# EXPLORING THE INFLUENCE OF COLLABORATIVE CAPABILITIES ON FOCAL-FIRM PRODUCT OUTCOMES: THE MEDIATING ROLE OF SUPPLIER CAPABILITIES

KENNETH D. HALL

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Cleveland State University

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This dissertation has been approved
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_____

Dissertation Committee Chairperson, Amit K. Ghosh

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Department/Date

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Committee Member's Name

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Department/Date

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Committee Member's Name

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Department/Date

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Committee Member's Name

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Department/Date

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Committee Member's Name

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Department/Date

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Dedicated with love to Susan, who put up with a lot.

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## ABSTRACT

As markets become more turbulent, dynamic, and competitive, and as customers become more sophisticated and demanding, the scope of capabilities and resources needed to meet customer needs, wants, and desires are less likely to be found in any one firm. Instead, firms must develop strong collaborative capabilities. Though the benefits of interfirm collaboration for focal firms (the firms responsible for the final offering) and suppliers are reasonably well understood, effectiveness and efficiency in collaboration remain elusive for many firms. It is likely that the collaborative capabilities of both focal firms and key suppliers contribute to effective collaboration, and that the collaborative capabilities of focal firms may influence the collaborative capabilities of suppliers, which in turn influence product-market outcomes.

This dissertation proposes an integrative model drawing on three prominent streams in collaboration and supply chain research. In the proposed model, supplier collaborative capabilities mediate the association between focal-firm collaborative

capabilities and operational product-market outcomes (closeness of the final offering to end-user needs and delivery performance). The model is founded in the knowledge-based and dynamic capabilities views of the firm, and tested empirically with data from a sample of managers from focal firms in industries producing relatively complex final products. Evidence is found of a relationship between focal-firm collaborative capabilities and supplier capabilities, and between supplier capabilities and product-market outcomes.

This study contributes to scholarship and practice in interfirm collaboration by testing an integrative model drawn from three prominent streams of collaboration and supply chain research, by clarifying the dimensions of the collaborative communications construct and investigating its relationship with operational outcomes, by investigating the mediating role of supplier capabilities on product-market outcomes, and by extending research in collaboration to a broader sampling frame than has been customary in supply chain research.

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## CHAPTER 1

## INTRODUCTION AND CONTRIBUTIONS

### Introduction

As markets become more turbulent, dynamic, and increasingly characterized by what some observers call hypercompetition (D'Aveni 1994; Prahalad and Ramaswamy 2004), the rules of the game are prone to change so quickly that competitive advantage is difficult to sustain (Zahra, Sapienza, and Davidsson 2006). At the same time, the development, production, and delivery of products and services has become more complex (Ghosh, Dutta, and Stremersch 2006; Park, Ding, and Rao 2008). A more intense focus on the needs and wants of customers, an important element of market orientation (Kohli and Jaworski 1990; Jaworski and Kohli 1993), along with higher levels of customer sophistication (i.e., a more thorough understanding by customers of their own needs and wants, and how to go about fulfilling them) drives greater

emphasis on the customization of products and services (Pine 1993; Hegde et al 2005). However, the customization of offerings to meet the ever-more-sophisticated demands of today's end users (Fawcett, Mangan, and McCarter 2008), many of whom are, after all, likely to be tomorrow's even more sophisticated end users, often comes at a cost to the firm, which may come to constrain the ability of the firm to perform all necessary and/or desirable functions "in house." Firms generally have (within broad boundaries) limited productive opportunities, partially because their own resources and competences are limited (Penrose 1959). As a result, firms today often must look beyond their own boundaries to obtain and combine the capabilities and resources needed to earn above-market returns on a consistent basis. Focal firms (those firms that sell to end-user customers, and whose brandmarks typically grace the complex offerings delivered to end-user customers) and their managers must be able to *collaborate* successfully with other firms. By doing so, these firms may be able to overcome constraints on the scope of in-house resources (Powell, Koput, and Smith-Doerr 1996; Gulati 1998), and reduce costs and improve performance (Andraski 1998; Krause, Scannell, and Calantone 2000; Stank, Keller, and Daugherty 2001). In fact, according to the dynamic capabilities view of the firm, among the "market-based assets" (Scheer, Miao, and Garrett 2010) focal firms can obtain are supplier capabilities (Srivastava, Shervani, and Fahey 1998). Collaboration may thus confer on the focal firm some of the advantages of vertical integration, without the attendant costs (Spekman 1988).

Collaboration is at its foundation primarily an intellectual task, yet firms must produce and deliver products and services in the physical world. Therefore, inter-organizational collaboration must involve at minimum the *desire* and the *ability* to turn knowledge into

purposeful and useful action. The firm must *intend* to collaborate in order for collaboration to succeed. In addition, because collaboration involves two or more actors, knowledge and information must be *communicated* among the participants. Finally, the organizations must be able to *act* in a way that maximizes the benefits of collaboration, adjusting existing processes and perhaps developing new processes as appropriate. The essential components of collaboration can be conceptualized as consisting of intention, communication, and action (Noordwier, John, and Nevin 1990; Lusch and Brown 1996; Antia and Frazier 2001).

Collaboration between firms has been researched extensively as a means for firms to achieve competitive advantage (Stern and Reve 1980; Frazier 1985; Crosby, Evans, and Cowles 1990; Anderson and Narus 1990, 1991; Heide and John 1990; Powell 1990; Mohr and Spekman 1994; Powell, Koput, and Smith-Doerr 1996; Gilmore and Pine 1997; Gulati 1998; Hobday 1998; Cannon and Perreault 1999; Hobday 2000; Stank, Keller, and Daugherty 2001; Cannon and Homburg 2001; Dyer and Hatch 2006; Ghosh, Dutta, and Stremersch 2006; Lusch, Vargo, and O'Brien 2007; Ang 2008; Cao et al 2010; Daugherty 2011; Richey, Adams, and Dalela 2012). However, the experience with collaboration of many firms has been at best mixed: Many inter-organizational alliances are characterized as failing to achieve necessary quality (Zhang et al 2011). It appears that collaborative capabilities may not be easily imitated or easily bought in factor markets. Instead, collaborative success is the result of some capability or capabilities resident within the firm(s) participating (Teece, Pisano, and Shuen 1997; Zahra, Sapienza, and Davidsson 2006). Furthermore, all organizations participating in a collaborative relationship need to be "good at collaboration" in order for the relation to perform well.

**Research Problems and Contributions**

Although there has been much research in inter-organizational collaboration, in the supply chain management, strategic management, and marketing strategy literatures, there are also significant gaps and inconsistencies in research into collaboration with respect to both focal firms and suppliers. The chief contribution of the present study is an integrative model of interfirm collaboration that proposes a mediating role for supplier collaborative capabilities in the relationship between focal-firm collaborative capabilities and product-market outcomes. The model to be proposed draws on three important areas of research into interfirm collaboration. The first is the work on Dyer and colleagues in knowledge and the focal firm's role in fostering knowledge sharing through the network (Dyer and Singh 1998; Dyer and Nobeoka 2000; Dyer and Hatch 2006). The second is the framework that identifies key supplier collaborative capabilities that contribute to relational success (Ulaga and Eggert 2006; Scheer, Miao, and Garrett 2010). The third focuses on operational (product-market) outcomes where, so to speak, "the rubber meets the road" (Cannon and Perreault 1999; Cannon and Homburg 2001; Ghosh, Dutta, and Stremersch 2006).

Another contribution of this study is toward a more systematic and comprehensive investigation of the scope and role of collaborative communication in interfirm collaboration. Collaborative communication, while recognized as perhaps the most important element of effective interfirm collaboration (Fawcett, Mangan, and McCarter 2008), has been operationalized and measured in an almost bewildering variety of ways in the literature, particularly with respect to its component facets. Collaborative communication has been

operationalized as everything from information exchange in isolation, to information exchange in conjunction with one or more process facets (frequency, mode, direction, etc.). A few studies (Cao et al 2010) have treated information exchange as a separate construct from collaborative communication, the latter being operationalized as the process facets noted above. Further, facets of collaborative communication other than information exchange have largely been investigated in the context of studies of trust and commitment, rather than investigation of operational (performance-based) outcomes of collaboration.

This presents a problem for both scholarship and practice, most particularly the latter. Without an understanding of the scope of the important facets of collaborative communication, it is more difficult for managers to structure collaborative arrangements that will be optimally effective and efficient. The present study seeks to resolve the definitional issues and develop a more rigorous operationalization of collaborative communication, drawing both on the extant literature and the author's experience as a practitioner engaged in the production of complex business-to-business marketing communications services. By doing so, this study will contribute to scholarship by extending and enhancing the understanding of the scope and nature of the collaborative communications capability, and to practice by assisting managers in structuring collaborative communication so that the resources thus used add the maximum value to the collaborative effort. Summarizing, extending and enhancing our understanding of collaborative communication should enable more effective and efficient collaboration, and thus better product-market outcomes. Additionally, this study will contribute to both scholarship and practice by investigating the role of collaborative communications facets beyond mere information exchange

in operational outcomes of collaboration, an area previously little explored.

Beyond questions of collaborative communication, studies of collaboration have not been consistent with respect to other capabilities that may contribute to effective collaboration. While collaborative communication is generally accorded pride of place in many studies, a number have entirely omitted consideration of collaborative orientation. Where behavior/action other than communication has been studied, it has often been investigated in the form of idiosyncratic or relation-specific investments, and though RSIs may be indicative of the presence of a capability, they are not capabilities in themselves. This dissertation seeks to investigate intention, communication, and action dimensions of focal-firm collaborative capabilities directly.

In particular, this dissertation will study *collaborative orientation* and *collaborative flexibility* – the ability of focal firms to adjust and adapt to dynamic environments and changing circumstances – as the intentional and behavioral capability companions to collaborative communications. Intention to act in a certain way activates capabilities that otherwise might remain latent or dormant. Behavior and action helps flesh out the dynamic-capability spectrum, which otherwise is left incomplete by study of communications capabilities alone. Flexibility, particularly supplier flexibility (Cannon and Homburg 2001, Homburg et al 2005; Scheer, Miao, and Garrett 2010), has been studied in the literature, but underlying capabilities have been less studied outside the literature regarding complex products and systems (Hobday 2000). The present study contributes to understanding of the role of dynamic capabilities (Teece et al 1997; Makadok 2001; Winter 2003; Zahra, Sapienza, and Davidsson 2006; Teece 2007; Barreto 2010) in practice by investigating focal-firm flexibility capabilities and the relationship of those

capabilities with the capabilities of suppliers. Should the focal firm's collaborative capabilities be found to have a positive relationship with supplier capabilities (in other words, if the focal firm's collaborative capabilities can help make suppliers better collaborators as well as improve the execution of their agreed-upon function in the relation), the managerial implications would be profound.

Surprisingly few studies that model or measure focal-firm collaborative orientation explicitly. Perhaps there is some justification in the thought that because firms more or less *must* collaborate in complex-offering markets, their desire to do so is either self-evident or superfluous. However, it seems intuitive that firms that choose to collaborate because they *want and need* to do so might enjoy some advantage over firms that collaborate relatively reluctantly because they *need* to do so. There is no other reason to believe collaborative orientation universal, even among firms that engage in collaboration (indeed, the author's personal experience as a practitioner suggests strongly collaborative orientation is heterogeneously distributed among firms that engage in collaboration), collaborative orientation should be modeled explicitly in a study of collaboration.

There has also been limited study of the relationship of supplier capabilities to concrete product-market outcomes. Although many scholars have studied various dimensions of supplier performance, the capabilities (Scheer, Miao, and Garrett 2010) that underlie performance should make deeper understanding of supplier capabilities and their influence on product-market outcomes of interest to scholars and practitioners. A supplier that can show evidence of collaborative capabilities should be a more attractive partner, because a capabilities-based

understanding should be applicable across a range of relationships, and therefore more generalizable, than mere performance.

Although there is an extensive supplier development literature, relatively few studies have attempted to model the relationship between focal-firm collaborative capabilities, supplier collaborative capabilities, and product-market outcomes. In other words, few studies have attempted to show that strong focal-firm collaborative capabilities can contribute to strong supplier collaborative capabilities, which in turn promote better product-market outcomes. In a noteworthy exception, Dyer and Hatch (2006) argue that the transfer of knowledge to suppliers by a more collaboratively oriented focal firm makes suppliers working with the collaboratively oriented focal firm capable of producing higher quality offerings at a higher level of operational productivity. If factors amenable to manipulation by managers at the focal firm can positively influence supplier performance, it should be possible that those same factors can also positively influence supplier capabilities. If so, focal firms may be able to help current suppliers enhance their own capabilities, and thus their performance. By helping to enhance the capabilities of their suppliers, focal firms may be able to improve product-market outcomes while avoiding the costs associated with supplier search, selection, and switching. This is also a potentially significant contribution to scholarship, bringing a capabilities-based perspective to research in supplier development, and extending the findings of Dyer and Hatch beyond a single focal firm (Toyota) in a single industry (the auto industry). Much of the literature in supplier development has focused on supplier performance; by focusing on the influence of focal-firm capabilities on supplier capabilities, this dissertation has the potential to produce a more generalizable model

than extant research has done. Firm capabilities are causally ambiguous to the outside observer, as well as socially complex (Amit and Schoemaker 1993), making investigation of firm capabilities a more potentially fruitful contribution to the understanding of competitive advantage than a study of overt performance, because understanding firm capabilities should enhance a firm's ability to replicate desired levels of performance.

This dissertation proposes a model of inter-organizational collaboration that relates the constructs based in focal firm and supplier capabilities as described above, to two important product-market outcomes: closeness of the final offering to end-user customer needs and delivery performance. In markets characterized by more demanding and sophisticated customers, closeness to end-user needs is a useful indicator of product quality, which (along with delivery performance) are rated by managers as the two most important elements of SCM (Fawcett, Mangan, and McCarter 2008).

This dissertation is intended to contribute to research and practice in interfirm collaboration as follows: by showing how specific collaborative capabilities of focal firms may help enhance specific collaborative capabilities of key suppliers, with the ultimate effect of enhancing operational outcomes. Put another way, it seeks to demonstrate that supplier collaborative capabilities mediate the relationship between focal-firm collaborative capabilities and product-market outcomes. This dissertation will also attempt to show that both content and process facets of collaborative communications are important to model, even when considering operational outcomes.

The effects of collaborative communications have been extensively researched in studies looking at trust and commitment among partners as outcomes, but research into collaborative communications and its relationship to operational outcomes has been more sporadic and less systematic. This dissertation takes its theoretical foundation in the capabilities literature rather than the relationship quality literature. For that reason, issues of trust and commitment between relational partners are not considered. By investigating the relationship between collaborative communications capabilities and operational outcomes, it is hoped that a more comprehensive and broadly useful conceptualization of collaborative communications will emerge, one that will be of use to both scholars and practitioners.

Overall, this dissertation is concerned with the strategic concerns and decisions that underlie the development and delivery of offerings that closely meet the demands of end users in ways that a firm's less adept competitors are less able to match, in order to achieve competitive advantage in turbulent and dynamic markets. Focal firms that collaborate to achieve competitive advantage are potentially less path-dependent and more agile than firms that try to do it all in-house, being better able to add, reconfigure, and discard capabilities and resources as market-winning requirements change (Teece, Pisano, and Shuen 1997). In addition to a model that incorporates important elements of major streams of supply chain and collaborative research as described above, the contributions of this study to research and practice are: a more rigorous and comprehensive operationalization of collaborative communication, the investigation of the mediating role of supplier capabilities in the focal firm capabilities/product-market outcomes relationship, and the extension of the study of collaboration to a broader sampling frame than has

typically been the case in prior research. All have the potential to contribute to research by extending scholar and practitioner understanding of interfirm collaboration, and to practice by enabling better product-market outcomes and more effective and efficient collaboration.

The balance of this dissertation is organized as follows. First, the literatures on inter-organizational collaboration, collaborative capabilities, and the role of supplier capabilities in the focal firm's product-market outcomes will be reviewed, along with a brief survey of the literatures on supplier development and dynamic capabilities. Next, the theoretical model depicting the antecedents of focal-firm competitive advantage (as expressed in product-market outcome measures) in complex offering settings will be developed and described, along with discussion of the scales to be used to measure the constructs in the model. This will be followed by discussion of the methodology used in sampling the population of interest, pre-testing, collecting the data, and conducting the empirical analysis. Following will be discussion of the empirical results, implications for research and practice, strengths and limitations of the investigation, and avenues for further research.

# CHAPTER II

# LITERATURE REVIEW AND HYPOTHESES

## 2.1. Interfirm Collaboration

Firms form relationships with other organizations and remain in those relationships because they expect to get something for their trouble, and are not merely stuck for lack of a more attractive alternative. Typically, firms expect to derive benefits from partnering that they could not achieve by doing it – whatever "it" is – independently (Buckley and Casson 1976; Williamson 1985). In fact, although the fear has been expressed that suppliers in long-term relationships bargain away their profits, suppliers in long-term relationships do appear to realize higher profits (Kalwani and Narayandas 1995). In addition, focal firms benefit by being able to leverage the capabilities of partners as advantage-conferring resources without the need to take on the additional fixed expense associated with developing those capabilities internally (Spekman 1988). In order to provide boundaries to the scope of the discussion for the balance of this dissertation, a definition of collaboration will be undertaken.

### 2.1.1. The Nature of Collaboration

The American Heritage Dictionary (1982) defines collaboration as follows: “To work together, esp. in a joint intellectual effort.” Taking the dictionary definition as a basis for further investigation, it would seem that some form of integrated or combined action is central to collaboration (in other words, it must involve action as well as discussion and volition; the discrete dimensions will be developed below). The aforementioned supposition is supported in the literature as well. Spekman (1988) defines collaboration as “the process by which partners adopt a high level of purposeful cooperation to maintain a trading relationship over time” (p. xx), while Daugherty (2011) defines collaboration as a set of responsibilities for relevant activities shared by two or more organizations. Daugherty, Stank, and Keller (2001) follow Kahn and Mentzer (1996) in conceptualizing collaboration as effective integration, involving mutual understanding between/among the participating organizations, a common vision of the partnership, the circumstances making partnership desirable, and the goals of the partnership, a sharing of resources among partners, and achievement of collective goals (i.e., the partners do not pursue independent goals to the hindrance of the performance of the partnership). Along related lines, Dwyer, Schurr, and Oh (1987) discuss the need for relational partners to share benefits and burdens, carry out joint efforts in both planning and performance, and be willing to make adjustments over time to the relationship and to the processes and actions arising therefrom.

Note also that the dictionary definition invokes *intellectual* effort, making knowledge explicitly a part of collaboration. The idea that knowledge is important for collaboration is

consistent with the knowledge-based view of the firm (Grant 1996) as well as the dynamic capabilities view (Teece, Pisano, and Shuen 1997). The collaborative capabilities of firms are therefore likely to be knowledge capabilities.

**2.2. The Collaborative Capabilities of Focal Firms**

As indicated by the etymology (i.e., co-labor) and confirmed by the literature, the fundamental element of collaboration is working together. However, there is clearly a heterogeneous distribution of success in working together, which suggests that the capabilities underlying collaboration are also heterogeneously distributed. Granting that firms collaborate in order to achieve competitive advantage, it seems reasonable to investigate whether there are characteristics or capabilities that contribute positively to a firm's ability to collaborate: and if collaborative capabilities exist, whether they are homogeneously or heterogeneously distributed among firms. After all, if the capabilities that appear to underlie collaboration are homogeneously distributed, yet firm market performance varies, then two possibilities exist: (1) other factors must make greater contributions to the heterogeneous performance of firms in collaborative relations and networks and/or (2) not all the capabilities that underlie inter-organizational collaboration have been identified, such that important dimensions of collaboration may have been overlooked.

The current broad scholarly consensus is that important factors explaining the heterogeneous distribution of economic rents are expressed at the firm/business unit/brand level as opposed to the industrial level (Amit and Schoemaker 1993). By partnering, the authors

contend, the firms making up the partnership could update their offerings in response to market dynamism as well as develop new products.

The theoretical foundation of this study rests primarily in the knowledge-based (Grant 1996) and the dynamic capabilities (Teece, Pisano, and Shuen 1997) views of the firm. According to the knowledge-based view, firms gain competitive advantage via the application of knowledge – by putting knowledge to use that enables the firm to create wealth. In the dynamic capabilities view, firms possess various capabilities (processes and routines) that can be coordinated, combined, reconfigured, and occasionally jettisoned as the firm's perceptions of its needs and environment change. The role of knowledge in the dynamic capabilities view lies first in identifying and understanding which of the firm's capabilities will contribute most to wealth creation, and how those capabilities should be combined and employed. Second, knowledge enables the firm to identify capabilities that it does not possess that would help contribute to wealth creation. Such a firm may obtain the benefits of capabilities not in its possession either via acquisition of the entities in possession of those capabilities (with the attendant fixed costs), or more often via collaboration with those entities.

While the knowledge-based and dynamic capabilities views provide a framework for describing and explaining inter-organizational collaboration, the roots of effective inter-organizational collaboration may lie in the theory of reasoned action (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980), which holds in part that the decision to engage in a given behavior requires the intention to engage in that behavior. Although there need be no effective delay between intention and action for an individual, in the organizational setting the intention to

engage in a behavior may reside in one part of the organization, while the responsibility for carrying out the action may reside elsewhere. The bridge in the organizational setting, whether of functional groups within organizational boundaries or of organizations across boundaries, is communication. By effective communication, not only is intention shared with the appropriate actors, but knowledge is delivered to where it can be applied for best effect. However, as Bock et al (2005) point out, effective knowledge sharing may remain the exception in organizational setting, rather than the rule. This enables the testing of the theoretical foundation: Firms that intend to collaborate, and that possess superior collaborative capabilities including superior knowledge-sharing (i.e. communication) capabilities, should achieve superior product-market outcomes in collaborative efforts and settings. While the consensus view is that collaboration is beneficial to participating firms, however, there appears to be limited agreement as to which aspects of collaboration contribute most to success in the market (and, as previously noted, there appears to be limited agreement with regard to what the various aspects of collaboration are). This is indicative of a gap in current scholarship in interfirm collaboration. However, a potential solution to this riddle can be found fairly near to hand, in one branch of the stream of channel-of-distribution (supply chain) research, in the construct known as relationalism:

> "Relationalism reflects the degree to which relational norms are established in a channel relationship (see Brown, Dev, and Lee 2000; Heide and John 1992). Three partially overlapping norm types have been used commonly to reflect relationalism's extent (see Lusch and Brown 1996; Noordewier, John, and Nevin 1990).

