 1, 2014.

As a purchasing professional your input is very important to us. Your responses will be kept strictly confidential and used only for scholarly purposes. No individual responses will be reported or published as a result of this research; responses will only be reported in summary form. To protect your confidentiality, the surveys will not require information that will personally identify you or your company.

If you have any questions about this research or would like to complete a paper survey please email me at collaboration@uta.edu . Your participation is strictly voluntary and there is no penalty if you do not participate.

Thank you, in advance, for your help with this research project.

Sincerely,

Kim Whitehead

Kimberly Whitehead
Ph.D. Candidate, Dept. of Information Systems & Operations Management
University of Texas at Arlington

This research has been reviewed according to UTA Institutional Review Board (IRB). If you have any questions about your rights in this study you may contact the UTA IRB at: Office of Regulatory Services, 817-272-3723 or regulatoryservices@uta.edu.

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