> Solidarity is the willingness of the firms to strive for joint solutions and benefits, flexibility reflects the willingness of the firms to make alterations as circumstances change, and information exchange represents the willingness of the firms to provide information proactively that is useful to the other.
>
> "When norms of solidarity, flexibility, and information exchange are solidly entrenched in a relationship, more cooperative interaction among the firms is likely to result (Dwyer, Schurr, and Oh 1987; Jap and Ganesan 2000)" (Antia and Frzazier 2001, p.71).

This study will accordingly explore the following key dimensions of inter-organizational collaboration: solidarity, or collaborative orientation, flexibility, or collaborative flexibility, and information exchange, or collaborative communication. Because collaborative communication has received the most attention in collaboration research, and because communication is considered critical to effective and efficient collaboration, collaborative communication will be considered first.

### 2.2.1. Focal Firm Collaborative Orientation

The third focal-firm capability to be investigated in this dissertation is the oft-invoked (or at least oft-assumed) but relatively little-studied member of the triumvirate of collaborative capabilities, collaborative orientation. Table 2-1 summarizes recent scholarly inquiry into collaborative orientation.

## TABLE 2-1. COLLABORATIVE ORIENTATION

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Lusch and Brown (1996) | Solidarity is the willingness of the firms to strive for joint solutions and benefits; partially overlapping component (along with information transfer and flexibility) of relationalism | Dependence structure, channel contracting arrangement, relationship duration, long-term orientation | Wholesale-distributor performance | Merchant wholesalers and distributors in SIC codes durable goods (SIC codes 5031, 5044, 5045, 5064, 5072, 5091, 5092. and 5094) or non-durable goods (51 12, 5141, 5142, 5143. 5145. 5192, 5194, and 5198), with fewer than 20 employees |
| Jap and Ganesan (2000) | Operationalized as commitment to improvements that benefit relation as a whole, not just one party; problems treated as joint responsibility; partners do not mind owing each other favors | None | Retailer perception of supplier commitment | Crop protection (agricultural pesticides and other crop inputs) supply chain (U.S.): manufacturer and retailers |
| Antia and Frazier (2001) | Solidarity is the willingness of the firms to strive for joint solutions and benefits; partially overlapping component (along with information transfer and flexibility) of relationalism | None | Severity of contract enforcement | Franchisee top managers drawn from U.S. Chamber of Commerce Franchise Opportunities Handbook (automobile services, B2B services, fast food and restaurants, cleaning services, personal care, personnel recruitment agencies) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Huxham (2003) | Collaborative capability is the capacity and readiness of an organization to collaborate | Organizational/individual autonomy, structural cohesiveness of organization, strategic processes, degree to which collaboration is an issue | None | Local government and political organizations in the U.K. |
| Joshi and Campbell (2003) | Collaborative belief: the belief that cooperation with other organizations can generate economic rents (relational rents) | None | (As moderator) Relationship between environmental dynamism and relational governance | Members of the Purchasing Management Association of Canada |
| Mareschal (2005) | Openness, willingness to share information, respect for right of other parties to bargain, mutual respect | None | Successful mediation | Study of mediation cases |
| Wong, Wilkinson, and Young (2010) | Cooperativeness, including desire and ability to maintain good trading relations (measured at buyer and supplier level) | None | Relationship atmosphere | Buyer and supplier firms from diverse industries (not further specified) |

Drawing on research concerning individuals, traditional attitude theory predicts that individuals' attitudes toward a behavior will determine whether or not they will perform that behavior (Frazier and Sheth 1985). Organizations (not least because they are made up of

individuals) presumably are subject to the same conditions: in other words, an organization whose managers are more inclined to collaborate should collaborate more often and (presumably) more effectively. Richey, Adams, and Dalela (2012) support this contention, noting that collaboration works better when all participants make a serious, vigorous effort to collaborate, and when they have a common understanding of what collaboration is. Lusch and Brown (1996) and Antia and Frazier (2001) follow prior research in using the construct solidarity, defined as the willingness to strive for joint solutions and benefits. Jap and Ganesan (1999) operationalize solidarity as commitment to improvements that benefit the relation as a whole, not just one party. Additionally, problems facing the relation are treated as the joint responsibility of the partners, and the partners do not mind owing each other favors.

Other researchers use different definitions. For Joshi and Campbell (2003), collaborative orientation is the belief that cooperation with other firms can yield economic rents. Mareschal (2005) characterizes collaborative orientation as including openness, a willingness to share information (essential, perhaps, to the actual sharing of information), mutual respect, and respect for the right of other parties in the relation to bargain. For Wong, Wilkinson, and Young (2010), collaborative orientation is cooperativeness, or the desire (of both the focal firm and supplier) to maintain good trading relations.

Based on review of the extant literature, for the purpose of this dissertation collaborative orientation is proposed as the willingness of an organization to strive for joint benefits and joint solutions to problems that arise, along with willingness to share information.

#### 2.2.1.1. Collaborative Orientation: Links to Other Constructs

The relative paucity of scholarly work in collaborative orientation compared to collaborative communication, combined with the reliance on solidarity as a collaborative orientation construct, tends to constrain the number of other constructs with which it has been related. As solidarity, for example, it is invariably treated as a component of relationalism (Lusch and Brown 1996; Antia and Frazier 2001). Lusch and Brown (1996) investigate relationalism as potentially associated with wholesale-distributor performance (in other words, the performance of the relation as a whole) but find no significant relationship in their empirical study. Jap and Ganesan (2000) investigate solidarity as an antecedent of the retailer's perception of the supplier's commitment to the relation, in a study of the crop protection retail supply chain. Antia and Frazier (2001) treat relationalism (including solidarity) as negatively associated with contracturally-based enforcement of the relation, while Joshi and Campbell (2003) treat the manufacturer's collaborative belief as a moderator between environmental dynamism and the governance form employed in the relation. Other potential relationships remain to be investigated. Based on review of the literature as, collaborative orientation gives strategic direction to organizations, maximizing the benefits of collaboration. Collaboratively oriented organizations focus on building capabilities related to working with and managing suppliers and partners, in order to gain better product-market outcomes and competitive advantage.

#### 2.2.1.2. Collaborative Intention Hypothesis Generation

The collaborative capabilities of focal firms, particularly those capabilities that facilitate knowledge transfer, can enhance supplier capabilities in at least some industries (Dyer and Hatch 2006). Other scholars look for a reduced role for the supplier when focal-firm capabilities are

particularly strong. For example, Ghosh, Dutta, and Stremersch (2006) hypothesize that suppliers will be given less control over customization when buyer (focal-firm) know-how is higher. Lusch and Brown (1996) propose – but do not find in their empirical study – a relationship between solidarity (as previously discussed, the willingness to strive for joint solutions and benefits) and wholesale-distributor performance in durable and non-durable goods industries. Still, Richey, Adams, and Delala (2012) argue that strong collaborative intention on the part of all participants contributes to the success of collaborative partnerships. Similarly, Antia and Frazier (2001) find an inverse relationship between solidarity and severity of contract enforcement in a study of U.S. franchise organizations. Where capabilities and performance arising therefrom are strong, parties may have less need for more stringent enforcement mechanisms.

The differences in the arguments and findings discussed above may lie in the focus of the capabilities in question. The Ghosh, Dutta, and Stremersch (2006) model seems to rely more on buyers' knowledge and capabilities in the product category in question, rather than their collaborative capabilities *per se*, while Dyer and Hatch (2006) contend that transfer of knowledge from a firm oriented toward collaboration contributes to the ability of suppliers in the relation to produce goods of higher quality with greater efficiency than they otherwise might. Therefore, this study follows and extends the logic of Dyer and Hatch (2006) in proposing a relationship between buyer collaborative capabilities and supplier capabilities. Drawing on Scheer, Miao, and Garrett (2010), the supplier capabilities of interest in this study (in addition to supplier communications capability, for which hypotheses are developed below) are supplier core offering capability (ability to produce goods of requisite quality) and supplier operations

capability (ability to be flexible in the face of emergent properties, changing requirements, and changing circumstances).

***H1a.*** *Focal firm collaborative orientation is positively associated with supplier core offering capability.*

Dyer and Nobeoka (2000) cite in their study an executive from a Toyota supplier in Japan who acknowledges the contribution made by Toyota's genuine commitment to collaboration to the success of all parties in the relation, suppliers and Toyota alike. Meanwhile, Scheer, Miao, and Garrett (2010) contend that supplier operations capability is positively associated with both benefit-based and cost-based customer dependency on the supplier. Benefit-based dependency refers to the supplier's ability to do a better job (characterized by the authors as manifest positive benefits), while cost-based dependency refers to the supplier's ability to do the job at a cost to the customer that discourages switching (which the authors characterize as dormant or latent negative benefits; another way to put it might be the avoidance of negative outcomes). As previously discussed, supplier operations capabilities refer to the ability of suppliers to improve existing products or contribute to the design and development of new ones in response to changing needs and circumstances (Flint, Woodruff, and Gardial 2002; Scheer, Miao, and Garrett 2010). Customers' changing needs puts a premium on the ability of suppliers to identify and anticipate customers' future needs as well as present needs (Flint, Woodruff, and Gardial 2002); suppliers with stronger operations capabilities are likely to enjoy longer relationships with focal firms than suppliers with weaker operations capabilities. Applying the logic of focal-firm collaborative orientation as identified and discussed in prior work by Dyer and Nobeoka (2000)

and Dyer and Hatch (2006) and reaffirmed by Richey, Adams, and Delala (2012) to operations capability as discussed by Flint, Woodruff, and Gardial (2002) and Scheer, Miao, and Garrett (2010), focal firm collaborative orientation contributes to the ability of focal firms to enhance the operations capabilities of its suppliers, as the focal firm acts on its conviction that sharing relevant knowledge will help the relation perform better.

***H1b.*** *Focal firm collaborative orientation is positively associated with supplier operations capability.*

### 2.2.2. Focal Firm Collaborative Communications Capability

The turbulent, dynamic nature of modern business markets puts a premium on the firm's ability to accumulate and make use of knowledge about customers, competitors, and environmental conditions (Grant 1996). These same conditions tend to require firms to be able to collaborate effectively. Prior research has demonstrated that codified knowledge can be transferred to another party via communication (Kogut and Zander 1992), and firms must in fact be able to communicate well with their partners in order to transfer necessary knowledge about both environment and offering, enabling the partners to conduct relationships efficiently and effectively (Mohr and Nevin 1990). However, miscommunication can lead to collaboration failure (Teixeira, Guerra, and Ghirardi 2006; Paulraj, Lado, and Chen 2008). Conversely, effective and efficient communication between supply chain partners can lead to a number of salutary benefits, including reduced cost, increased quality, and increased customer responsiveness (Carr and Pearson 1999; Chen and Paulraj 2004), as well as improved performance of both the buyer and supplier (Paulraj, Lado, and Chen 2008).

Given the importance of collaborative communications capability to successful interfirm collaboration, it is unsurprising that communication has received considerable attention in the literature. However, the literature has been surprisingly scattershot with respect to the scope and component facets of a collaborative communication capability. This poses a problem; an intention-communication-action framework for interfirm collaboration requires a solid understanding of the constituents and boundaries of collaborative communications capability. Table 2-2 lists 31 research papers published between 1990 and 2010 that incorporate at least one facet of a collaborative communications capability.

**TABLE 2-2. Collaborative Communication and Related Constructs**

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Anderson and Narus (1990) | Communication as formal and informal sharing of meaningful and timely information between firms | Outcomes given comparison levels (bidirectional relationship) | Trust between partners | Wholesaler/distributors (National Association of Wholesaler-Distributors) and manufacturers (each participating NAW member selected one manufacturer with which it had a working relationship) |
| Noordwier, John, and Nevin (1990) | Information provided to supplier (advance information about production plans, supply requirements, design changes, also usage information to help supplier planning) | Environmental uncertainty (high uncertainty enhances effect of relational governance on purchasing performance) | Purchasing performance (performance higher with higher relational governance in high uncertainty) | OEM purchasers of bearings and bearing suppliers |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Mohr and Nevin (1990) | Frequency, bidirectionality, mode (face-to-face, phone, mail, also formality), content (direct/indirect influence) | None | Qualitative channel outcomes (satisfaction, coordination, commitment) | Conceptual paper |
| Stuart (1993) | Sharing of valuable information with suppliers (part of problem-solving construct) | Committed resources | Productivity improvements, competitive advantages | Purchasing managers at industrial firms in the midwestern United States |
| Mohr and Spekman (1994) | Communication (quality: accuracy, adequacy, and timeliness; information sharing; participation) | None | Satisfaction with partnership, dyadic sales | Computer manufacturers and dealers in the United States |
| Mohr, Fisher, and Nevin (1996) | Collaborative communication (Frequency, Bidirectionality, Formality, Noncoercive content) | None | Channel member and dealer satisfaction, commitment, and coordination | Association of Better Computer Dealers members |
| Doney and Cannon (1997) | Confidential information sharing (supplier's) | None | Buyer trust of supplier | National Association of Purchasing Managers (U.S.), SIC codes 33-37 |
| Dyer and Singh (1998) | Knowledge-sharing routines | None | Potential for relational rents | Automotive industry (Toyota, General Motors, and their respective suppliers) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Cannon and Perreault (1999) | Information exchange as the sharing of valuable (proprietary and relevant) information between parties | Market and situational determinants of buyer-seller relationships (availability of alternatives, supply market dynamism, importance of supply, complexity of supply) | Customer satisfaction, customer evaluation of supplier performance | National Association of Purchasing Managers (U.S.) in manufacturing, utilities, education, government agencies, and distributors. |
| Krause (1999) | Communication with suppliers includes exchange of proprietary information, frequency, and timeliness (3 items) | None | Supplier development activities | National Association of Purchasing Managers (U.S.) in multiple industries |
| Jap and Ganesan (2000) | Information exchange as component of relationalism (relational norms) | None | Direct effect on retailer perception of supplier commitment and moderating effect on relationship between retailer transaction-specific investments and retailer perception of supplier commitment | Crop protection (agricultural pesticides and other crop inputs) supply chain (U.S.) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Cannon and Homburg (2001) | Frequency, information sharing (separate constructs) | None | Customer direct, product acquisition, operations costs | Chemical, electrical, and mechanical manufacturers in U.S. and Germany (National Association of Purchasing Managers, Bundesverband fur Materialwirtschaft, Einkauf und Logistik, German Chamber of Commerce) |
| Stank, Keller, and Daugherty (2001) | Single item measuring information exchange in external collaboration construct | Internal collaboration (bi-directional relationship) | Logistical service performance | Council of Logistics Management executives in U.S., Canada, Mexico from manufacturing, wholesaling, retailing |
| Zhao, Dröge, and Stank (2001) | Information sharing (willingness to exchange key information from various functional areas) | Customer-focused capabilities (segmental focus, relevancy, responsiveness, flexibility; bi-directional relationship) | Return on assets, low logistic costs, customer satisfaction | Council of Logistics Management executives in U.S., Canada, Mexico from manufacturing, wholesaling, retailing |
| Antia and Frazier (2001) | Information sharing | Transaction-specific investments (as moderator) | Severity of contract enforcement | Franchisor top managers drawn from U.S. Chamber of Commerce Franchise Opportunities Handbook (automobile services, B2B services, fast food and restaurants, cleaning services, personal care, personnel recruitment agencies) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Mavondo and Rodrigo (2001) | Information sharing as dimension of cooperation | Social bonding | Trust, interpersonal commitment, inter-organizational commitment | Chinese firms doing business with Australia and Australian firms doing business with China |
| Bello, Chelariu, and Zhang (2003) | Information exchange | Resource inadequacy, manufacturer dependence, market volatility, psychic distance, product complexity, human content | Distributor performance | U.S. manufacturing firms exporting through offshore distributors |
| Prahinski and Benton (2004) | Collaborative communication as formality (vs. informality, 5 items), feedback (4 items), indirect influence strategy | None | Buyer-supplier relationship (cooperation, buyer commitment, operational linkages), supplier performance | Automotive industry: U.S. first-tier suppliers working with selected manufacturers (Honda, Ford, General Motors, Daimler-Chrysler) |
| Phan, Styles, and Patterson (2005) | Communication quality, information sharing, participation | Interpersonal relationship quality (trust, commitment, interpersonal satisfaction, joint problem solving) | Partnership financial and non-financial performance (bi-directional relationship) | Firms representing numerous industries from Australia, Thailand, Indonesia, and Malaysia |
| Dyer and Hatch (2006) | Knowledge transfers (quality and productivity assistance) | None | Supplier performance | U.S. auto industry suppliers serving both Toyota and U.S. automakers |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Tan and Vonderembse (2006) | Information sharing (across functions, using CAD as a medium) | CAD use for engineering design | Product development performance | Manufacturing executives/managers from five industries: SIC codes 30, 34, 35, 37, 38; Rubber and Miscellaneous Plastic Products, Fabricated Metal Products, Industrial Machinery and Equipment, Transportation Equipment, and Instruments and Related Products |
| Brush and Rexha (2007) | Supplier disclosing behavior (openness with regard to potential problems) | None | Trust in supplier | Singaporean manufacturers and their independent suppliers in Asian countries |
| Moser and Blome (2008) | Information and knowledge exchange (one dimension of formative "collaboration capabilities" construct) | None | Sales increase | Automotive, engineering, food, aerospace, electronics, and other product and service industries in Germany and Switzerland |
| Ngai, Jin, and Liang (2008) | Knowledge transfer (also frequent interaction and frequent joint problem-solving) | Tightness of network embeddability | Inter-organizational knowledge acquisition and management | Case studies of mass transit railway and power generation supplier in China |
| Paulraj, Lado, and Chen (2008) | Inter-organizational communication (Sensitive information shared openly, frequent/informal/ timely, partners informed about events/changes that may affect other, bi-directional feedback) | Long-term relationship orientation, network governance, information technology | Buyer performance, supplier performance | Member firms of the U.S. Institute for Supply Management, SIC codes 34-39 |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Joshi (2009) | Collaborative communication (frequency, feedback, formality, rationality) | None | Supplier knowledge, supplier affective commitment | Canadian firms in SIC codes 35, 36, 37 |
| Hollenbeck, Zinkhan, French, and Song (2009) | Constant dialogue and responsive feedback (setting is e-collaboration, specific to sales force, conceptual paper) | Navigational structure that supports reciprocity, customization and flexibility, interactivity features that promote community, structure (security, privacy, etc.) that facilitates trust | Productivity, cognitive culture, social connections, agility | Sales personnel from a major IT firm who use the Internet for e-collaboration |
| Lages, Silva, and Styles (2009) | Communication quality and information sharing as dimensions of relationship capabilities | None | Relationship capabilities | Portugese manufacturing firms involved in export |
| Scheer, Miao, and Garrett (2010) | Communication capability (effective, productive, formal and informal, timely) | None | Customer benefit-based dependence on supplier | Institute for Supply Management member firms in SIC codes 35-38 |
| Pettit, Fiksel, and Croxton (2010) | Communications (single dimension of collaboration capability construct in conceptual paper) | Management controls | Supply chain resilience | Managers at Limited Brands |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Cao, Vonderembse, Zhang, and Ragu-Nathan (2010) | Collaborative communication (Frequent, open, bi-directional, informal, multi-channel, non-coercive) and information sharing (relevant, complete, accurate, confidential, and timely) as separate constructs | None | Supply chain collaboration | Managers and senior executives (Council of Supply Chain Management members) at U.S. firms in SIC codes 25, 30, 34-38 |

#### 2.2.2.1. Communications: Process and Content

Inspection of Table 2-1 reveals a number of issues in the treatment of collaborative communications capability. Some studies treat communications as part of a broader collaboration construct (Jap and Ganesan 2000; Mavondo and Rodrigo 2001; Stank, Keller, and Daugherty 2001; Moser and Blome 2008; Lages, Styles, and Silva 2009; Pettit, Fiksel, and Croxton 2010) or as an element of a problem-solving construct (Stuart 1993). Intention, communication, and action are different phenomena; attempting to combine them (or portions of each) into a single construct is problematic on its face. Other studies measure information exchange or information transfer alone (Noordwier, John, and Nevin 1990; Dyer and Singh 1998; Zhao, Dröge, and Stank 2001; Antia and Frazier 2001; Bello, Chelariu, and Zhang 2003; Dyer and Hatch 2006; Tan and Vonderembse 2006). The potential problem with considering information transfer in isolation is that there are other facets of communication that can influence its efficiency and effectiveness. There is a process of communication that should be considered as well as the content

communicated. As Stephenson (1969) argues, information transfer and communication are not synonymous: rather, information is what is transmitted from one party to the other when communication occurs, a line of reasoning followed by Kogut and Zander (1992). Accepting this argument, one may see that communication may be executed with greater or lesser quality, more or less independent of the quality of the information exchanged.

Although Table 2-1 suggests that communication (and particularly information transfer, explicitly modeled in 27 of 31 papers) is indeed central to inter-organizational collaboration, it equally suggests that there have been two broad, general (and, to be sure, often overlapping) schools of thought with regard to collaborative communication. The first school focuses on the quality and usefulness of the information exchanged in communication. In fact, it often appears to focus exclusively on these considerations; 18 of the 31 papers in the table consider information exchange only, without regard to other facets of communication. Ironically, four of the 31 do not incorporate information exchange, apparently taking it as a given, and focusing on various process-oriented dimensions of communication. The latter group, in fact, includes one of the classic studies of collaborative communications conducted by Fisher, Mohr, and Nevin (1996). However, there are a few studies that, while focusing on information exchange, incorporate timeliness as part of the construct (Anderson and Narus 1990; Cao et al 2010). This introduces a complication, because it is possible to conceptualize timeliness as a process facet, rather than a content facet (more on this below). To make matters even more interesting, Cao et al (2010) incorporate timeliness as a dimension of information exchange, treating the other process facets of collaborative communication as facets of a separate construct, collaborative

communication. Other studies, such as Mohr and Spekman (1994), also treat information exchange as a construct distinct from other dimensions of communication.

As implied by the preceding discussion, another school of thought in collaborative communications research conceptualizes additional facets – evaluations of the communication process, independent of the specific information exchanged – that might enhance the efficiency and effectiveness of collaborative communication. Again referring to Table 2-1, one may see that among the facets of the collaborative communications process researchers have studied are:

- The frequency with which communications take place in a collaborative relationship
- The direction of communications (i.e., whether communications are two-way or incorporate feedback among the parties)
- The mode of communication (whether formal, informal, or both)
- Whether communication occurs on a timely basis (as discussed above)
- The influence strategy used in communication (whether direct, as in directives given, or indirect, as in suggestions made)

Cao et al (2010) contend that "the exact nature and attributes of SCC (supply chain collaboration) are not well understood" (p. 6614), and so it appears to be with respect to collaborative communications capability as well. It is possible, by drawing on a broad selection of prior research, the proposition that collaborative communications capability consists of both content and process, each of which in turn may be conceptualized as having several component facets.

#### 2.2.2.1.1. Collaborative Communications Capability: Content Facets

The primary purpose of communication is to share or transfer knowledge, and because it is the most extensively studied dimension of collaborative communications, it seems appropriate to first consider collaborative communication literature focusing on *information transfer* (Anderson and Narus 1990). Here the emphasis appears to be on the *operational* aspect of communication: the transfer/exchange of information necessary to all parties in order to produce goods and/or services at desired levels of quality and cost. Some work in this stream does nod in the direction of process; some researchers look at mode (formality/informality) of communication (Anderson and Narus 1990; Scheer, Miao, and Garrett 2010), some at bi-directional exchange of information (Mohr and Spekman 1994; Phan, Styles, and Patterson 2005; Hollenbeck et al 2009), others at frequency of communication (Krause 1999; Cannon and Homburg 2001), some at frequency and formality (Ngai, Jin, and Liang 2008), among other combinations short of all the process facets, and so on.

For the most part, though, information transfer is the primary consideration (Doney and Cannon 1997; Dyer and Singh 1998; Antia and Frazier 2001; Stank, Keller, and Daugherty 2001; Zhao, Stank, and Dröge 2001; Bello, Chelariu, and Zhang 2003; Dyer and Hatch 2006; Moser and Blome 2008). However, the content communicated may vary in important ways (making the content more or less “good” or useful for the effective and efficient conduct of the relationship); one must therefore consider the aspects of communication content. Indeed, communications content – information transfer – has been conceptualized as consisting of a number of facets, including credibility (Frone and Major 1988; Phan, Styles, and Patterson 2005), meaningfulness

(Anderson and Narus 1990), value (Stuart 1993), having a sensitive, confidential, or proprietary nature (Doney and Cannon 1997; Cannon and Perreault 1999; Krause 1999; Paulraj, Lado, and Chen 2008), usefulness (Frone and Major 1988; Phan, Styles, and Patterson 2005), completeness (Mohr and Spekman 1994; Cao et al 2010), relevance (Cannon and Perreault 1999), adequacy (Mohr and Spekman 1994), and accuracy (Frone and Major 1988; Mohr and Spekman 1994; Phan, Styles, and Patterson 2005; Cao et al 2010).

A number of these facets appear to overlap, and some are more broadly construed than others. That information be *accurate* seems essential to effective collaborative communication. Likewise *completeness* and *relevance* seem to be applicable in all conceivable situations. Partners should, on balance, be able to work together more effectively if they have *all* the information they have initially identified as being necessary (the preceding caveat is important because complex products may exhibit emergent properties in development and production, making it difficult to know whether all the knowledge required at the *outset* of the relation will be all the information that is *ever* required as the relation goes forward). Finally, information that is relevant to the job at hand would seem to benefit the partners more than information that is irrelevant or of questionable relevance; irrelevant information would seem to tend to reduce the efficiency of collaboration by lowering the "signal-to-noise" ratio.

The above-mentioned aspects of communication content appear to enjoy the advantage of being more broadly applicable, more comprehensive in terms of encompassing the important aspects, and more conceptually concrete than aspects such as adequacy. Information that is complete, accurate, and relevant would seem to be *inherently* adequate (if not more than

adequate). Similarly, information that can be evaluated as accurate, complete, and relevant is also likely to be evaluated as *credible*. Further, certain facets, such as whether the content is sensitive or proprietary in nature (not to mention credible), seem to influence affective aspects of collaboration, such as trust and commitment (cf. Doney and Cannon 1997, Brush and Rexha 2007), more than operational issues. Additionally, whether the content is proprietary or sensitive in nature is not necessarily its completeness, accuracy, or relevance. A firm's payroll information, for example, is sensitive and confidential, but is highly unlikely to be relevant to (nor contribute to the completeness of) collaborative communication. Therefore, based on the review of the literature the essential content facets of collaborative communication capability are *accuracy*, *completeness*, and *relevance*. If information also happens to be sensitive, confidential, and/or proprietary, it will be shared as deemed appropriate by the partners, under the content framework proposed herein.

**2.2.2.1.2. Collaborative Communications Capability: Process Facets**

Information transfer alone appears to be a necessary, but not sufficient, condition of an effective collaborative communications capability. Process also influences efficiency and effectiveness of collaborative communication, so additional process-oriented facets will be considered for incorporation into the operationalized construct.

As has already been noted, a number of other dimensions of collaborative communication have been studied in the literature, among them frequency (Mohr, Fisher, and Nevin 1996; Cannon and Homburg 2001; Joshi 2009), formality, or formal, regularly scheduled sessions to exchange information and air issues, with prescribed participants from all parties in the

relationship (Anderson and Narus 1990; Mohr, Fisher, and Nevin 1996; Prahinski and Benton 2004), timeliness (Anderson and Narus 1990; Scheer, Miao, and Garrett 2010), participation/feedback/bidirectionality (Mohr and Spekman 1994; Prahinski and Benton 2004; Phan, Styles, and Patterson 2005; Joshi 2009), and influence strategy, or whether the content of the communication is coercive or non-coercive (Mohr, Fisher, and Nevin 1996; Cao et al 2010). Still another construct, communication quality and/or effectiveness (Mohr and Spekman 1994; Dyer and Hatch 2006), has also been used; communication quality will be addressed separately from the other process facets, not least because it encompasses (or can encompass) both content and process facets.

Additionally, for the purpose of this dissertation timeliness will be incorporated as a process facet rather than a content facet. Treating timeliness as a process facet seems appropriate because, in common with other process facets, lack of timeliness may reduce the value of information content that would have been valuable otherwise. However, timeliness cannot, for instance, enhance the relevance, usefulness, or accuracy of information content that had no intrinsic relevance, usefulness, or accuracy to begin with. In other words, “untimeliness” may reduce the usefulness or relevance of otherwise useful/relevant content, but no quality of timeliness can make inherently useless content useful, or irrelevant content relevant.

Each of the above-named facets addresses some aspect of the process, rather than the strict content, of collaborative communication. Collaborative communications that is well executed in both content and process helps ensure that information transfer will be as valuable and effective as possible to the participants. For example, frequency is intended to produce the

amount of communication necessary to carry out the activities of the relationship effectively, without overloading the members of the partnership (Mohr and Nevin 1990). In addition, communications of appropriate frequency should help ensure that issues are addressed as they arise, rather than being allowed (potentially) to fester and damage the working relationship or the products/services that flow from the relationship. Recall also that (among other issues) the increasing complexity of the offering means that products increasingly may have emergent properties. In other words, the emergent properties of the offering may lead to changes in information content requirements during development and production. More frequent communication may help ensure that newly required information is transferred on a timely basis.

Formality is intended to assure that information exchange takes place at specified, agreed-upon intervals and involves the proper players from each relational partner. Prahinski and Benton (2004) follow Vijayasarathy and Robey (1997) and Carr and Pearson (1999) in observing that communication formality positively influences cooperation, and further note (following Mohr and Sohi 1995) that formal communications is negatively associated with the withholding of important information. Joshi (2009) also calls for formal, in the sense of routinized, communications. However, Paulraj, Lado, and Chen (2008) note the benefits of informal communication in assuring communication frequency and timely information exchange (themselves both process facets). Therefore, the literature suggests that the most effective examples of collaborative communication incorporate both formal and informal modes of contact.

Participation, feedback, and/or bidirectionality considerations ensure that communication is two-way in the partnership (or *n*-way in a relational network), and that all members are participating actively in the relationship (Mohr and Nevin 1990), including planning and goal-setting relative to the relationship (Mohr and Spekman 1994). A truly collaborative relationship can be conceptualized as distinct from a relationship in which one partner executes tasks entirely at the specific direction of the other ("put tab A in slot B"). In such an arrangement, the first partner is more "an extra pair of hands" than a partner.

Influence strategy is concerned with whether the content of communications is coercive or noncoercive (Mohr and Nevin 1990; Mohr, Fisher, and Nevin 1996; Prahinski and Benton 2004; Cao et al 2010). It is included among the process facets because its object is to influence the behavior of the partner, not to transfer information necessary to the goals and objectives of the partnership (Mohr and Nevin 1990). A non-coercive influence strategy is considered to be more conducive to collaboration, in part because it may influence the more affective aspects of collaboration such as trust and commitment. However, at certain times and places coercion (or at least language suggestive of coercion) may be necessary even in a highly collaborative (and even otherwise egalitarian) relationship: for example, when a change must be made to satisfy certain legal requirements pertaining to the final offering. Prahinski and Benton (2004), however, take a slightly different tack with respect to influence strategy, operationalizing indirect influence strategy as "education, training, and site visits between two partners" (p. 43). ). Because, as described above, coercive communication may occasionally be appropriate in a high-functioning collaborative relationship, influence strategy will not be included as an essential process facet of

a collaborative communications capability in this dissertation. Following logic similar to that used to identify key content facets, the key process facets of collaborative communications will consist of *timeliness, frequency, bi-directionality, formality,* and *informality*.

Another construct – communications quality or communications effectiveness (Mohr and Spekman 1994) – requires mention here. Mohr and Spekman (1994) operationalize communications quality as accuracy, adequacy, and timeliness of information shared among partners (thus incorporating two content facets and one process facet). Meanwhile, Phan, Styles, and Patterson (2005) operationalize communications quality as timeliness, usefulness, accuracy, and credibility (one process and three content facets), following Frone and Major (1988). Lages, Silva, and Styles (2009) characterize communications quality along similar lines. While they are inconsistent about the facets of collaborative communication, these studies share a conviction that both content and process facets are part and parcel of a collaborative communications capability.

A related question that must be addressed is whether collaborative communications and information transfer should be treated as separate constructs, as in Cao et al (2010). It is possible to argue for separate constructs, based on the distinction between process and content. It is also possible to conceive of an excellent process for transferring information of poor quality (incomplete, inaccurate, irrelevant), which might also be seen to argue in favor of separate constructs. However, it should become clear fairly early in a collaborative relationship whether or not the information being exchanged is the right information. In fact, among the early tasks in a collaborative relationship is deciding what information will be exchanged, in order that the

relationship be as successful as possible. Therefore, in the case of inter-organizational collaboration, it seems clear that both appropriate content (information transfer) and process (collaborative communication) are required for fruitful partnership. The necessity of both content and process is implicit in Stephenson's (1969) previously noted argument (information is transferred when communication takes place). Without appropriate content, even the best process would be a sterile exercise; without an appropriate process, the value of the content would be compromised. Therefore, collaborative communication will be operationalized as a single reflective construct incorporating the content facets of completeness, accuracy, and relevance, along with the process facets of timeliness, frequency, direction (bidirectional), and mode (formality/informality).

#### 2.2.2.2. Linking Collaborative Communications Capability to Other Constructs

A number of studies in the literature incorporate collaborative communications as antecedent to affective dimensions of collaboration such as trust (Anderson and Narus 1990; Doney and Cannon 1997; Brush and Rexha 2007), commitment (Mohr and Nevin 1990; Jap and Ganesan 2000; Mavondo and Rodrigo 2001; Joshi 2009), and satisfaction, consisting variously of buyer satisfaction with the supplier (Mohr and Nevin 1990; Cannon and Perreault 1999) or end-user customer satisfaction with the partnership's offering (Mohr and Spekman 1994). Other studies link collaborative communications to various operational outcomes of collaboration, such as improved productivity and competitive advantage (Stuart 1993), sales (Mohr and Spekman 1994; Moser and Blome 2008), logistics service performance (Stank, Keller, and Daugherty 2001), reduction in various costs (Cannon and Homburg 2001; Zhao, Dröge, and Stank 2001;

Paulraj, Lado, and Chen 2008), product quality (Dyer and Hatch 2006; Paulraj, Lado, and Chen 2008; Lages, Silva, and Styles 2009), agility and flexibility in responding to customer needs (Paulraj, Lado, and Chen 2008; Hollenbeck et al 2009), and product development performance (Tan and Vonderembse 2006).

Many of the studies link collaborative communication to various supplier-oriented constructs, but a number also link to focal-firm-oriented constructs (Cannon and Homburg 2001; Zhao, Dröge, and Stank 2001; Bello, Chelariu, and Zhang 2003; Moser and Blome 2008; Ngai, Jin, and Liang 2008) or with constructs relating to the performance of the partnership as a unit (Mohr and Spekman 2004; Vonderembse and Tan 2006; Paulraj, Lado, and Chen 2008; Lages, Silva, and Styles 2009). There appears to be as little consensus regarding the outcomes to which collaborative communication is related as there is about its component elements.

#### 2.2.2.3. Focal Firm Collaborative Communcations Capability: Hypothesis Generation

Collaborative communications capabilities (Spekman 1988; Mohr and Spekman 1994; Fisher, Mohr, and Nevins 1996; Cannon and Perreault 1999; Cannon and Homburg 2001; Davis and Mentzer 2006) help firms enhance existing capabilities by exchanging knowledge and information. In addition, for Dyer and colleagues (Dyer and Singh 1998; Dyer and Nobeoka 2000; Dyer and Hatch 2006), the success of Japanese automakers is founded in the knowledge-sharing routines developed by the focal firms (automakers) for use in their supplier networks. Krause (1999) proposes a relationship between focal-firm/supplier communication and successful supplier development activities, and Stuart (1993) finds a relationship between sharing valuable information with suppliers and improved productivity as well as competitive

advantage. A number of other researchers have reported a relationship between inter-organizational communication or information transfer and focal-firm and supplier financial and non-financial performance measures (Phan, Styles, and Patterson 2005), focal firm and supplier performance (Paulraj, Lado, and Chen 2008), and increased sales (Moser and Blome 2008). Because the communications capabilities of both parties contribute to the effectiveness and efficiency of communications, a relationship between the communications capabilities of the focal firm and those of the supplier is proposed. The proposed hypothesis is grounded in the theory of reasoned action (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980), in which intention precedes action; in a relational setting, as previously discussed, communication bridges intention and action. Supplier firms working with a focal firm that is highly adept at collaborative communications may be able to enhance their own communications capabilities by adopting "best practices" from their relational partners, leading to the following hypothesis:

***H2.*** *Focal firm collaborative communication capability is positively associated with supplier collaborative communication capability.*

### 2.2.3. Focal Firm Collaborative Flexibility Capability

The next capability to be considered in this study is collaborative flexibility capability of the focal firm. Gundlach, Achrol, and Mentzer (1995) define flexibility as a relational norm that implies the flexible party will make a good-faith effort to adapt the substance and nature of the relationship as circumstances evolve. Similarly, Cannon and Perreault (1999) address flexibility as a cooperative norm (an expectation firms have about working together) enabling a firm to respond to changing conditions. Doney and Cannon (1997), meanwhile, characterize flexibility

as the supplier's willingness to customize its offering as needed. This too is an important dimension of flexibility. As previously discussed, in markets characterized by sophisticated and demanding customers, the ability to customize allows a firm (or collaborative alliance of firms) to produce offerings that are relatively more in tune with customer needs and wants.

Cannon and Homburg (2001) also characterize flexibility as conferring the ability to accommodate the customer, a position shared by Zhao, Dröge, and Stank (2001) and Antia and Frazier (2001). Meanwhile, Lin (2004) in effect brings together both streams of collaborative flexibility understanding, describing it as the ability to accommodate changing circumstances and changing customer requirements. Based on this review of the relevant literature, it is proposed that collaborative flexibility incorporates the ability to adapt to changing environmental conditions and to customize an offering in order to better meet sophisticated customer needs.

Table 2-2 summarizes extant scholarly treatments of collaborative flexibility and ostensibly related constructs.

**Table 2-2: Focal Firm Collaborative Flexibility Capability**

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Gundlach, Achrol, and Mentzer (1995) | Flexibility as a component of relational social norms | None | Commitment, commitment inputs, future commitment intention (all positively associated), opportunism (negatively associated) | University students participating in a management simulation for course credit |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Doney and Cannon (1997) | Supplier willingness to customize | None | Buyer trust of supplier | National Association of Purchasing Managers (U.S.), SIC codes 33-37 |
| Cannon and Perreault (1999) | Flexibility as element of cooperative norms | Market and situational determinants of buyer-seller relationships (availability of alternatives, supply market dynamism, importance of supply, complexity of supply) | Customer satisfaction, customer evaluation of supplier performance | National Association of Purchasing Managers (U.S.) in manufacturing, utilities, education, government agencies, and distributors. |
| Cannon and Homburg (2001) | Supplier flexibility in accommodating the customer | None | Customer direct, product acquisition, operations costs | Chemical, electrical, and mechanical manufacturers in U.S. and Germany (National Association of Purchasing Managers, Bundesverband fur Materialwirtschaft, Einkauf und Logistik, German Chamber of Commerce) |
| Zhao, Dröge, and Stank (2001) | Ability to accommodate changing circumstances and changing customer requirements) | Information sharing (willingness to exchange key information from various functional areas; bi-directional relationship) | Return on assets, low logistic costs, customer satisfaction | Council of Logistics Management executives in U.S., Canada, Mexico from manufacturing, wholesaling, retailing |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Antia and Frazier (2001) | Flexibility (willingness to make alterations as circumstances change) as component of relationalism | Transaction-specific investments (as moderator) | Severity of contract enforcement (negative association) | Franchisor top managers drawn from U.S. Chamber of Commerce Franchise Opportunities Handbook (automobile services, B2B services, fast food and restaurants, cleaning services, personal care, personnel recruitment agencies) |
| Lin (2004) | Manufacturing flexibility (ability to customize, to respond quickly to changing customer requirements, to adapt to changing circumstances) | None | Network innovation agility | Taiwanese OEM firms in electronics, chemical, and materials industries |
| Prahinski and Benton (2004) | Focal firm flexibility in making changes and solving problems, as evaluated by supplier | None | Buyer-supplier relationship | Automotive industry: U.S. first-tier suppliers working with selected manufacturers (Honda, Ford, General Motors, Daimler-Chrysler) |
| Homburg, Kuester, Beutin, and Menon (2005) | Flexibility of the supplier | None | Buyer add-on benefits | Businesses in SIC codes 28-38 in the U.S. and Germany |
| Gounaris (2005) | Flexibility (open to ideas and suggestions) as a component of soft process quality | None | Service quality | Industrial firms in Greece |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Ghosh and John (2005) | Ability to be flexible under changing circumstances, requirements, and requests | None | End-product outcomes | OEM firms in SIC 35, 36, 37 |
| Dyer and Hatch (2006) | (Not measured but reported anecdotally, p. 713-15) Focal firm process rigidity inhibits knowledge transfer and supplier performance | None | Knowledge transfer, supplier performance | U.S. auto industry suppliers serving both Toyota and U.S. automakers |
| Moser and Blome (2008) | Short-term and long-term flexibility capabilities | None | Short-term flexibility associated with risk reduction; long-term flexibility associated with sales increase | Automotive, engineering, food, aerospace, electronics, and other product and service industries in Germany and Switzerland |
| Ngai, Jin, and Liang (2008) | Flexibility (ability to change as requirements change) | None | Inter-organizational knowledge management, knowledge acquisition, knowledge transfer | Case studies of mass transit railway and power generation supplier in China |
| Scheer, Miao, and Garrett (2010) | Supplier operations capability (ability to adjust to dynamic environment) | None | Buyer cost-based dependence and benefit-based dependence on supplier | Institute for Supply Management member firms in SIC codes 35-38 |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Pettit, Fiksel, and Croxton (2010) | Flexibility in sourcing, flexibility in order commitment, and adaptability (ability to modify operations in response to challenges or opportunities) | Management controls | Supply chain resilience | Managers at Limited Brands |
| Richey, Adams, and Dalela (2012) | Ability to adapt to changes in customer requests and the market environment | None | Collaboration | Retailers from 26 industries |

As with collaborative communications capability, collaborative flexibility capability has been operationalized and measured in a variety of ways in the literature, and in some cases has been combined with other phenomena in a way that poses potential problems. For example, collaborative flexibility has been combined with other elements into relational social norms (Gundlach, Achrol, and Mentzer 1995) and cooperative norms (Cannon and Perreault 1999). This dissertation proposes that collaborative flexibility stands on its own as an important collaborative capability in a model of interfirm collaboration.

#### 2.2.3.1. Collaborative Flexibility Capability: Links to Other Constructs

In contrast with collaborative communication, the scope and dimensionality of collaborative flexibility capability is a less contentious matter. However, much of the extant research is concerned with the flexibility of the supplier, requiring investigation of whether the construct can be applied as is to focal firms (buyers, in the supply chain parlance), or whether some accommodation is required. With respect to suppliers, Cannon and Perreault (1999)

associate flexibility with customer satisfaction and perceived supplier performance, including product quality and delivery performance, while Dyer and Hatch (2006) link flexibility and core offering quality. Other researchers, such as Doney and Cannon (1997) and Homburg et al (2005) link flexibility to buyer trust of the supplier. Flexibility may also offer benefits to the focal firm, such as reduced focal firm costs (Cannon and Homburg 2001; Zhao, Dröge, and Stank 2001), increased buyer cost-based dependence (Scheer, Miao, and Garrett 2010), increased sales (Moser and Blome 2008). Finally, some link collaborative flexibility to measures pertaining to the relation as a whole, including network innovation agility (Lin 2004) and supply chain resilience, or ability to withstand environmental shocks (Pettit, Fiksel, and Croxton 2010). Because collaboration (and collaborative flexibility as a part of collaboration) should have some effect on product-market outcomes in order to justify the level of effort involved, studies linking collaborative flexibility to operational product-market measures are of particular interest here.

#### 2.2.3.2. Collaborative Flexibility Capability: Hypothesis Generation

The collaborative flexibility capability (the ability to adjust to dynamic conditions, emergent properties of the end-user offering, and the like) of the focal firm may also contribute to the development of supplier capabilities, as the supplier observes the positive (i.e., success-oriented) behaviors of the focal firm. Again following and extending Dyer and Nobeoka (2000) and Dyer and Hatch (2006), a relationship is proposed between the collaborative flexibility capability of the focal firm (the “action” element of collaboration on the part of the focal firm) and the “action” elements of supplier collaborative capabilities. The key “action” capabilities associated with desirable product-market outcomes are core offering capability, or the ability of

the supplier to provide goods of suitable and consistent quality in a reliable manner (Ulaga and Eggert 2006; Scheer, Miao, and Garrett 2010) and operations capability, or the ability to modify existing goods and help develop new ones to address emerging customer needs and changing circumstances (Flint, Woodruff, and Gardial 2002; Scheer, Miao, and Garrett 2010).

Cannon and Perreault (1999) find a relationship between flexibility and focal-firm evaluation of supplier performance, while Zhao, Dröge, and Stank (2001) propose a relationship between flexibility and return on assets, reduced logistic costs, and other outcomes. Similarly, Lin (2004) finds a relationship between focal-firm flexibility and network innovation agility in Taiwanese OEM firms, while Ghosh and John (2005) find a relationship between flexibility and superior end-product outcomes. These studies point to the existence of a link joining focal-firm flexibility and supplier core offering capabilities.

***H3a.*** *Focal firm collaborative flexibility capability is positively associated with supplier core offering capability.*

Just as focal-firm collaborative flexibility may help key suppliers enhance core offering capability, focal-firm collaborative flexibility may influence supplier operations capability (in fact, the relationship between the latter two constructs may be particularly critical, given their common characteristics). Suppliers observe and learn from the demonstration of flexibility by focal firms in responding to changing end-user customer needs and changing circumstances, and via observation knowledge may be shared (Dyer and Nobeoka 2000; Ngai, Jin, and Liang 2008). As a beneficial consequence of knowledge transfer, suppliers may develop the ability to

anticipate and respond flexibly to changing needs and circumstances (Flint, Woodruff, and Gardial 2002).

Enhanced flexibility-oriented capabilities may contribute to stronger focal-firm/supplier relationships (Prahinski and Benton 2004), greater innovation (Lin 2004), service quality (Gounaris 2005), customer add-on benefits, or benefits beyond the minimum requirements of the focal firm in the setting in question (Homburg et al 2005), increased sales (Moser and Blome 2008), and supply chain resilience in the face of disruption (Pettit, Fiksel, and Croxton 2010). As previously discussed, prior research indicates that focal firm collaborative flexibility capability and supplier operations capability share a number of important characteristics, leading to the development of the following hypothesis:

***H3b.*** *Focal firm collaborative flexibility capability is positively associated with supplier operations capability.*

**2.3. Supplier Collaborative Capabilities**

The ultimate measure of an actor in a given set of circumstances is performance (the proof of the pudding is in the eating), but the capabilities that underlie performance ought also to be of interest to scholars and practitioners. Olavarrieta and Ellinger (1997) note that a firm's resources do not reach their full potential value unless those resources are put into use, (for instance) in order to capitalize on opportunities or counter threats from the external environment (Barney 1995).

Firms that develop the ability to work cooperatively/collaboratively within the supply chain have the opportunity to build long-term relationships with key suppliers (Kalwani and

Narayandas 1995). At the same time, suppliers are searching for ways to differentiate themselves from potential competitors (Van Den Bosch and Dawar 2002), in order to defend favorable relationships with the focal firms they supply. However, while a number of studies of inter-organizational collaboration have investigated the relationship between measures of supplier *performance* and various desirable outcome measures, comparatively few studies have attempted to delve into the supplier *capabilities* that presumably influence (along with contextual factors, of course) performance.

In one example, Olavarrieta and Ellinger (1997) argue for logistics distinctive capability (offered here as one potential type of dynamic supplier capability) as a source of competitive advantage, citing as examples Bose Corporation's JIT II system and Wal-Mart's renowned inventory-management capabilities. The authors note that rival firms have had little success in duplicating Wal-Mart's logistical capability, lending credence to the idea that Wal-Mart's success in the logistical arena is the outcome of its ability to deploy a scarce, valuable, and relatively inimitable/non-substitutable resource (or set of related resources). This raises a particularly intriguing question: Can focal firms, working in a collaborative relationship with key suppliers, influence the development of distinctive (advantage-conferring) capabilities by those suppliers? Returning to the previous Wal-Mart example for a moment, anecdotal evidence suggests that the answer is "yes." At the least, some Wal-Mart suppliers are willing to say so for publication. One beverage-maker CEO who supplied goods to Wal-Mart said of the experience (which, among other things, required the supplier to deliver product to Wal-Mart loading docks in a 30-second window):

> “With a customer like that, it changes your organization. For the better. It wakes everybody up. And all our customers benefitted. We changed our whole approach to doing business.” (Fishman 2003, p. 73)

Taking this executive's words at face value, what we see here is an example of the focal firm’s capabilities improving not only the performance of a supplier (which would pertain to the relationship in question, but not necessarily to any other relationships in which the supplier firm might be involved) , but the capabilities of the supplier (with attendant benefits to the supplier’s other customers). This idea enjoys some support in the academic literature as well. As previously noted, among the “market-based assets” (Scheer, Miao, and Garrett 2010) focal firms can obtain are the capabilities of its suppliers (Srivastava , Shirvani, and Fahey 2008). Likewise, Krause, Handfield, and Scannell (1998) assert that supplier development can be a “strategic weapon” conferring a competitive edge.

Supplier capabilities are important to the success of focal firms that choose to collaborate in order to compete in the market. However, focal firms have been, and to some extent continue to be, skeptical about the adequacy of the capabilities of their suppliers. An extensive literature on supplier development has recorded focal firms citing the need for supplier improvement in a variety of areas, among them offering quality, delivery performance, financial health, and design capability (Monczka and Trent 1991; Krause 1999).

Forker (1997) contends that uneven or inconsistent adoption of processes across firms pursuing Total Quality Management accounts for at least some of the inconsistent quality

performance across firms. Under TQM, firms seek to “build quality in” to their offerings by adopting processes that facilitate quality (in other words, by developing quality-enabling process capabilities), rather than simply catching defects during post-production inspection. TQM seeks to eliminate defects before they occur, by improving the process capabilities of the producer (Pall 1987). However, Forker (1997) reports mixed results from firms attempting to implement TQM in a number of empirical studies in the early 1990s. What this suggests is that process implementation, or the development of relevant capabilities, is heterogeneous across firms. The following passage is offered by way of illustration:

> “...the inconsistent relationship between process and performance is accounted for by considering structural differences among the aerospace component producers surveyed. Structural differences are system-wide features of a firm's manufacturing and organizational processes where overall performance is influenced by nonlinear interactions among the system's components. Structural differences may be due to varying decisionmaking competencies among managements, better and worse communication with workers, different levels of morale/cooperation among firm employees, diverse degrees of intelligence and learning among a firm's workers, and/or any of a number of other intangible characteristics that directly impact company processes.” (Forker 1997, p. 244)

Each of those “system-wide features of a firm's manufacturing and organizational processes” noted in the above-quoted passage is more representative of a firm-level capability (being, for one thing, embedded to a significant degree in the firm's personnel), rather than a resource. Because capabilities cannot be easily acquired in factor markets, heterogeneous outcomes in TQM implementation (and firm performance) are thus consistent with the dynamic capabilities framework. In fact, Forker (1997) found a significant relationship between the interaction of process optimization (which can be conceptualized as capability-building) and TQM, and aerospace-industry supplier performance. The same author further found a strong correlation between employee training and design and firm performance when process efficiencies were high; where efficiencies were low, the training-design/performance relationship was *negative* (Forker 1997). Efficiency is not something that can be purchased in the market; it must instead be developed within the firm (in other words, efficiency is an outward manifestation of a capability).

This study investigates three particularly relevant supplier capabilities, drawing on Forker (1997), Ulaga and Eggert (2006) and Scheer, Miao, and Garrett (2010): *core offering capabilities*, *operations capabilities*, and *communications capabilities*. These three constructs cover the important and relevant dimensions of supplier capabilities, from the point of view of the focal firm.

### 2.3.1. Supplier Core Offering Capabilities

*Core offering capabilities* refers to the supplier’s ability to deliver product quality in response to current customer needs (Ulaga and Eggert 2006; Scheer, Miao, and Garrett 2010);

the construct has been referred to in supply chain research as the “first level of value creation” (Ulaga and Eggert 2006, p.123). Focal firms benefit when suppliers deliver consistent high core offering quality through reduced scrap and rework, as well as by enhanced final (end-user) offering quality (Cannon and Homburg 2001). Suppliers who efficiently implement product/service design capabilities also perform better in the market, to the benefit of themselves and their partners (Forker 1997). In addition, supplier firms that combine process management and process improvement (i.e., attention to process-related capabilities) have shown better market performance (Forker 1997). Table 2-4 summarizes research in collaboration depicting core offering capabilities and related constructs.

**TABLE 2-4. SUPPLIER CORE OFFERING CAPABILITY**

| **Source** | **Construct** | **Antecedent** | **Consequence** | **Setting of Study** |
|---|---|---|---|---|
| Doney and Cannon (1997) | Product/service performance | None | Purchase choice, anticipated future interaction | National Association of Purchasing Managers (U.S.), SIC codes 33-37 |
| Ulaga and Eggert (2006) | Product quality and delivery performance | None | Buyer's relationship costs and relationship benefits with respect to supplier | Senior managers at Institute for Supply Management member firms in SIC codes 28-30, 32-38 |
| Dyer and Hatch (2006) | Product quality (lower number of defects per million parts) | Knowledge transfer from customer (focal firm) | Supplier performance | U.S. auto industry suppliers serving both Toyota and U.S. automakers |

| Source | Construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Scheer, Miao, and Garrett (2010) | Core offering capability (offering quality) | None | Customer benefit-based dependence on supplier | Institute for Supply Management member firms in SIC codes 35-38 |

#### 2.3.1.1. Core Offering Capabilities: Links to Other Constructs

The supplier's core offering capability has been linked with supplier selection probability (Doney and Cannon 1997), and with the focal (buying) firm's benefit-based dependence on the supplier (Ulaga and Eggert 2006; Scheer, Miao, and Garrett 2010). Finally, Dyer and Hatch treat core offering capability as endogenous to receiving assistance from the buying firm, in their study of Japanese and U.S. automakers. In other words, buyer assistance contributes to the core offering capabilities of key suppliers, one of the strongest indications in the literature that focal firms can influence the development of supplier capabilities, to the ultimate betterment of product-market outcomes.

### 2.3.2. Supplier Operations Capabilities

As Ulaga and Eggert (2006) argue, product quality alone is no longer sufficient to confer competitive advantage; firms must bring other capabilities to the table as well. In contrast to core offering capabilities, a supplier's *operations capabilities* refer to its application of relevant knowledge to meet changing customer needs in dynamic conditions (Teece, Pisano, and Shuen 1997; Flint, Woodruff, and Gardial 2002; Ulaga and Eggert 2006; Scheer, Miao, and Garrett 2010). Product/service design capabilities (Forker 1997) perform a relatively closely related

function. Table 2-5 summarizes extant research incorporating the operational capabilities of suppliers.

**TABLE 2-5. SUPPLIER OPERATIONS CAPABILITIES**

| Source | Construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Doney and Cannon (1997) | Supplier willingness to customize | Supplier willingness to customize | Buyer's trust of supplier | National Association of Purchasing Managers (U.S.), SIC codes 33-37 |
| Cannon and Homburg (2001) | Supplier flexibility in accommodating the customer | None | Customer direct, product acquisition, operations costs | Chemical, electrical, and mechanical manufacturers in U.S. and Germany (National Association of Purchasing Managers, Bundesverband fur Materialwirtschaft, Einkauf und Logistik, German Chamber of Commerce) |
| Lin (2004) | Manufacturing flexibility (ability to customize, to respond quickly to changing customer requirements, to adapt to changing circumstances) | None | Network innovation agility | Taiwanese OEM firms in electronics, chemical, and materials industries |
| Homburg, Kuester, Beutin, and Menon (2005) | Flexibility of the supplier | None | Buyer add-on benefits | Industrial firms in SIC codes 28-38 in the U.S. and Germany |

| Source | Construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Gounaris (2005) | Flexibility (open to ideas and suggestions) as a component of soft process quality | None | Service quality | Industrial firms in Greece |
| Ulaga and Eggert (2006) | Time to market and supplier know-how (ability to respond quickly) | None | Buyer's relationship costs and relationship benefits with respect to supplier | Senior managers at Institute for Supply Management member firms in SIC codes 28-30, 32-38 |
| Moser and Blome (2008) | Short-term and long-term flexibility capabilities | None | Short-term flexibility associated with risk reduction; long-term flexibility associated with sales increase | Automotive, engineering, food, aerospace, electronics, and other product and service industries in Germany and Switzerland |
| Scheer, Miao, and Garrett (2010) | Operations capability (ability to adjust to changing circumstances) | None | Buyer cost-based and benefit-based dependence on supplier | Institute for Supply Management member firms in SIC codes 35-38 |

#### 2.3.2.1. Supplier Operations Capabilities: Links to Other Constructs

Supplier operations (flexibility and customization) capabilities and closely related constructs have been linked in prior research to both affective and operational constructs in inter-organizational collaboration. Doney and Cannon (1997) and Gounaris (2005) investigate the relationship between operations capabilities and focal firm trust of the supplier. Scheer, Miao, and Garrett (2010) find a relationship between operations capabilities and the buyer's benefit-

based and cost-based dependence on the supplier. These findings are important, because buyer dependence is higher where product-market outcomes are more positive. Homburg et al (2005) find a relationship with buyer's add-on benefits (value-added benefits beyond product quality and delivery performance, treated by the authors as "core" benefits in their study). Cannon and Homburg (2001) investigate the link between operations capabilities and cost reductions, while Ulaga and Eggert (2006) focuses on both costs and benefits related to operations, contending that the overall objective is that operations benefits outweigh operations costs. Lin (2004) studies the relationship between operations capabilities and network agility capabilities (as previously noted, the ability to respond quickly to changing customer needs), and Moser and Blome (2008), modeling both short-term and long-term relational flexibility, find a relationship between short-term flexibility capabilities and risk reduction, and a relationship between long-term flexibility capabilities and increased focal firm sales to end users. The latter finding in particular, along with the other findings in the literature, strongly suggest a link between supplier operations/flexibility capabilities and positive product-market outcomes.

### 2.3.3. Supplier Collaborative Communications Capabilities

Finally, in the quest for relevant and valuable knowledge, supplier firms may benefit from strong *communications capabilities* (Ulaga and Eggert 2006; Paulraj, Lado, and Chen 2008; Scheer, Miao, and Garrett 2010), being thus able to share information and knowledge in order to solve mutual problems. Communications capabilities are as important to the supplier in a relation as they are to the focal firm. The reader is referred to Table 2-6 below for a summary of research into collaborative communication.

**TABLE 2-6. SUPPLIER COLLABORATIVE COMMUNICATION CAPABILITIES**

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Mohr and Nevin (1990) | Frequency, bidirectionality, mode (face-to-face, phone, mail, also formality), content (direct/indirect influence) | None | Qualitative channel outcomes (satisfaction, coordination, commitment) | Conceptual paper |
| Mohr and Spekman (1994) | Communication (quality: accuracy, adequacy, and timeliness; information sharing; participation) | None | Satisfaction with partnership, dyadic sales | Computer manufacturers and dealers in the United States |
| Mohr, Fisher, and Nevin (1996) | Collaborative communication (Frequency, Bidirectionality, Formality, Noncoercive content) | | | |
| Doney and Cannon (1997) | Confidential information sharing (supplier's) | None | Buyer trust of supplier | National Association of Purchasing Managers (U.S.), SIC codes 33-37 |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Cannon and Perreault (1999) | Information exchange as the sharing of valuable (proprietary and relevant) information between parties | Market and situational determinants of buyer-seller relationships (availability of alternatives, supply market dynamism, importance of supply, complexity of supply) | Customer satisfaction, customer evaluation of supplier performance | National Association of Purchasing Managers (U.S.) in manufacturing, utilities, education, government agencies, and distributors. |
| Jap and Ganesan (2000) | Information exchange as component of relationalism (relational norms) | None | Direct effect on retailer perception of supplier commitment and moderating effect on relationship between retailer transaction-specific investments and retailer perception of supplier commitment | Crop protection (agricultural pesticides and other crop inputs) supply chain (U.S.) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Cannon and Homburg (2001) | Frequency, information sharing (separate constructs) | None | Customer direct, product acquisition, operations costs | Chemical, electrical, and mechanical manufacturers in U.S. and Germany (National Association of Purchasing Managers, Bundesverband fur Materialwirtschaft, Einkauf und Logistik, German Chamber of Commerce) |
| Zhao, Dröge, and Stank (2001) | Information sharing (willingness to exchange key information from various functional areas) | Customer-focused capabilities (segmental focus, relevancy, responsiveness, flexibility; bi-directional relationship) | Return on assets, low logistic costs, customer satisfaction | Council of Logistics Management executives in U.S., Canada, Mexico from manufacturing, wholesaling, retailing |
| Antia and Frazier (2001) | Information sharing | Transaction-specific investments (as moderator) | Severity of contract enforcement | Franchisor top managers drawn from U.S. Chamber of Commerce Franchise Opportunities Handbook (automobile services, B2B services, fast food and restaurants, cleaning services, personal care, personnel recruitment agencies) |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Mavondo and Rodrigo (2001) | Information sharing as dimension of cooperation | Social bonding | Trust, interpersonal commitment, inter-organizational commitment | Chinese firms doing business with Australia and Australian firms doing business with China |
| Bello, Chelariu, and Zhang (2003) | Information exchange | Resource inadequacy, manufacturer dependence, market volatility, psychic distance, product complexity, human content | Distributor performance | U.S. manufacturing firms exporting through offshore distributors |
| Prahinski and Benton (2004) | Collaborative communication as formality (vs. informality, 5 items), feedback (4 items), indirect influence strategy | None | Buyer-supplier relationship (cooperation, buyer commitment, operational linkages), supplier performance | Automotive industry: U.S. first-tier suppliers working with selected manufacturers (Honda, Ford, General Motors, Daimler-Chrysler) |
| Phan, Styles, and Patterson (2005) | Communication quality, information sharing, participation | Interpersonal relationship quality (trust, commitment, interpersonal satisfaction, joint problem solving) | Partnership financial and non-financial performance (bi-directional relationship) | Firms representing numerous industries from Australia, Thailand, Indonesia, and Malaysia |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Tan and Vonderembse (2006) | Information sharing (across functions, using CAD as a medium) | CAD use for engineering design | Product development performance | Manufacturing executives/managers from five industries: SIC codes 30, 34, 35, 37, 38; Rubber and Miscellaneous Plastic Products, Fabricated Metal Products, Industrial Machinery and Equipment, Transportation Equipment, and Instruments and Related Products |
| Brush and Rexha (2007) | Supplier disclosing behavior (openness with regard to potential problems) | None | Trust in supplier | Singaporean manufacturers and their independent suppliers in Asian countries |
| Moser and Blome (2008) | Information and knowledge exchange (one dimension of the authors' formative “collaboration capabilities” construct) | None | Sales increase | Automotive, engineering, food, aerospace, electronics, and other product and service industries in Germany and Switzerland |
| Ngai, Jin, and Liang (2008) | Knowledge transfer (also frequent interaction and frequent joint problem-solving) | Tightness of network embeddability | Inter-organizational knowledge acquisition and management | Case studies of mass transit railway and power generation supplier in China |

| Source | Definition of construct | Antecedent | Consequence | Setting of Study |
|---|---|---|---|---|
| Paulraj, Lado, and Chen (2008) | Inter-organizational communication (Sensitive information shared openly, frequent/informal/timely, partners informed about events/changes that may affect other, bi-directional feedback) | Long-term relationship orientation, network governance, information technology | Buyer performance, supplier performance | Member firms of the U.S. Institute for Supply Management, SIC codes 34-39 |
| Lages, Silva, and Styles (2009) | Communication quality and information sharing as dimensions of relationship capabilities | | | |
| Scheer, Miao, and Garrett (2010) | Communication capability (effective, productive, formal and informal, timely) | None | Customer benefit-based dependence on supplier | Institute for Supply Management member firms in SIC codes 35-38 |
| Pettit, Fiksel, and Croxton (2010) | Communications (single dimension of collaboration capability construct in conceptual paper) | Management controls | Supply chain resilience | Managers at Limited Brands |
| Cao, Vonderembse, Zhang, and Ragu-Nathan (2010) | Collaborative communication (Frequent, open, bi-directional, informal, multi-channel, non-coercive) and information sharing (relevant, complete, accurate, confidential, and timely) as separate constructs | None | Supply chain collaboration | Managers and senior executives (Council of Supply Chain Management members) at U.S. firms in SIC codes 25, 30, 34-38 |

#### 2.3.3.1. Supplier Collaborative Communications Capabilities: Links to Other Constructs

Effective communication helps firms build strong relationships (Anderson and Narus 1990; Wathne, Biong, and Heide 2001), and may lead to positive customer outcomes (Jap 1999; Paulraj, Lado, and Chen 2008). The previous discussion of links between focal firm collaborative communications and other constructs applies equally well here, and does not require extensive reiteration, the more so because many of the studies in Table 2-1 are as applicable to the circumstances of suppliers as they are to those of focal firms.

### 2.3.4. Supplier Collaborative Capabilities: Communications and Action

The information-gathering and assimilation engendered by collaborative communication should enable suppliers to enhance other dynamic capabilities they possess, as they absorb and apply the knowledge gained from relational partners as well as the environment (Cohen and Levinthal 1989; Zahra and George 2002; Lane, Koka, and Pathak 2006; Lichtenthaler 2009; Murovec and Prodan 2010). In fact, the transfer of knowledge is considered essential to success in inter-organizational collaboration (Dyer and Hatch 2006); along analogous lines, Ghosh, Dutta, and Stremersch (2006) find that the supplier's ability to internalize and act on knowledge resources obtained from the customer (the focal firm) may confer upon the supplier greater control over customization of its contribution to the partnership, particularly under conditions of technological uncertainty. As communications is a two-way process, well-developed supplier communications capabilities (following the logic in Ghosh, Dutta, and Stremersch 2006 as well as Dyer and Hatch 2006) should contribute to the supplier's ability to move knowledge to functional areas in which the knowledge may be put to effective use.

The following hypotheses capture the association between the "communication element" and "action elements" of supplier collaborative capabilities. First, suppliers with superior communications capability may be better placed to provide differential levels of core offering capability, the ability of the supplier to provide goods of required quality and consistency to the focal firm (Scheer, Miao, and Garrett 2010). The supplier's communications capability may equip it to better understand focal firm requirements from the outset of the relationship – in other words, the focal firm's present or manifest needs, as proposed by Flint, Woodruff and Gardial (2002) – leading to the following hypothesis:

***H4a.*** *Supplier collaborative communication capability is positively associated with supplier core offering capability.*

Effective communication between focal firm and supplier contribute to the supplier's ability to recognize the ways in which the focal firm's *future* needs might change as circumstances change (Flint, Woodruff, and Gardial 2002; Scheer, Miao, and Garrett 2010). Observation and communication lead to learning. Scholars and practitioners alike believe that knowledge sharing is essential to the success of a collaborative relation or network (Dyer and Nobeoka 2000; Ngai, Jin, and Liang 2008). In prior studies, researchers have found that information sharing contributes to positive focal-firm evaluation of supplier performance (Cannon and Perreault 1999), operations costs (Cannon and Homburg 2001), return on assets (Zhao, Dröge, and Stank 2001), product development performance (Tan and Vonderembse 2006), supplier performance (Dyer and Hatch 2006), improved supplier and focal-firm performance

(Paulraj, Lado, and Chen 2008), supplier knowledge (Joshi 2009), and more effective/efficient supply chain collaboration (Cao et al 2010).

Although a number of the studies cited above investigate supplier performance rather than supplier capabilities, the fact that capability underlies performance provides insight and direction to guide the development of hypotheses regarding the relationship between supplier communications capability and supplier operations capability. Accordingly, the following hypothesis is advanced:

***H4b.*** *Supplier collaborative communication capability is positively associated with supplier operations capability.*

#### 2.3.4.1. Supplier Collaborative Capabilities and Product-Market Outcomes

The collaborative capabilities of suppliers should contribute to positive product-market outcomes; Daugherty (2011) cites a number of studies in which collaboration leads to positive product-market outcomes. Scheer, Miao, and Garrett (2010) find that supplier capabilities are associated with customer-firm (focal firm) dependence and relational loyalty, but do not directly investigate the link, if any, between supplier capabilities and product-market outcomes. However, a relation that does not produce product-market success seems likely to engender loyalty or dependence. The finding by Ghosh, Dutta, and Stremersch (2006) that low modularity (i.e., greater need for customization of the supplier's offering) increases the supplier's customization control (the degree to which the supplier directs customization of its contribution to the end user product) suggests that supplier flexibility is more important where it is required (as in a low-modularity situation).

Following Cannon and Perreault (1999), the investigation for the purposes of this dissertation is limited to those relational factors that are operational (as opposed to affective) in nature. It being exceedingly unlikely that any supplier could be coerced into collaboration against its will (in contrast to focal-firm collaboration: focal firms may well seek partners more or less unwillingly, driven by the necessity of using capabilities and/or resources not in its possession, while suppliers are free to attempt to collaborate or not with any given focal firm), the collaborative orientation of the supplier is taken as a given, leaving the communication and action dimensions of supplier collaborative capabilities for investigation. In addition to focusing on operational dimensions of inter-organizational collaboration, this dissertation focuses on product-market-related outcome variables, specifically delivery performance (Zhao, Dröge, and Stank 2001; Ghosh, Dutta, and Stremersch 2006; Ulaga and Eggert 2006). The following hypothesis is therefore advanced:

***H5a.*** *Supplier core offering capability is positively associated with delivery performance.*

A good that is delivered when, where, and in the quantity/condition required is all to the good, of course, but is not sufficient for success. The good in question should also be something of value to the customer. The primary study linking supplier capabilities to closeness of the final offering to customer needs is Ghosh, Dutta, and Stremersch (2006), but other studies lend support to the relationship between supplier capabilities and positive product-market outcomes. Among these are product/service performance (Doney and Cannon 1997), product quality and reliability (Homburg et al 2005; Ulaga and Eggert 2006; Brush and Rexha 2007), and overall focal-firm/supplier performance quality (Paulraj, Lado, and Chen 2008).

***H5b.*** *Supplier core offering capability is positively associated with closeness of product/service to customer needs.*

As with core offering capability, supplier operations capability should contribute meaningfully to appropriate product-market outcomes in order to be worthy of managerial attention. Once again, the primary study of the relationship between control of customization and delivery quality is Ghosh, Dutta, and Stremersch (2006). Supplier firms who exhibit better capabilities may gain greater control over product customization; in contrast, focal firms may be more likely to retain customization control when supplier collaborative capabilities are weaker. The authors' study does not address supplier operations capability directly, but it is unlikely that a supplier that earned greater customization control from a focal firm would be deficient in the ability to contribute to product innovation.

Meanwhile, Moser and Blome (2008) also propose an association between supplier flexibility and focal-firm sales to end users. As higher levels of delivery performance should contribute positively to sales (among other positive outcomes) supplier flexibility may contribute to improved delivery performance. The mechanism by which this occurs may have to do with the greater speed (and accuracy) with which a more flexible supplier can respond to changing requirements and/or circumstances. Additionally, Paulraj, Lado, and Chen (2008) investigate the association between supplier flexibility and quality, speed, and reliability of delivery. Further, Brush and Rexha (2007) investigate the relationship between supplier initiatives, which may be seen as an effort to develop operations (flexibility) capability, and delivery speed and reliability. The insights drawn from prior research suggest that the following hypothesis may be proposed:

***H6a.*** *Supplier operations capability is positively associated with delivery performance.*

Supplier operations capability, speaking as it does to the ability of suppliers to adapt and respond to customer needs and environmental changes, enhances the ability of the collaborative relation to deliver offerings that are closer to end-user customer needs. Lin (2004) investigates the relationship between operations capability and the agility of the network (ability of the collaborative network to respond quickly and effectively to changing customer needs). Homburg et al (2005) investigate the link between supplier flexibility and buyer (focal-firm) add-on benefits, or benefits/characteristics of the supplier's offering that are above and beyond the minimum quality requirements set by the focal firm. It appears from these clues in the literature that it is not the focal firm alone that orchestrates the development and delivery of the offering to the end user. Instead, the capabilities of key suppliers enable them to make their own contributions to the success of the partnership. The following hypothesis is thus advanced:

***H6b.*** *Supplier operations capability is positively associated with closeness of the final offering to customer needs.*

## 2.4. A Model of Interfirm Collaboration

Building on the foundation provided by the knowledge-based view of the firm (Grant 1996), a model of interfirm collaboration is proposed that permits focal firms, by arranging the sharing of important knowledge and best practices, to help key suppliers to enhance their own collaborative capabilities (Dyer and Singh 1998; Dyer and Nobeoka 2000; Dyer and Hatch 2006) in the service of superior operational product-market outcomes (Cannon and Perreault 1999; Cannon and Homburg 2001). The basic Dyer and colleagues model is enhanced and refined by a

process-content treatment of collaborative communications capability (Stephenson 1969; Mohr and Spekman 1994; Cannon and Homburg 2001; Cao et al 2010), along with the incorporation of the useful Scheer, Miao, and Garrett (2010) supplier collaborative capabilities framework.

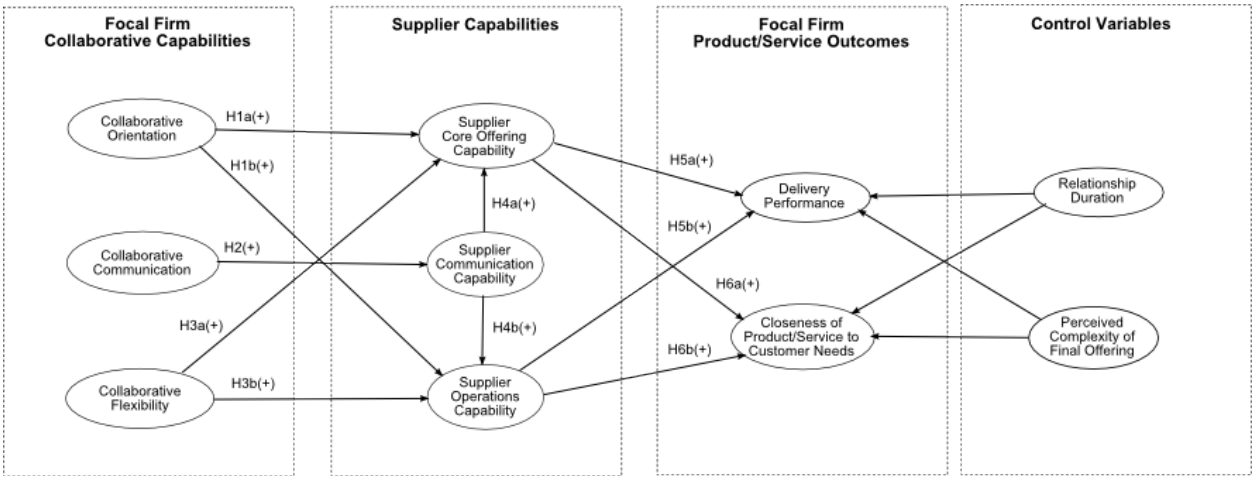
Under the knowledge-based view of the firm, the source of competitive advantage is the possession of and ability to use differential knowledge resources (Grant 1996). Firms succeed by knowing things (market opportunities, issues in the market environment, customer preferences and idiosyncrasies, productive capabilities, collaborative capabilities, etc.) their competitors do not know. As interfirm collaboration increasingly becomes a way of life (Powell, Koput, and Smith-Doerr 1996; Gulati 1998; Andraski 1998; Krause, Scannell, and Calantone 2000; Stank, Keller, and Daugherty 2001), particularly for firms operating in complex product-market environments (Ghosh, Dutta, and Stremersch 2006; Park, Ding, and Rao 2008), collaborative capabilities become some of the most important knowledge resources a firm can have. Firms are able to share differential knowledge resources through their supplier networks, resulting in better performance by network alliances (Dyer and Singh 1998; Dyer and Nobeoka 2000; Dyer and Hatch 2006).

For knowledge resources to be shared effectively, the partners must be in possession of effective collaborations communications capabilities. Following Stephenson's contention that information is transferred when communication takes place (Stephenson 1969), any investigation of collaborative communications capabilities should take into account the process of communication as well as the content communicated. Because the focal firm typically sets the tone for the scope and nature of collaborative relationships, the proposed model will incorporate

process and content facets of a collaborative communication capability; on the key supplier side, content facets of a collaborative communications capability are most important (the process largely being set by the focal firm).

Collaborative communications capability, of course, is not the only supplier collaborative capability that can influence product-market outcomes. Scheer, Miao, and Garrett (2010) argue that supplier core offering (product/service quality), communications, and operations (ability to adjust and contribute to innovation in changing conditions) capabilities are important contributors to relational success. However, the bilateral nature of inter-organizational relationships (Dwyer, Schurr, and Oh 1987; Fisher, Mohr, and Nevins 1996) should enable focal firms to contribute to the development of capabilities in partner organizations. If both of the preceding conceptualizations are accepted as plausible, one may propose a model in which the capabilities of focal firms are related to the capabilities of suppliers, which are related in their turn to relevant product-market outcomes. Accordingly, this study proposes a model in which supplier capabilities mediate the relationship between focal-firm collaborative capabilities and product-market outcomes (and, as discussed previously, is operational in nature and anchored in behavior, rather than being based in affect), using an intention/communication/action framework for the conceptualization and study of interfirm collaborative capabilities. The proposed model is depicted below in Figure 2-1:

**Figure 2-1: A Model of Interfirm Collaboration**


Focal Firm
Collaborative Capabilities
Supplier Capabilities
Focal Firm
Product/Service Outcomes
Control Variables
Collaborative Orientation
Collaborative Communication
Collaborative Flexibility
Supplier Core Offering Capability
Supplier Communication Capability
Supplier Operations Capability
Delivery Performance
Closeness of Product/Service to Customer Needs
Relationship Duration
Perceived Complexity of Final Offering
H1a(+)
H1b(+)
H2(+)
H3a(+)
H3b(+)
H4a(+)
H4b(+)
H5a(+)
H5b(+)
H6a(+)
H6b(+)

# CHAPTER III

# METHODOLOGY

As noted in Chapter 2, the constructs incorporated into the model proposed for the purposes of this dissertation have been measured in a variety of ways. The first step in development of reliable, valid measures of constructs is a thorough review of the research in order to delineate the domain of each construct and select or generate appropriate measurement items that tap the important facets of each construct (Churchill 1979; Anderson and Gerbing 1988). Adapting recommended procedure to this study, a review will be conducted of measurement items used to measure the main constructs in prior research, in order to illustrate the delineation of the domain of each construct and its facets, and to develop measurement scales that will be appropriate for this dissertation. For each construct in the proposed model, a survey of extant measures is presented, followed by discussion of measurement items best suited for use in measuring the constructs as they have been delineated in Chapter 2 and following here.

## 3.1. Focal Firm Collaborative Communications

Of all the constructs in the proposed model, collaborative communication has been measured most often and, partially as a result of the sheer number of studies conducted, has enjoyed (for given values of enjoyed) the greatest variety in operationalization and measurement.

Table 3-1a (see below) summarizes measurement scales used in key studies of collaborative communications and related constructs, drawn from the collaboration, supply chain, and supplier improvement literatures.

**TABLE 3-1a**

**PREVIOUSLY USED MEASURES OF COLLABORATIVE COMMUNICATIONS AND RELATED CONSTRUCTS**

| **Source** | **Definition of construct** | **Measurement items** |
|---|---|---|
| Anderson and Narus (1990) | Communication as formal and informal sharing of meaningful and timely information between firms | Manufacturer X lets our firm know as soon as possible of any unexpected problems with things such as lead times, delivery schedules, or product quality<br>(operationalized as 3 items, 7-point scale: strongly disagree/strongly agree) |
| Noordwier, John, and Nevin (1990) | Information provided to supplier (advance information about production plans, supply requirements, design changes, also usage information to help supplier planning) | We give supplier usage information to help him plan for our needs.<br>We keep our supplier informed of production plans.<br>We regularly provide supplier with long-range forecasts of supply requirements.<br>We inform supplier in advance of impending design changes. |
| Stuart (1993) | Sharing of valuable information with suppliers (part of problem-solving construct) | Valuable information is shared with our suppliers. |
| Mohr and Spekman (1994) | Communication (quality: accuracy, adequacy, and timeliness; information sharing; participation) | **Communication Quality**<br>To what extent do you feel that your communication with this manufacturer is: Timely/untimely, Accurate/inaccurate, Adequate/inadequate, Complete/incomplete, Credible/not credible.<br>**Participation (Strongly disagree/strongly agree):**<br>Our advice and counsel is sought by this manufacturer.<br>We participate in goal setting and forecasting with this manufacturer.<br>We help the manufacturer in its planning activities. Suggestions by us are encouraged by this manufacturer.<br>Information sharing (Strongly disagree/strongly agree):<br>We share proprietary information with this manufacturer.<br>We inform the manufacturer in advance of changing needs. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Mohr, Fisher, and Nevin (1996) | Collaborative communication (Frequency, Bidirectionality, Formality, Noncoercive content) | **Frequency (very infrequently/very frequently):**<br>For each of the following modes, over a typical four-week period, please estimate the frequency with which communication is spent in:<br>1. your providing information to the manufacturer via Face-to-face interaction with salespeople,<br>Telephone interaction with salespeople,<br>Technical support,<br>Written letters, correspondence,<br>Computer Link,<br>Trade Shows,<br>Dealer Councils,<br>Seminars (Summed and divided by 8)<br>2. the manufacturer providing information to you via Face-to-face interaction with salespeople,<br>Telephone interaction with salespeople,<br>Technical support,<br>Written letters, correspondence,<br>Computer Link,<br>Trade Shows,<br>Dealer Councils,<br>Seminars (Summed and divided by 11)<br>**Bidirectionality (none/a lot): How much feedback:**<br>•Do you provide to this manufacturer about their product, market conditions, etc.?<br>•Does this manufacturer provide to you? (negative feedback) (positive feedback)<br>**Formality (strongly disagree/strongly agree):**<br>In coordinating our activities with this manufacturer, formal communication channels are followed (i.e., channels are regularized, structured modes versus casual, informal, word-of-mouth modes):<br>The terms of our relationship have been written down in detail.<br>The manufacturer's expectations of us are communicated in detail. |
| Lusch and Brown (1996) | Information exchange (complete, frequent, proprietary, | We provide any information that might help our major supplier.<br>We provide information to our major supplier frequently and informally, and not only according to a prespecified agreement. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| | formal/informal) | We will provide proprietary information to our major supplier if it can help.<br>We keep our major supplier informed about events or changes that may affect them. |
| Doney and Cannon (1997) | Confidential information sharing (supplier's) | This supplier shares proprietary information with our firm.<br>This supplier will share confidential information to help us. |
| Cannon and Perreault (1999) | Information exchange as the sharing of valuable (proprietary and relevant) information between parties | In this relationship it is expected that...(very inaccurate description-very accurate description ... of this relationship):<br>Proprietary information is shared with each other.<br>We will both share relevant cost information.<br>We include each other in product development meetings.<br>We always share supply and demand forecasts. |
| Krause (1999) | Communication with suppliers includes exchange of proprietary information, frequency, and timeliness (3 items) | In this relationship, any information that might help the supplier will be provided to them<br>Exchange of information in this relationship takes place frequently and informally and not only according to a pre-specified agreement<br>It is expected that we keep each other informed about events or changes that may affect the other party |
| Jap and Ganesan (2000) | Information exchange as component of relationalism (relational norms) (frequency, completeness, informal, proprietary) | In this relationship, it is expected that any information that might help the other party will be provided to them.<br>Information is informally exchanged in this relationship.<br>It is expected that we keep each other informed about events or changes that may affect the other party.<br>Exchange of information in this relationship takes place frequently.<br>It is expected that the parties will provide proprietary information if it can help the other party. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Cannon and Homburg (2001) | Frequency, information sharing (separate constructs) | Frequency of face-to-face communication: About how often does your firm interact with ... (once per day or more, 1-4 times per week, 1-3 times per month, 4-10 times per year, 2-5 times per year, once per year or less (influenced by Mohr, Fisher, and Nevin 1996)<br>this supplier's salesperson face-to-face?<br>this supplier's service/support personnel face-to-face?<br>other people from this supplier face-to-face?<br>Frequency of telephone communication: About how often does your firm interact with ... (once per day or more, 1-4 times per week, 1-3 times per month, 4-10 times per year, 2-5 times per year, once per year or less (influenced by Mohr, Fisher, and Nevin 1996)<br>this supplier's salesperson on the phone?<br>this supplier's service/support personnel on the phone?<br>other people from this supplier on the phone?<br>Frequency of written communication: About how often does your firm interact with ... (once per day or more, 1-4 times per week, 1-3 times per month, 4-10 times per year, 2-5 times per year, once per year or less) (influenced by Mohr, Fisher, and Nevin 1996)<br>this supplier via electronic mail or EDI?<br>this supplier via fax?<br>this supplier via regular mail?<br>Amount of information sharing: (strongly agree-strongly disagree)<br>This supplier rarely talks with us about its business strategy. (reverse coded)<br>This supplier frequently discusses strategic issues with us.<br>This supplier openly shares confidential information with us. |
| Stank, Keller, and Daugherty (2001) | Single item measuring information exchange in external collaboration construct | My firm effectively shares operational information externally with selected suppliers and/or customers. |
| Zhao, Dröge, and Stank (2001) | Information sharing (willingness to exchange key information from various functional areas) | My firm effectively shares operational information between departments.<br>My firm effectively shares operational information externally with selected suppliers and/or customers.<br>My firm maintains an integrated database and access method to facilitate information sharing.<br>My firm is willing to share strategic information with selected suppliers. |
| Antia and Frazier (2001) | Information sharing | In this relationship, it is expected that any information that might help the other party will be provided to them.<br>Exchange of information in this relationship takes place frequently and informally.<br>It is expected that the parties will provide proprietary information if it can help the other party.<br>It is expected that we keep each other informed about events or changes that may affect the other party. |
| Bello, Chelariu, and Zhang (2003) | Information exchange | Regarding your export channel relationship...<br>It is expected that both parties will provide proprietary information if |

| Source | Definition of construct | Measurement items |
|---|---|---|
| | | it can help the other party.<br>Exchange of information in this relationship takes place frequently and informally.<br>It is expected that both parties keep each other informed about events or changes that may affect the other party. |
| Prahinski and Benton (2004) | Collaborative communication as formality (vs. informality, 5 items), feedback (4 items), indirect influence strategy | **Indirect influence strategy (1 = strongly Agree to 7 = strongly disagree)**<br>Assessment of your firm's performance through formal evaluation, using guidelines and procedures<br>Use of a supplier certification program to certify your firm's process control<br>Public recognition of your firm's achievements/performance<br>Site visits by Mfg to your premises to help your firm improve its performance<br>Inviting your personnel to Mfg's site to increase your awareness of how the product is used<br>Training and education of your personnel<br>**Formality (1 = strongly Agree to 7 = strongly disagree)**<br>In coordinating our activities with communication channels are followed (i.e., channels that are regularized, structured modes versus casual, informal, word-of-mouth modes)<br>Mfg has a formal system to track the performance of their suppliers<br>Mfg has a formal program for evaluating and recognizing suppliers<br>The source of our information about Mfg's evaluation program is predominantly word-of-mouth. (reverse coded)<br>Mfg's evaluation process is conducted through standard procedures<br>**Feedback (1 = strongly Agree to 7 = strongly disagree)**<br>Our firm can easily approach Mfg for discussion:<br>To clarify their expectations of our firm's performance<br>Regarding their evaluation of our firm's performance<br>Regarding ideas for performance improvement<br>To establish goal activities for performance improvement |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Phan, Styles, and Patterson (2005) | Communication quality, information sharing, participation | **(a) Communication quality**<br>Timeliness, accuracy, usefulness, and credibility of information exchanged between the managers<br>Quality of the information transmission between partners (Mohr and Spekman, 1994).<br>**(b) Information exchange**<br>Proactive provision of critical and confidential information useful to the other manager<br>The extent to which critical, often proprietary, information is communicated from one partner to another (Mohr and Spekman, 1994)<br>**(c) Participation**<br>The extent to which the managers engage jointly in planning and goal setting<br>The extent to which partners engage jointly in planning and goal setting |
| Tan and Vonderembse (2006) | Information sharing (across functions, using CAD as a medium) | CAD files are accessible to other functions within the firm.<br>end-users in production planning retrieve specific CAD information.<br>end-users in marketing retrieve specific CAD information and/or CAD files for their work. |
| Brush and Rexha (2007) | Supplier signaling behavior (advance notice of changes in marketing programs affecting the partner) and disclosing behavior (openness with regard to potential problems) | **Signaling behavior**<br>This supplier gives your firm ample notice of planned price changes.<br>This supplier does a good job of notifying your firm in advance of any delivery schedule changes.<br>This supplier tells your firm of any changes in billing procedures well ahead of time.<br>This supplier would inform your firm early of any plans to change the target product.<br>This supplier would discuss with your firm any plans to change the quality of the target product.<br>This supplier would give your firm plenty of notice if the level of after-sales service was going to change.<br>**Disclosing behavior: Withholding Information**<br>This supplier would try to cover up if they had a manufacturing setback. (reverse coded)<br>This supplier tends to be secretive about politics in their company. (reverse coded)<br>**Disclosing Information**<br>This supplier gives your firm a clear picture of what goes on behind the scenes in their firm.<br>This supplier is willing to let your firm see their weaknesses as well as their strengths. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Paulraj, Lado, and Chen (2008) | Inter-organizational communication (Sensitive information shared openly, frequent/informal/timely, partners informed about events/changes that may affect other, bi-directional feedback) | We share sensitive information (financial, production, design, research, and/or competition)<br>Suppliers are provided with any information that might help them<br>Exchange of information takes place frequently, informally and/or in a timely manner<br>We keep each other informed about events or changes that may affect the other party<br>We have frequent face-to-face planning/communication<br>We exchange performance feedback |
| Joshi (2009) | Collaborative communication (frequency, feedback, formality, rationality) | **Collaborative communication**<br>**Frequency** (adapted from Cannon and Homburg 2001)<br>Frequency of face-to-face communication: About how often does this customer interact with … (once per day or more, 1–4 times per week, 1–3 times per month, 4–10 times per year, 2–5 times per year, once per year or less) (reverse scored)<br>Your company's sales/marketing personnel face-to-face?<br>Your company' s operations personnel face-to-face?<br>Other people from your company face-to-face?<br>Frequency of telephone communication: About how often does this customer interact with ... (once per day or more, 1–4 times per week, 1–3 times per month, 4–10 times per year, 2–5 times per year, once per year or less) (reverse scored)<br>Your company's sales/marketing personnel on the phone?<br>Your company's operations personnel on the phone?<br>Other people from your company on the phone?<br>Frequency of written communication: About how often does this customer interact with ... (once per day or more, 1–4 times per week, 1–3 times per month, 4–10 times per year, 2–5 times per year, once per year or less) (reverse scored)<br>Your company via electronic mail or EDI?<br>Your company via fax?<br>Your company via regular mail?<br>**Reciprocal feedback** (adapted from Fisher, Maltz, and Jaworski 1997)<br>This customer solicits our views on new product ideas on an ongoing basis.<br>The customer responds promptly to communications from us.<br>This customer has great dialogues with us.<br>This customer provides us with a lot of feedback on our performance.<br>This customer solicits our views on improvements to operational processes on an ongoing basis.<br>This customer works hard to ensure that there is a lot of two-way communication between our firms.<br>**Formality** (adapted from Mohr, Fisher, and Nevin 1996)<br>In coordinating their activities with our firm, this customer adopts formal communication channels (i.e., channels are regularized and structured as opposed to being casual and informal).<br>This customer has written down the terms of our relationship in detail.<br>This customer has developed a set schedule of times at which they communicate with our firm over the course of a particular transaction.<br>This customer has explicitly communicated their precise information requirements from our firm at particular points in time over the course of a particular transaction.<br>This customer has explicitly verbalized and discussed the terms of our relationship.<br>This customer has conveyed their expectations from the relationship to our firm in detail.<br>**Rationality** (adapted from Payan and McFarland 2006)<br>This customer provides specific information or data in order to make a case for a particular course of action that they would like us to implement.<br>This customer provides justification for a particular course of action through research findings that they make available to us.<br>This customer shares the results of their past experience with us in making a case for a particular course of action that they would like us to implement. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Lages, Silva, and Styles (2009) | Communication quality and information sharing as dimensions of relationship capabilities | **Communication Quality**<br>The parties involved had continuous interaction during implementation of strategy.<br>The strategy's objectives and goals were communicated clearly to involved and concerned parties.<br>Team members openly communicated while implementing the strategy.<br>There was extensive formal and informal communication during implementation.<br>**Amount of Information Sharing**<br>The importer frequently discussed strategic issues with us.<br>The importer openly shared confidential information with us.<br>This importer rarely talked with us about its business strategy. (reverse coded) |
| Scheer, Miao, and Garrett (2010) | Communication capability (effective, productive, formal and informal, timely) | **Communication Capability (1=very weak, 7=very strong)**<br>Capability to effectively communicate to our firm.<br>Capability to develop formal communication channels and procedures with our firm.<br>Capability to have productive communication with our firm.<br>Capability to develop informal communication channels with our firm.<br>Capability to encourage productive feedback and input from our firm.<br>Capability to provide our firm with timely information regarding problems it encounters. |
| Cao, Vonderembse, Zhang, and Ragu-Nathan (2010) | Collaborative communication (Frequent, open, bi-directional, informal, multi-channel, non-coercive) and information sharing (relevant, complete, accurate, confidential, and timely) as separate constructs | **Information sharing**<br>Our firm and supply chain partners...<br>Exchange relevant information<br>Exchange timely information<br>Exchange accurate information<br>Exchange complete information<br>Exchange confidential information<br>**Collaborative communication**<br>Our firm and supply chain partners...<br>Have frequent contacts on a regular basis<br>Have open and two-way communication<br>Have informal communication<br>Have many different channels to communicate<br>Influence each other's decisions through discussion rather than request |

Note that at least one item in nearly all the studies listed in Table 3-1 explicitly refers to some form of information transfer, sharing, or exchange, reinforcing the importance of communications content (and its facets) as part of the collaborative communications construct.

Information sharing as operationalized and measured has a variety of facets, requiring the researcher to select facets that seem to appropriately cover the scope of the domain as recommended by Churchill (1988) and Gerbing and Anderson (1991).

The various process facets of collaborative communications are less consistently measured; however, it may be noteworthy (and in any case is noted) that recent studies (Lages, Silva, and Styles 2009; Scheer, Miao, and Garrett 2010) all explicitly measure both informal and formal instances of communication. Additionally, several earlier studies implicitly measure formal and informal communication, asking respondents to indicate the degree to which they communicate informally, and "not just according to a pre-specified plan" (Lusch and Brown 1996; Krause 1999). This lends weight to the contention that both formal and informal communication are desirable in inter-organizational collaboration; formality helps ensure that all key personnel are informed in due course, while informal communication helps assure that communication is appropriately timely and frequent. Note further that several studies implicitly condition the transfer of proprietary information upon whether it will help the partnership fluorish (Lusch and Brown 1996; Krause 1999; Antia and Frazier 2001; Bello, Chelariu and Zhang 2003), supporting the contention made earlier that a proprietary nature need not be a facet of collaborative communications content.

As noted in Chapter 2 prior, an operationalization is adopted for focal firm collaborative communications capability that incorporates the following facets: accurate, relevant, and complete content, along with timely, frequent, formal/informal, and bidirectional process characteristics. Following an extensive review of the relevant literature for measurement items

used in prior research, an eight-item measure for collaborative communications capability of the focal firm is proposed, as shown in Table 3-1b.

**TABLE 3-1b**

**PROPOSED MEASURE OF FOCAL FIRM COLLABORATIVE COMMUNICATIONS CAPABILITY**

| **Focal Firm Collaborative Communications Capability** |
|---|
| Our firm exchanges relevant information with our key supplier. |
| Our firm exchanges whatever information we believe necessary to the success of the relationship with our key supplier. |
| Our firm exchanges accurate information with our key supplier. |
| Our firm shares information with our key supplier on a timely basis. |
| Our firm has frequent contacts with our key supplier. |
| Two-way feedback is a hallmark of our firm's communication with our key supplier. |
| Our firm arranges formal communication with our key supplier. |

### 3.2. Focal Firm Collaborative Flexibility Capability Measures

As with collaborative communications, an extensive review of the research literature was used to identify items used to measure flexibility of the focal firm (and/or supplier) in collaborative relationships. Items measuring the flexibility of the supplier as well as the focal firm are deemed appropriate in this portion of the literature review, on the grounds that flexibility

on the part of any partner in a collaborative relationship will tend to enhance collaborative outcomes. Table 3-2a following provides items identified:

**TABLE 3-2a**

**PREVIOUSLY USED MEASURES OF COLLABORATIVE FLEXIBILITY**

| **Source** | **Definition of construct** | **Measurement items** |
|---|---|---|
| Gundlach, Achrol, and Mentzer (1995) | Flexibility as a component of relational social norms | Relationship is flexible in accommodating one another if special problems/needs arise. |
| Doney and Cannon (1997) | Supplier willingness to customize | **Supplier Firm Willingness to Customize for Buyer (not at all-very much)**<br>Just for us this supplier is willing to customize its products.<br>Just for us this supplier is willing to change its production process.<br>Just for us this supplier is willing to change its inventory procedures.<br>Just for us this supplier is willing to change its delivery procedures.<br>Just for us this supplier is willing to invest in tools and equipment. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Cannon and Perreault (1999) | Flexibility as element of cooperative norms | **In this relationship it is expected that...(very inaccurate description-very accurate description of this relationship)**<br>Both sides are willing to make cooperative changes.<br>**Buyer adaptations (not at all - very much)**<br>Just for this supplier, we changed our product's features.<br>Just for this supplier, we changed our personnel.<br>Just tor this supplier, we changed our inventory and distribution.<br>Just for this supplier, we changed our marketing.<br>Just for this supplier, we changed our capital equipment and tools. |
| Cannon and Homburg (2001) | Supplier flexibility in accommodating the customer | **(strongly agree-strongly disagree)**<br>This supplier is flexible enough to handle unforeseen problems.<br>This supplier handles changes well.<br>This supplier can readily adjust its inventories to meet changes in our needs.<br>This supplier is flexible in response to requests we make. |
| Zhao, Dröge, and Stank (2001) | Ability to accommodate changing circumstances and changing customer requirements) | My firm has increased operational flexibility through supply chain collaboration.<br>In comparison to three years ago, my firm's logistical capability is significantly more responsive (pull) as compared to predetermined (push).<br>My firm has developed information linkages with customers that permit substantial last-minute accommodation without loss of planned efficiencies.<br>My firm has developed programs to facilitate postponement of final product. manufacturing, packaging, labeling, or assembly until customer preferences become more certain. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Antia and Frazier (2001) | Flexibility (willingness to make alterations as circumstances change) as component of relationalism | Flexibility in response to requests for changes is a characteristic of this relationship.<br><br>We expect to make adjustments in the ongoing relationship to cope with changing circumstances.<br><br>When some unexpected situation arises, we would rather work out a new deal together than hold each other to the original terms.<br><br>Changes in terms are not ruled out by the parties if considered necessary. |
| Lin (2004) | Manufacturing flexibility (ability to customize, to respond quickly to changing customer requirements, to adapt to changing circumstances) | Changeover time of the manufacturing system of your company is very short<br><br>Your company adopts flexible manufacturing processes<br><br>Your company can make customized product offering (sic)<br><br>Your company's manufacturing system has the ability to dealing (sic) with unexpected events<br><br>Your company have the ability to quickly respond to customers' order changes |
| Prahinski and Benton (2004) | Focal firm flexibility in making changes and solving problems, as evaluated by supplier | **(1 = very flexible to 7 = very inflexible)**<br><br>How flexible is (Mfg) in response to requests your firm makes?<br><br>When we are solving problems jointly, how flexible is (Mfg) in resolving them? |
| Homburg, Kuester, Beutin, and Menon (2005) | Flexibility of the supplier | This supplier is flexible enough to handle unforeseen problems.<br><br>This supplier handles changes well.<br><br>This supplier can readily adjust its inventories to meet changes in our needs.<br><br>This supplier is flexible in response to requests we make. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Gounaris (2005) | Flexibility (open to ideas and suggestions) as a component of soft process quality | Open to suggestions/ideas |
| Ghosh and John (2005) | Ability to be flexible under changing circumstances, requirements, and requests | Purchasing contracts may specify the design features of the item(s) such as the type of materials to be used. How would you describe the arrangement for design specifications for the item(s) under this contract? (Choose one)<br>No changes in design specs permitted.<br>Mutually approved changes in design specs permitted.<br>Unilateral changes in design specs are possible.<br>Contract does not specify the design features of this item(s). |
| Moser and Blome (2008) | Short-term and long-term flexibility capabilities | **Short-term Flexibility**<br>Changes in Current Orders<br>Delivery Flexibility<br>Short-term Product Introduction<br>Short-term Production Volume Change<br>**Long-term Flexibility**<br>Geographical Flexibility<br>Product Portfolio Flexibility<br>R&D Strategy Flexibility<br>PLC adapted Production Flexibility |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Scheer, Miao, and Garrett (2010) | Supplier operations capability (ability to adjust to dynamic environment) | Capability to design desirable new products for our firm.<br><br>Capability to accommodate our firm's design changes within required deadlines.<br><br>Capability to improve the features of its products our firm purchases each year.<br><br>Capability to develop new technologies that enhance its products sourced by our firm. |
| Pettit, Fiksel, and Croxton (2010) | Flexibility in sourcing, flexibility in order commitment, and adaptability (ability to modify operations in response to challenges or opportunities) | **Flexibility in sourcing (proposed sub-factors)**<br><br>Part commonality, Modular product design, Multiple uses, Supplier contract flexibility, Multiple sources<br><br>**Flexibility in order fulfillment (proposed sub-factors)**<br><br>Ability to quickly change outputs or the mode of delivering outputs, Alternate distribution channels, Risk pooling/sharing, Multi-sourcing, Delayed commitment, Production postponement, Inventory management, Re-routing of requirements |

As Table 3-2a illustrates, the measurement items for collaborative flexibility are concerned chiefly with the ability of the firm (whether focal firm or supplier) to change and adapt as circumstances and requirements change (Gundlach, Achrol, and Mentzer 1995; Doney and Cannon 1997; Cannon and Perreault 1999; Lin 2004; Homburg et al 2005; Scheer, Miao, and Garrett 2010). Note also that several of the studies listed contain measurement items explicitly addressing the firm's ability to make changes in response to partner *requests* (Antia and Frazier 2001; Cannon and Homburg 2001; Prahinski and Benton 2004; Homburg et al 2005). A measure of collaborative flexibility is proposed as shown in Table 3-2b following.

**TABLE 3-2b**

**PROPOSED MEASURE OF COLLABORATIVE FLEXIBILITY**

| **Focal Firm Collaborative Flexibility Capability** |
|---|
| Our firm has increased operational flexibility through collaboration with our key supplier… |
| Our firm has the ability to work with our key supplier to respond quickly to customers' order changes… |
| Our firm's relationship with our key supplier is flexible in accommodating either partner if special problems/needs arise… |
| Our firm has developed programs with our key supplier to permit postponement of final product manufacturing, packaging, labeling, or assembly until customer preferences become more certain… |

As Table 3-2b illustrates, the proposed measure of focal-firm collaborative flexibility taps the facets of quick response to customer order changes, responsiveness to customer preferences, and response to unforeseen developments, all factors identified as important facets of collaborative flexibility in the relevant literatures.

### 3.3. Focal Firm Collaborative Orientation

Some of the facets of collaborative orientation have been operationalized and measured in prior research as collaborative belief, solidarity, or relationalism. A review of the prior research literature for items used in measurement of collaborative belief, solidarity, and/or relationalism are summarized in Table 3-3a following:

**TABLE 3-3a**

**PREVIOUSLY USED MEASURES OF COLLABORATIVE ORIENTATION**

| **Source** | **Definition of construct** | **Measures** |
|---|---|---|

| Source | Definition of construct | Measures |
|---|---|---|
| Lusch and Brown (1996) | Solidarity is the willingness of the firms to strive for joint solutions and benefits; partially overlapping component (along with information transfer and flexibility) of relationalism | When our major supplier incurs problems, we try to help.<br><br>We share in the problems that arise in the course of dealing with our major supplier.<br><br>We are committed to improvements that may benefit relationships with our major supplier as a whole and not only ourselves.<br><br>We do not mind owing our major supplier favors. |
| Jap and Ganesan (2000) | Solidarity operationalized as commitment to improvements that benefit relation as a whole, not just one party; problems treated as joint responsibility; partners do not mind owing each other favors | Problems that arise in the course of this relationship are treated by my firm and X as joint rather than individual responsibilities.<br><br>Both firms are committed to improvements that may benefit the relationship as a whole and not only the individual parties.<br><br>The firms do not mind owing each other favors. |
| Antia and Frazier (2001) | Solidarity is the willingness of the firms to strive for joint solutions and benefits; partially overlapping component (along with information transfer and flexibility) of relationalism | Problems that arise in the course of this relationship are treated by the parties as joint rather than individual responsibilities.<br><br>The parties are committed to improvements that may benefit the relationship as a whole and not only the individual parties.<br><br>The responsibility for making sure that the relationship works for both of us is shared jointly. |
| Joshi and Campbell (2003) | Collaborative belief: the belief that cooperation with other organizations can generate economic rents (relational rents) | Our upstream (e.g., suppliers) and downstream (e.g., distributors) trading partners play important roles in creating competitive advantage for us in the marketplace.<br><br>Increased coordination with our trading partners can enhance our competitive advantage in the marketplace.<br><br>Our success in the marketplace is influenced by the actions of our trading partners. |

| Source | Definition of construct | Measures |
|---|---|---|
| Wong, Wilkinson, and Young (2010) | Cooperativeness, including desire and ability to maintain good trading relations (measured at buyer and supplier level) | **Respondent firm's cooperativeness (highly uncooperative-highly cooperative)**<br>My firm has and demonstrates a sincere interest in Firm X's success<br>We work hard to maintain a good working relationship with Firm X<br>My firm has the desire and ability to maintain a good trading relationship with Firm X<br>My firm has a genuine interest in Firm X's continued business<br>My firm is interested in helping to make Firm X's operations profitable<br>My firm works well as a team with Firm X |

Returning to the intention-communication-action framework, it appears that the measurement items for solidarity are concerned as much with collaborative action as they are with collaborative intention (cf. Lusch and Brown 1996: "When our major supplier incurs problems, we try to help," and "We share in the problems that arise in the course of dealing with our major supplier;" or Antia and Frazier 2001: "Problems that arise in the course of this relationship are treated by the parties as joint rather than individual responsibilities," or "The responsibility for making sure that the relationship works for both of us is shared jointly").

In contrast, items drawn from the collaborative belief construct (Joshi and Campbell 2003) and/or cooperativeness (Wong, Wilkinson, and Young 2010) seem to tap the intention to collaborate or the belief that collaboration in general will benefit the firm, even before any action

is taken: for example, “Our upstream (e.g., suppliers) and downstream (e.g., distributors) trading partners play important roles in creating competitive advantage for us in the marketplace” from Joshi and Campbell (2003), and “My firm has the desire and ability to maintain a good trading relationship with Firm X” from Wong, Wilkinson, and Young (2010). Accordingly, focusing primarily on the “intention” elements of belief that collaboration is a good thing and that collaboration will benefit the firm, the following four-item measure of collaborative orientation is proposed (see Table 3-3b):

**Table 3-3b**

**PROPOSED MEASURE OF FOCAL FIRM COLLABORATIVE ORIENTATION**

| **Focal Firm Collaborative Orientation** |
|---|
| Our firm has the desire and ability to maintain a good trading relationship with our key supplier. |
| Our firm’s key supplier plays an important role in creating competitive advantage for our firm in the marketplace. |
| Increased coordination with our firm’s key supplier can enhance our firm’s competitive advantage in the marketplace. |

As discussed above, the proposed measure takes account of the desire and intention to maintain collaborative relationships with partners up and down the value chain, and recognition of the competitive benefits of collaborative value-chain relationships.

### 3.4. Supplier Collaborative Communications Capability

Communication always involved at least two parties. In collaborative communication built on an intention-communication-action framework, all participants bring capabilities to bear

on the efficiency and effectiveness of communication, in order to be able to take appropriate and effective action for the success of the partnership. Therefore, the proposed model must account for the appropriate collaborative communications capabilities of the key supplier as well as those of the focal firm. Table 3-4a following provides a representative set of measures of supplier collaborative communications capabilities drawn from a thorough review of the literatures in collaboration, supplier development, and supply chain management.

**Table 3-4a**

**PREVIOUSLY USED MEASURES OF SUPPLIER COMMUNICATIONS CAPABILITY**

| **Source** | **Definition of construct** | **Measurement items** |
|---|---|---|
| Anderson and Narus (1990) | Communication as formal and informal sharing of meaningful and timely information between firms | Manufacturer X lets our firm know as soon as possible of any unexpected problems with things such as lead times, delivery schedules, or product quality<br><br>(operationalized as 3 items, 7-point scale: strongly disagree/strongly agree) |
| Doney and Cannon (1997) | Confidential information sharing (supplier's) | This supplier shares proprietary information with our firm.<br><br>This supplier will share confidential information to help us. |
| Cannon and Perreault (1999) | Information exchange as the sharing of valuable (proprietary and relevant) information between parties | In this relationship it is expected that...(very inaccurate description-very accurate description ... of this relationship):<br><br>Proprietary information is shared with each other.<br><br>We will both share relevant cost information.<br><br>We include each other in product development meetings.<br><br>We always share supply and demand forecasts. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Jap and Ganesan (2000) | Information exchange as component of relationalism (relational norms) (frequency, completeness, informal, proprietary) | In this relationship, it is expected that any information that might help the other party will be provided to them.<br><br>Information is informally exchanged in this relationship.<br><br>It is expected that we keep each other informed about events or changes that may affect the other party.<br><br>Exchange of information in this relationship takes place frequently.<br><br>It is expected that the parties will provide proprietary information if it can help the other party. |
| Zhao, Dröge, and Stank (2001) | Information sharing (willingness to exchange key information from various functional areas) | My firm effectively shares operational information between departments.<br><br>My firm effectively shares operational information externally with selected suppliers and/or customers.<br><br>My firm maintains an integrated database and access method to facilitate information sharing.<br><br>My firm is willing to share strategic information with selected suppliers. |
| Antia and Frazier (2001) | Information sharing | In this relationship, it is expected that any information that might help the other party will be provided to them.<br><br>Exchange of information in this relationship takes place frequently and informally.<br><br>It is expected that the parties will provide proprietary information if it can help the other party.<br><br>It is expected that we keep each other informed about events or changes that may affect the other party. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Bello, Chelariu, and Zhang (2003) | Information exchange | Regarding your export channel relationship...<br><br>It is expected that both parties will provide proprietary information if it can help the other party.<br><br>Exchange of information in this relationship takes place frequently and informally.<br><br>It is expected that both parties keep each other informed about events or changes that may affect the other party. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Brush and Rexha (2007) | Supplier signaling behavior (advance notice of changes in marketing programs affecting the partner) and disclosing behavior (openness with regard to potential problems) | **Signaling behavior**<br><br>This supplier gives your firm ample notice of planned price changes.<br><br>This supplier does a good job of notifying your firm in advance of any delivery schedule changes.<br><br>This supplier tells your firm of any changes in billing procedures well ahead of time.<br><br>This supplier would inform your firm early of any plans to change the target product.<br><br>This supplier would discuss with your firm any plans to change the quality of the target product.<br><br>This supplier would give your firm plenty of notice if the level of after-sales service was going to change.<br><br>**Disclosing behavior: Withholding Information**<br><br>This supplier would try to cover up if they had a manufacturing setback. (reverse coded)<br><br>This supplier tends to be secretive about politics in their company. (reverse coded)<br><br>**Disclosing Information**<br><br>This supplier gives your firm a clear picture of what goes on behind the scenes in their firm.<br><br>This supplier is willing to let your firm see their weaknesses as well as their strengths. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Scheer, Miao, and Garrett (2010) | Communication capability (effective, productive, formal and informal, timely) | **Communication Capability (1=very weak, 7=very strong)**<br>Capability to effectively communicate to our firm.<br>Capability to develop formal communication channels and procedures with our firm.<br>Capability to have productive communication with our firm.<br>Capability to develop informal communication channels with our firm.<br>Capability to encourage productive feedback and input from our firm.<br>Capability to provide our firm with timely information regarding problems it encounters. |

As previously discussed in Chapter 2 above, review of the relevant literature suggests that the facets of supplier communications capabilities are roughly akin to the facets of focal-firm collaborative communications, though they are not identical. In preference to reproducing all the items from Table 3-1a here, only those measurement items that were used or could be used by a key informant at one firm to report on the communications capability of a partner are reproduced in Table 3-4a. This permits the discussion of the construct and its domain delineation to focus on items that will or can be used to operationalize the desired construct in this dissertation. Beyond this consideration, however, the facets tapped by measurement items in Table 3-4a resemble some those tapped for the collaborative communications construct as discussed at greater length in Chapter 2: "...any information that might help..." (in other words, completeness), relevant information, formal and informal communications, "plenty of notice..." (in other words,

timeliness), frequency, and bi-directionality. The sole facet not explicitly and directly measured in any study in Table 3-4a is accuracy of content.

However, it is not necessary to incorporate identical sets of facets to measure focal firm and key supplier collaborative communications capabilities. It is likely that the focal firm is typically responsible for determining the appropriate process facets of collaborative communication. The key supplier's contribution to collaborative communications on the process side becomes conforming to the preferences of the focal firm, with the possible exception of timeliness. Timeliness tends to be determined more judgmentally and contextually by all participants in communication. In selecting measurement items for supplier communications capabilities, then, focus will be on the content facets used in the main collaborative communications construct (with the exception, as noted above, of accuracy). Wording for the items will be adapted from the syntax used in Scheer, Miao, and Garrett (2010). The proposed measure of supplier communications capability can be seen in Table 3-4b following.

**TABLE 3-4b**

**PROPOSED MEASURE OF SUPPLIER COLLABORATIVE CAPABILITY**

| **Supplier Collaborative Communications Capability** |
|---|
| This supplier has the capability to provide our firm with timely information regarding problems it encounters. |
| In this relationship, it is expected that any information that might help the other party will be provided to them. |
| This supplier has the capability to recognize and share relevant information with our firm. |

### 3.5. Supplier Core Offering Capabilities

Scheer, Miao, and Garrett (2010) define core offering capabilities as the supplier's ability to deliver the requisite product quality to the focal firm, in order to help ensure maximum quality in the final end-user offering. Taking the preceding definition as the starting point for delineation of the domain of the construct, a review of the literatures in collaboration, supply chain management, and supplier development (the supplier development and collaboration literatures being of particular interest for purposes of this dissertation) provided a set of measurement items summarized in Table 3-5a following:

**TABLE 3-5a**

**PREVIOUSLY USED MEASURES OF SUPPLIER CORE OFFERING CAPABILITY**

| **Source** | **Definition of construct** | **Measurement items** |
|---|---|---|
| Doney and Cannon (1997) | Product/service performance | **Product/Service Performance [How did this supplier compare with others on each of these criteria?**<br>**(much worse than others-equal to others-much better than others)]**<br>product/service features<br>product/service quality<br>product/service reliability<br>technical support<br>after sale service and support |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Ulaga and Eggert (2006) | Product support (quality) delivered by key supplier compared to a second supplier | Compared to the second supplier, the main supplier provides us with better product quality.<br>Compared to the second supplier, the main supplier meets our quality standards better.<br>Compared to the second supplier, the main supplier's products are more reliable.<br>Compared to the second supplier, we reject less products from the main supplier.<br>Compared to the second supplier, the main supplier provides us with more consistent product quality over time.<br>Compared to the second supplier, we have less variations in product quality with the main supplier. |
| Dyer and Hatch (2006) | Product quality (lower number of defects per million parts) | Operationalized as change in the rate of defects (number of defects per million parts delivered by supplier) |
| Scheer, Miao, and Garrett (2010) | Core offering capability (offering quality) | The products of this supplier are of high quality.<br>We often complain about this supplier's products. (reverse coded)<br>This supplier's product quality is excellent.<br>This supplier rarely delivers incorrect products.<br>This supplier rarely delivers wrong quantity. |

A perusal of Table 3-5a suggests that quality and reliability are the most-often cited facets of supplier core offering quality, with consistency/lack of variability (Ulaga and Eggert 2006) and delivery of correct products in correct quantities (Scheer, Miao, and Garrett 2010) also appearing. The domain of supplier core offering capabilities is accordingly conceptualized here as encompassing the facets of the ability of the supplier to produce high quality and reliability in

its core offering. Measurement items capturing quality and reliability will be incorporated into the measure used for the supplier core offering capabilities construct, adapting the syntax from the scale used by Scheer, Miao, and Garrett (2010). The proposed measurement items are listed in Table 3-5b following:

**TABLE 3-5b**

**PROPOSED MEASURE OF SUPPLIER CORE OFFERING CAPABILITY**

| **Supplier Core Offering Capability** |
|---|
| This supplier's products are highly reliable. |
| We reject very few or no products from this supplier. |
| This supplier provides us with consistent product quality over time. |
| We have few or no variations in product quality with the main supplier. |

### 3.6. Supplier Operations Capabilities

A review of the literature in supply chain management, supplier development, and colloaboration suggests that the domain of supplier operations capabilities encompasses the supplier's ability to customize products as needed, and/or otherwise adjust to changing requirements and circumstances (Scheer, Miao, and Garrett 2010). Taking this definition as a point of departure, Table 3-6a following lists measurement items used in prior research to assess supplier operations capabilities and related constructs:

**TABLE 3-6a**

**PREVIOUSLY USED MEASURES OF SUPPLIER OPERATIONS CAPABILITY**

| **Source** | **Definition of construct** | **Measurement items** |
|---|---|---|

| Source | Definition of construct | Measurement items |
|---|---|---|
| Doney and Cannon (1997) | Supplier willingness to customize | Just for us this supplier is willing to customize its products.<br>Just for us this supplier is willing to change its production process.<br>Just for us this supplier is willing to change its inventory procedures.<br>Just for us this supplier is willing to change its delivery procedures.<br>Just for us this supplier is willing to invest in tools and equipment. |
| Cannon and Homburg (2001) | Supplier flexibility in accommodating the customer | This supplier is flexible enough to handle unforeseen problems.<br>This supplier handles changes well.<br>This supplier can readily adjust its inventories to meet changes in our needs.<br>This supplier is flexible in response to requests we make. |
| Lin (2004) | Manufacturing flexibility (ability to customize, to respond quickly to changing customer requirements, to adapt to changing circumstances) | Changeover time of the manufacturing system of your company is very short<br>Your company adopts flexible manufacturing processes<br>Your company can make customized product offering (sic)<br>Your company's manufacturing system has the ability to dealing (sic) with unexpected events<br>Your company have the ability to quickly respond to customers' order changes |
| Homburg, Kuester, Beutin, and Menon (2005) | Flexibility of the supplier | This supplier is flexible enough to handle unforeseen problems.<br>This supplier handles changes well.<br>This supplier can readily adjust its inventories to meet changes in our needs.<br>This supplier is flexible in response to requests we make. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Ulaga and Eggert (2006) | Time to market and supplier know-how (ability to respond quickly) | **Know-How**<br><br>Compared to the second supplier, the main supplier provides us a better access to his know-how.<br><br>Compared to the second supplier, the main supplier knows better how to improve our existing products.<br><br>Compared to the second supplier, the main supplier performs better at presenting us with new products.<br><br>Compared to the second supplier, the main supplier knows better how to help us drive innovation in our products.<br><br>Compared to the second supplier, the main supplier knows better how to assist us in new product development.<br><br>**Time to Market**<br><br>Compared to the second supplier, the main supplier performs better in helping us improve our time to market.<br><br>Compared to the second supplier, the main supplier helps us more in improving our cycle time.<br><br>Compared to the second supplier, the main supplier helps us more in getting our products to market faster.<br><br>Compared to the second supplier, the main supplier performs better in helping us speed up product development. |

| Source | Definition of construct | Measurement items |
|---|---|---|
| Moser and Blome (2008) | Short-term and long-term flexibility capabilities | **Short-Term Flexibility Capabilities**<br>Changes in Current Orders<br>Delivery Flexibility<br>Short-term Product Introduction<br>Short-term Production Volume Change<br>**Long-Term Flexibility Capabilities**<br>Geographical Flexibility<br>Product Portfolio Flexibility<br>R&D Strategy Flexibility<br>PLC adapted Production Flexibility |
| Scheer, Miao, and Garrett (2010) | Ability of the supplier to adjust to changing circumstances | Capability to design desirable new products for our firm.<br>Capability to accommodate our firm's design changes within required deadlines.<br>Capability to improve the features of its products our firm purchases each year.<br>Capability to develop new technologies that enhance its products sourced by our firm. |

Leaving aside measurement items drawn from scales used to measure related constructs, it appears that ability to adapt to changes in circumstances (design changes, current orders, production volume, unforeseen problems, unexpected events), the ability to customize offerings as needed (assisting in new product development, driving innovation, designing desirable new products, improving features, developing new technologies), and to a somewhat lesser extent the ability to reduce cycle times (especially seen in Ulaga and Eggert 2006) are the important facets

of the domain of supplier operations capability. As noted for supplier communications capability and supplier core offering capability, syntax for the measurement items for the supplier operations capability construct will be adapted from Scheer, Miao, and Garrett (2010), as shown in Table 3-6b following.

**TABLE 3-6b**

**PROPOSED MEASURE OF SUPPLIER OPERATIONS CAPABILITY**

| **Supplier Operations Capability** |
|---|
| This supplier has the capability to design desirable new products for our firm. |
| This supplier has the capability to accommodate our firm's design changes within required deadlines. |
| This supplier has the capability to improve the features of its products our firm purchases each year. |
| This supplier is flexible enough to handle unforeseen problems. |

### 3.7. Output Variable Measures

As discussed in Chapter 2, the focus of this study is on operational outcomes of interfirm collaboration, rather than on trust and commitment. For that reason, the output variables used in the proposed model are operational product-market outcomes. Following Ghosh, Dutta, and Stremersch (2006), the product-market outcomes investigated here are closeness of the final offering to customer needs and delivery performance. Table 3-7a provides an overview of measurement items used in studies of collaboration, supplier development, and the supply chain:

**TABLE 3-7a**

**PREVIOUSLY USED MEASURES OF CLOSENESS OF THE FINAL OFFERING TO CUSTOMER NEEDS (AND RELATED CONSTRUCTS) AND DELIVERY PERFORMANCE**

| Source | Construct | Measurement items |
|---|---|---|
| Doney and Cannon (1997) | Delivery performance | delivery speed<br>delivery reliability<br>product availability |
| Doney and Cannon (1997) | Product/service performance | product/service features<br>product/service quality<br>product/service reliability |
| Prahinski and Benton (2004) | Product quality and delivery performance as dimensions of supplier performance | Product quality<br>Delivery performance |
| Homburg, Kuester, Beutin, and Menon (2005) | Core benefits (product quality and on-time delivery) | |
| Ghosh, Dutta, and Stremersch (2006) | Closeness to customer needs | The degree to which we met the needs of the customer in this relationship was “very low” (1) or “very high” (7). |
| Ghosh, Dutta, and Stremersch (2006) | Delivery performance | Our delivery performance in this relationship was “very low” (1) or “very high” (7). |
| Ulaga and Eggert (2006) | Delivery performance: On-time, accurate in content and quantity | Compared to the second supplier, the main supplier performs better in meeting delivery due dates.<br>Compared to the second supplier, we have less delivery errors with the main supplier.<br>Compared to the second supplier, deliveries from the main supplier are more accurate (no missing or wrong parts). |

| Source | Construct | Measurement items |
|---|---|---|
| Brush and Rexha (2007) | Product quality/reliability, delivery speed/reliability | product quality<br>product reliability<br>delivery speed<br>delivery reliability |
| Paulraj, Lado, and Chen (2008) | Buyer/supplier performance (cost, quality, volume and scheduling flexibility, speed and reliability of delivery, and rapid responsiveness) | **Supplier performance**<br>Quality<br>On-time delivery<br>Delivery reliability/consistency<br>**Buyer performance**<br>Product conformance to specifications<br>Delivery speed<br>Delivery reliability/dependability |

Because much prior work in the area of collaboration comes from the supply chain literature, delivery performance appears to have been measured more often and more consistently than closeness of the final offering to customer needs, although Doney and Cannon (1997) with "product features" may come closer to that conceptualization than a strict rendering of product quality would. Consider that a product may be of acceptable or even excellent inherent quality and yet not be at all close to what end-user customers seek in a given situation. Such a product would be a great solution to some problem other than the one customers seek to solve. The domain of delivery performance in this dissertation is conceptualized to incorporate facets of timeliness (on-time), reliability, consistency, quickness, and conformance to customer

requirements. The measure of closeness to customer needs will incorporate degree to which the final offering meets customer needs, conformance to customer specifications, performance to customer requirements, and degree to which quality meets customer expectations, as shown in Tables 3-7b and 3-7c following:

**TABLE 3-7b**

**PROPOSED MEASURE OF CLOSENESS OF THE OFFERING TO CUSTOMER NEEDS**

| **Closeness to Customer Needs** |
|---|
| The degree to which we met the needs of the customer in this relationship was: “very low” (1) or “very high” (7). |
| The degree to which the final offering conformed to customer specifications was: “very low” (1) or “very high” (7). |
| The degree to which the final offering performed to customer requirements was: “very low” (1) or “very high” (7). |

**TABLE 3-7c**

**PROPOSED MEASURE OF DELIVERY PERFORMANCE**

| **Delivery Performance** |
|---|
| The degree to which delivery of the final offering was reliable was: “very low” (1) or “very high” (7). |
| The degree to which delivery of the final offering was consistent was: “very low” (1) or “very high” (7). |
| The degree to which delivery of the final offering met customer requirements was “very low” (1) or “very high” (7). |

### 3.8. Control Variables

A single item measure will be used for the control variable relationship duration. To operationalize the nature of the offering, a single item asking respondents to rate the complexity of the offering on a Likert-like scale will be used.

# CHAPTER IV

## SAMPLE AND DATA ANALYSIS

The constructs in the measurement instrument for the proposed model are pretested by drawing a pilot sample of respondents from the proposed sampling frame, which consists of purchasing managers and managers performing equivalent functions (following procedures initially developed for supply chain research) in the United States. The sample will be drawn from multiple industries fitting the description of complex business-to-business product/service markets in NAICS codes 22, 23, 31, 32, 333-336, 339, and 517, in order to enhance the generalizability of the results (Dess, Ireland, and Hitt 1990).

The scope of this study is broader than many previous studies in this area, a number of which focuses on Standard Industrial Classification (SIC, the framework replaced by NAICS) codes 35 (industrial machinery and equipment), 36 (electronic machinery and equipment), 37 (transportation equipment), and 38 (instruments and related products). Expanding the scope of the study contributes to research and practice in inter-firm collaboration in important ways: first, it recognizes the fact that product complexity has increased in industries outside the traditional technology-oriented heavy industries represented in SIC 35, 36, 37, and 38. The increasing complexity of other product-markets and industries enables the investigation of collaborative

capabilities in industries where collaborative practices may not be as long-established as in the industries often used in supply chain research. By expanding the domain of investigation, this study may yield important insights about the generalizability of the constructs and relationships in the proposed models. In addition to the positive benefits listed above, it must be noted that data collection in the B2B setting has become increasingly challenging. At least one recent study has reported a response rate in the neighborhood of 6% (Cao et al 2010). The volume of supply-chain and marketing research conducted in SIC 35-38 may be contributing to "respondent fatigue" to some degree; if this is indeed the case, it may raise questions about the degree to which samples drawn exclusively from these firms accurately represent the population of interest. It is hoped that expanding the sampling frame to additional firms and industries will make available sufficient data to ameliorate any response bias that might mark a particular industry or subset of industries. The specific industries proposed are listed in Table 4-1 following:

**TABLE 4-1. Industries Included in the Sampling Frame**

| **NAICS Code** | **Industry** |
|---|---|
| 22 | Utilities |
| 23 | Construction |
| 31 | Food, Textile, & Related Products Manufacturing |
| 32 | Wood, Paper, Printing, Petroleum, Chemicals, Plastics, & Nonmetal Minerals Manufacturing |
| 333 | Machinery Manufacturing |
| 3336 | Engine, Turbine, and Power Transmission Equipment Manufacturing |
| 334 | Computer and Electronic Product Manufacturing |
| 3341 | Computer and Peripheral Equipment Manufacturing |

| NAICS Code | Industry |
|---|---|
| 22 | Utilities |
| 23 | Construction |
| 31 | Food, Textile, & Related Products Manufacturing |
| 32 | Wood, Paper, Printing, Petroleum, Chemicals, Plastics, & Nonmetal Minerals Manufacturing |
| 335 | Electrical Equipment, Appliance, and Component Manufacturing |
| 3361 | Motor Vehicle Manufacturing |
| 33611 | Automobile and Light Duty Motor Vehicle Manufacturing |
| 336312 | Gasoline Engine and Engine Parts Manufacturing |
| 33632 | Motor Vehicle Electrical and Electronic Equipment Manufacturing |
| 3364 | Aerospace Product and Parts Manufacturing |
| 517 | Telecommunications |
| 3391 | Medical Equipment and Supplies Manufacturing |

Although the Institute for Supply Management does not support dissertation research directly, ISM did kindly provide a list of 5,000 names and mailing addresses in SIC codes 35-38. Scales used in the measurement instrument were adapted from extant measures after an extensive review of the relevant literatures, as recommended by Gerbing and Anderson (1988); the item selection for each construct is described earlier in Chapter 3. The proposed measures and questionnaire were then evaluated by a panel of approximately 10 experienced researchers and managers in the industries of interest. These procedures assure sufficient initial content validity of the measures.

### 4.1. Pretest Data Collection and Analysis

After minor modification of the instrument based on feedback provided by the panel, a stratified random $n^{th}$-name sample was drawn, in order that the proportion of potential

respondents from each SIC/NAICS classification correspond with the classification's actual proportion of the total sampling frame. A total of 508 questionnaires were mailed to randomly selected respondents from the ISM-provided list. Respondents were contacted by letter with a request for participation accompanied by a paper questionnaire, and given the opportunity to complete the questionnaire via the Web if preferred. A total of 22 completed surveys were received, for a response rate of 4.3%. While low, this response rate is not unusual for the sampling frame; as noted above, a recent study by Cao et al (2010) reported response in the 6% range. However, in order to obtain sufficient additional data for pretest purposes an additional 35 responses were obtained via an online panel of qualified managers assembled by a research firm. Before obtaining the panel data, two items were added to each of the outcome variable measures (closeness to end-user customer needs and delivery performance), in order to better capture the full conceptual domain of each construct and to avoid methodological issues related to measures consisting of three or fewer items.

### 4.1.1. Internal Consistency

A multi-step procedure was employed to evaluate the constructs and their associated measures, and to perform a preliminary investigation of the hypothesized relationships among the constructs. The initial step, following procedures suggested by Gerbing and Anderson (1988) and Viswanathan (2005), was to inspect the constructs for internal consistency. Internal consistency analysis typically begins with an inspection of the item-total correlation of each item in each of the constructs, in order to determine the contribution of each item to the construct of which it is a constituent (Gerbing and Anderson 1988). Cronbach's alpha was subsequently

computed for each scale and item in order to determine the internal consistency of the scales (Gerbing and Anderson 1998). Like most empirical tests, alpha is not without weaknesses; in particular, the alpha coefficient tends to increase with the number of items in the proposed measure. Other methods suggested by Viswanathan (2005) include test-retest and multitrait-multimethod procedures. Neither procedure is available in this study; respondents take a single test and only a single method is used (the Likert-like scale in the questionnaire). Therefore, despite its potential limitations, Cronbach's alpha will be the procedure used in this study to establish internal measure consistency.

**Table 4-2. Item-Total Correlations and Cronbach's Alpha for Each Construct**

| | | Item-Total Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| Focal firm collaborative communications capability n=57 α=0.935 | Relevant | 0.921 | | | | | | | |
| | Complete | 0.867 | | | | | | | |
| | Accurate | 0.805 | | | | | | | |
| | Timely | 0.786 | | | | | | | |
| | Frequent | 0.769 | | | | | | | |
| | Bi-directional | 0.836 | | | | | | | |
| | Formal | 0.796 | | | | | | | |
| | Informal | 0.253 | | | | | | | |
| Focal firm collaborative flexibility capability n=57 α=0.879 | Deal with unexpected events | | 0.711 | | | | | | |
| | Quick response to customers | | 0.758 | | | | | | |
| | Increased flexibility via collaboration | | 0.712 | | | | | | |
| | Postpone activities until customer preferences clear | | 0.609 | | | | | | |
| Focal firm collaborative orientation n=57 α=0.931 | Desire/ability to maintain trading relation | | | 0.836 | | | | | |
| | Key supplier important to competitive advantage | | | 0.870 | | | | | |
| | Increased coordination w/ key supplier for competitive advantage | | | 0.769 | | | | | |
| Supplier collaborative communications capability n=57 α=0.946 | Timely | | | | 0.861 | | | | |
| | Complete | | | | 0.825 | | | | |
| | Relevant | | | | 0.837 | | | | |
| Supplier core offering | Highly reliable | | | | | 0.910 | | | |
| | Reject few or no products | | | | | 0.933 | | | |

| | | Item-Total Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| capability n=57 α=0.960 | Consistent quality over time | | | | | 0.887 | | | |
| | Few or no variations in quality | | | | | 0.800 | | | |
| Supplier operations capability n=57 α=0.921 | Capacity to design desirable products | | | | | | 0.747 | | |
| | Accommodate design changes within deadline | | | | | | 0.785 | | |
| | Improve features of products purchased each year | | | | | | 0.791 | | |
| | Handle unforeseen problems | | | | | | 0.806 | | |
| Closeness of the final offering to end-user needs n=35 α=0.957 | Met customer needs | | | | | | | 0.907 | |
| | Conformed to customer specifications | | | | | | | 0.813 | |
| | Performed to customer requirements | | | | | | | 0.924 | |
| Delivery performance n=35 α = 0.965 | Reliable | | | | | | | | 0.905 |
| | Consistent | | | | | | | | 0.908 |
| | Met customer requirements | | | | | | | | 0.930 |

### 4.1.2. Unidimensionality

In order to evaluate construct unidimensionality, exploratory factor analyses were conducted for each of the proposed constructs in the model, using the maximum likelihood method. Although principal component analysis is sometimes used in EFA, common factor analysis was used in this pretest. Principal components analysis looks at all components of variance in a measure, while common factor analysis focuses on the variance common to the items in a proposed measure (Viswanathan 2005). Because the underlying construct is the phenomenon of interest in this part of the study, common factor analysis is used in preference to PCA (additionally, maximum likelihood will be used for confirmatory factor analysis and analysis of the structural model in the next stage of this study, as described below). Results follow in Table 4-3:

**Table 3-10. Exploratory Factor Analysis of Each Construct**

| | | Factor Loadings | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| **Focal firm collaborative communications capability n=57** | Relevant | **95** | | | | | | | |
| | Complete | **89** | | | | | | | |
| | Accurate | **83** | | | | | | | |
| | Timely | **83** | | | | | | | |
| | Frequent | **81** | | | | | | | |
| | Bi-directional | **86** | | | | | | | |
| | Formal | **83** | | | | | | | |
| **Focal firm collaborative flexibility capability n=57** | Deal with unexpected events | | **80** | | | | | | |
| | Quick response to customers | | **85** | | | | | | |
| | Increased flexibility via collaboration | | **77** | | | | | | |
| | Postpone activities until customer preferences clear | | **64** | | | | | | |
| **Focal firm collaborative orientation n=57** | Desire/ability to maintain trading relation | | | **89** | | | | | |
| | Key supplier important to competitive advantage | | | **90** | | | | | |
| | Increased coordination w/ key supplier for competitive advantage | | | **80** | | | | | |
| **Supplier collaborative** | Timely | | | | **91** | | | | |
| | Complete | | | | **83** | | | | |

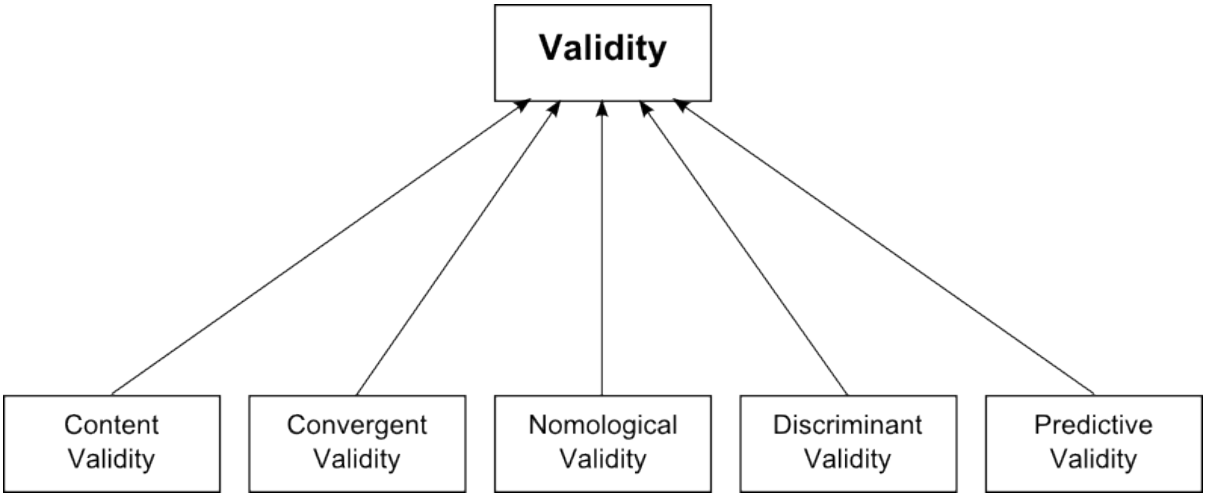
| | | Factor Loadings | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| **communications capability n=57** | Relevant | | | | **87** | | | | |
| **Supplier core offering capability n=57** | Highly reliable | | | | | **94** | | | |
| | Reject few or no products | | | | | **95** | | | |
| | Consistent quality over time | | | | | **92** | | | |
| | Few or no variations in quality | | | | | **82** | | | |
| **Supplier operations capability n=57** | Capacity to design desirable products | | | | | | **79** | | |
| | Accommodate design changes within deadline | | | | | | **83** | | |
| | Improve features of products purchased each year | | | | | | **84** | | |
| | Handle unforeseen problems | | | | | | **83** | | |
| **Closeness of final offering to end-user needs n=35** | Met customer needs | | | | | | | **92** | |
| | Conformed to customer specifications | | | | | | | **82** | |
| | Performed to customer requirements | | | | | | | **96** | |
| **Delivery performance n=35** | Reliable | | | | | | | | **93** |
| | Consistent | | | | | | | | **93** |
| | Met customer requirements | | | | | | | | **95** |

In all cases, scree tests (not reproduced here but available upon request showed the single-factor solution is preferable to other possible solutions. Therefore, based on analysis of the pretest data, all scales used in the study appear to be satisfactorily unidimensional. Note that *n* for the dependent variables is smaller (n=35) than for the independent variables; this is due to the addition of two items to each of the dependent- variable measures prior to the use of the qualified panel for additional data collection. Under ideal circumstances, confirmatory factor analysis would also be conducted in order to evaluate the measurement model, but the pretest did not yield sufficient data in the time allotted for it. This step will be conducted as part of the main empirical test, upon collection of sufficient additional data.

**4.1.3. Measure Validity**

Having assessed the internal consistency and unidimensionality of the measures to be used, the final step in the pre-test is to assess the validity of the measures. The validity of a measure refers to whether it measures what it purports to measure, and consists of a number of dimensions, as illustrated in Figure 3.1 below.

**Figure 4.1 Forms of Validity**



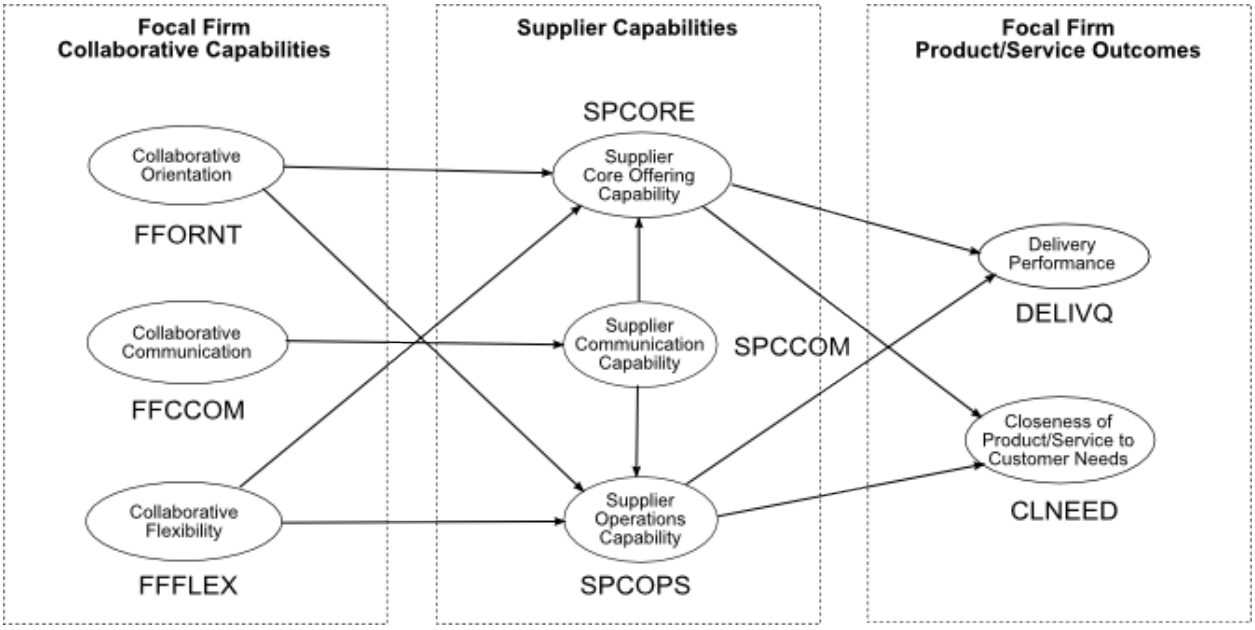

(Adapted from Viswanathan 2005)

### 4.1.4. Nomological Validity

Viswanathan (2005) describes nomological validity as the "empirical counterpart" to domain delineation. To establish nomological validity of a construct, one should find evidence that it is related to constructs with which it should be related. The limited pre-test sample in this study limits what can be done empirically to establish nomological validity; however, one procedure that can be used is simple regression analysis for the individual model paths. The model proposes relationships among the variables; a significant regression result might then suggest that there is indeed a relationship among the variables as hypothesized. Confirmatory factor analysis and structural equation modeling would be a stronger test of nomological validity (the simultaneous action of all the hypothesized links calls for simultaneous analysis of the path

relationships), but the volume of pretest data is not sufficient to allow SEM to be used. For the reader's convenience, the proposed model is reproduced here in Figure 4.2:

**Figure 4.2: Model of Interfirm Collaboration**




Pretest data is limited to 35 observations for the dependent variables (CLNEED and DELIVP as shown in the model above) and 57 observations for the various independent variables. Accordingly, regression tests have been conducted using the pretest data in order to investigate the path relationships between model variables, by testing the individual paths in the structural model above. At this stage of the study, intervening-variable models are not investigated, leaving five regression models to be estimated. The first model estimates delivery performance as a function of supplier core offering capability and supplier operations capability. The overall model is significant at $p<.0001$ ($F = 119.26$, adjusted $r^2=0.874$), with both supplier core offering capability (0.709, $t=8.55$, $p<.0001$) and supplier operations capability (0.264,

t=3.12, p<.01) significantly contributing to variance in delivery performance, providing some preliminary empirical evidence (along with the extensive review of the literature as described in Chapter 2 above) of nomological validity for these constructs.

Supplier core offering capability and supplier operations capability are also related in the second model to the outcome variable closeness of the final offering to end-user needs. The overall model is significant at the .0001 level (F=100.09, adjusted $r^2$=0.854). Supplier core offering capability is significantly associated with closeness of the final offering to end-user needs (0.707, t=9.35, p<.0001), but supplier operations capability (0.074, t=0.96) is not. Results of the regression analysis indicate that supplier core offering capability, at least, is significantly associated with closeness of the final offering to end-user needs, offering preliminary empirical evidence in support of the nomological validity of those two constructs. However, it is interesting to note that the supplier capability associated with flexibility and customization is not associated with closeness of the final offering to end-user needs, while it is associated with delivery performance. It is possible to speculate that focal firms see supplier flexibility capability as more enabling the partnership to meet deadlines and other elements of delivery performance, while the focal firm (at least in the eyes of respondents) bears primary responsibility for directing the actual design and/or customization (to the extent appropriate) of the final offering.

The third pretest regression model seeks to estimate the relationship between supplier core offering capability and focal firm collaborative flexibility capability, focal firm collaborative orientation, and supplier collaborative communications capability. Although the regression model is significant at .0001 (F=35.60, adj. r2=0.645), only supplier collaborative

communications is significantly associated with supplier core offering capability (0.592, t=0.707, p<.0001). Neither focal firm collaborative flexibility capability (0.110, t=1.05) nor focal firm collaborative orientation (-0.056, t=-0.41) are significantly associated with supplier core offering capability. However, the results do indicate at least some preliminary evidence of nomological validity for the SPCORE construct.

The fourth regression model in this stage of the pretest seeks to estimate supplier operations capability as a function of focal firm collaborative flexibility capability, focal firm collaborative orientation, and supplier collaborative communications capability. Once again, the overall model is significant at .0001 (F=.23.14, adj. $r^2$=0.543), and both focal firm collaborative flexibility capability (0.253, t=2.10, p<.05) and supplier collaborative communications capability (0.508, t=5.26, p<.0001) are significantly associated with supplier operations capability. However, focal firm collaborative orientation is not significantly associated with supplier outcome capability, and as was the case with supplier core offering capability in the immediately previous model, the parameter estimate is not in the hypothesized direction (-0.086, t=-0.55). Because this is a pretest rather than a formal hypothesis test, the results are not as troubling as they might seem. For any preliminary evidence of nomological validity to be present, one would expect the corresponding focal-firm and supplier constructs (in this case, focal firm collaborative flexibility capability and supplier operations capability) to show a statistically significant relationship, and it is encouraging that they do.

The fifth and final pretest regression model estimates supplier collaborative communications capability as a function of focal firm collaborative communications capability.

As was the case for the other four pretest regression models, the overall model is significant at .0001 (F=32.90, adj. $r^2$=0.359), and the parameter estimate for focal firm collaborative communications (0.560) is also significant at .0001 (t=5.74), suggesting (along with the literature review as described in Chapter 2 above) in a preliminary way that there is evidence for nomological validity for these constructs. Although the analyses conducted here are not without limitation), there appears to be sufficient evidence of nomological validity – and evidence supporting at least some of the hypothesized model relationships – to warrant proceeding with the final study. One key limitation relates to the relatively small sample size in the pretest. As noted by O'Rourke, Hatcher, and Stepanski (2005) as well as Berry and Feldman (1985), one potential effect of a small sample in regression is multicollinearity among the variables. As part of the regression analyses reported here, correlations of the variables in each regression model were run (not reproduced herein). The correlation results (Table 4.4) suggest that multicollinearity is present, because a number of the correlation coefficients for the summed variables are greater than 0.80 (Berry and Feldman 1985). However, some multicollinearity is to be expected, because the constructs themselves are theoretically related to one another in at least some cases.

**Table 4.4 Correlation Coefficients of the Summed Variables**

| Variable | SPCORE | SPCOPS | DELIVQ | CLNEED | FFORNT | FFFLEX | SPCCOM | FFCOM9 |
|---|---|---|---|---|---|---|---|---|
| **SPCORE** | 1.0000 | | | | | | | |
| **SPCOPS** | 0.7038 | 1.0000 | | | | | | |
| **DELIVQ** | **0.9196** | 0.7821 | 1.0000 | | | | | |
| **CLNEED** | **0.9264** | 0.6969 | **0.9229** | 1.0000 | | | | |
| **FFORNT** | 0.4293 | 0.4261 | 0.4977 | 0.4368 | 1.0000 | | | |
| **FFFLEX** | 0.6598 | 0.5877 | 0.7175 | 0.7229 | 0.4577 | 1.0000 | | |
| **SPCCOM** | **0.8366** | **0.8455** | **0.8627** | **0.8477** | 0.6006 | 0.6971 | 1.0000 | |
| **FFCCOM** | 0.5179 | 0.3321 | 0.5007 | 0.5483 | 0.7892 | 0.3684 | 0.5609 | 1.0000 |

N=35

In addition, one suggested rule for identifying multicollinearity is a significant overall regression model with no significant parameter estimates for any of the model's independent variables. At least one independent variable is significantly associated with the dependent variable in each of the five regression models tested here. Finally, variance inflation factors were computed (not reproduced herein), and in no case was the VIF greater than 2.4. VIF coefficients of greater than 10 are considered evidence of potentially excessive multicollinearity. Therefore, the tentative conclusion is that multicollinearity is not excessive, though close attention to the issue during the final study is warranted. Regression tables are reproduced in Appendix ___ at the end of this dissertation.

### 4.1.5. Discriminant Validity

Discriminant validity of the constructs was assessed in the pretest by analyzing the factor structure of all the measurement items for the independent variables (along with an unrelated construct – a five-item job satisfaction measure – included in the questionnaire as a check against common method bias) simultaneously, and then doing the same with the dependent variable

measures and job satisfaction measure. In the first test, because it was hypothesized that the variables would load on factors representing the six independent variables (along with one theoretically unrelated construct), a seven-factor structure was specified. In the event, the seven-factor solution met the criterion proposed by Cattell (1958), that the retained factors account for at least 99% of model variance. In addition, promax rotation was specified, since it was expected that the factors would be correlated. Following procedures recommended for the use of oblique rotation in Ward and Kennedy (1999), the pattern matrix is reproduced in Table 4.6a following:

**Table 4.6a. Factor Analysis, All Independent Variables and unrelated construct: Pattern Matrix**

| CONSTRUCT | Item | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Factor6 | Factor7 |
|---|---|---|---|---|---|---|---|---|
| **Focal firm collaborative communications capability** | Relevant | 92 * | -15 | 16 | -16 | 1 | 7 | 2 |
| | Complete | 88 * | 5 | 1 | -2 | 5 | 2 | -9 |
| | Accurate | 77 * | -16 | 9 | 25 | -2 | 12 | -7 |
| | Timely | 82 * | -2 | 11 | -15 | -2 | -8 | 1 |
| | Frequent | 80 * | -5 | 11 | -19 | 4 | 6 | 4 |
| | Bi-directional | 80 * | -6 | 6 | 5 | 1 | 4 | -5 |
| | Formal | 89 * | 17 | -29 | 9 | -5 | -14 | 5 |
| **Focal firm collaborative flexibility capability** | Deal with unexpected events | 13 | 13 | 23 | 57 * | 13 | -16 | -6 |
| | Quick response to customers | -2 | -16 | 48 * | 70 * | 1 | -10 | 7 |
| | Increased flexibility via collaboration | 1 | 3 | 25 | 59 * | -5 | 22 | -4 |
| | Postpone activities until customer preferences clear | -12 | -2 | -27 | 92 * | -8 | 6 | 4 |
| **Focal firm collaborative orientation** | Desire/ability to maintain trading relation | 63 * | 9 | -16 | 25 | -8 | 37 | 17 |
| | Key supplier important to competitive advantage | 52 * | 8 | 16 | 7 | 5 | 62 * | -6 |
| | Increased coordination w/ key supplier for competitive advantage | 65 * | 7 | -13 | -6 | 8 | 34 * | 8 |
| **Supplier collaborative communications capability** | Timely | 2 | 50 * | 29 | 4 | 0 | -15 | 29 |
| | Complete | 36 | 34 | 28 | 3 | -11 | 3 | 24 |
| | Relevant | 7 | 52 * | 23 | 0 | 4 | 1 | 61 * |
| **Supplier core offering capability** | Highly reliable | 7 | 9 | 80 * | -10 | 1 | 2 | 14 |
| | Reject few or no products | -3 | 2 | 95 * | 4 | -3 | 5 | 8 |
| | Consistent quality over time | 7 | 9 | 84 * | -3 | -11 | 1 | -9 |
| | Few or no variations in quality | -9 | 37 | 64 * | -2 | 2 | 7 | -6 |
| **Supplier operations capability** | Capacity to design desirable products | -10 | 80 * | 0 | -16 | -4 | 13 | 9 |
| | Accommodate design changes within deadline | 8 | 72 * | 14 | 16 | 5 | -11 | -3 |
| | Improve features of products purchased each year | -6 | 76 * | -2 | 3 | -2 | 0 | 28 |
| | Handle unforeseen problems | 0 | 85 * | 8 | 4 | -11 | 4 | -12 |
| **Job satisfaction** | Very satisfied with job | -5 | 46 * | 11 | 31 | 24 | 10 | -8 |
| | Satisfied with kind of work done | -9 | -7 | 4 | 1 | 101 * | 0 | 16 |

| CONSTRUCT | Item | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Factor6 | Factor7 |
|---|---|---|---|---|---|---|---|---|
| | Most on this job are satisfied | 16 | 2 | -18 | -4 | 73 * | 5 | -16 |

N=53. Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.429 are flagged by an asterisk (*).
(r) = reversed item

Note that the items for focal firm collaborative communications capability load on Factor 1, but not on any other of the seven factors. Focal firm collaborative flexibility capability loads most strongly on Factor 4 (with one item also loading on Factor 3), and focal firm collaborative orientation on factors 1 and 6. Most of the constructs load on a single factor otherwise, though supplier collaborative communications capability has one item loading on factors 1 and 2 and another on factors 2 and 7. One possible issue is the relatively small number of observations compared to the number of indicators (Bagozzi and Yi 1988), along with a known proclivity of factor analysis to combine two "content" factors into a single "empirical" factor if the two factors are akin to each other and sufficiently different from all other factors under consideration. This latter phenomenon may explain the loading of both focal firm collaborative communications capability and focal firm collaborative orientation on Factor 1, and supplier collaborative communications capability and supplier operations capability on Factor 2. Another possibility is within-measure correlational systematic error, possibly due to a different construct or common method bias (Viswanathan 2005). Confirmatory factor analysis in the final study will be employed to investigate the phenomenon further. As with other potential data-related empirical issues encountered in this study, close observation during the final study will be required.

Results of the factor analysis of the two dependent variable measures and the unrelated construct are reproduced in Table 4.6b following (again, promax rotation was used, and the pattern matrix is reported):

**Table 4.6b. Factor Analysis, Dependent Variables and unrelated construct: Pattern Matrix**

| CONSTRUCT | Item No. | Factor1 | Factor2 | Factor3 |
|---|---|---|---|---|
| **Closeness of the final offering to end-user needs** | Met customer needs | 97 * | 9 | -1 |
| | Conformed to customer specifications | 83 * | -20 | -4 |
| | Performed to customer requirements | 91 * | 5 | 25 |
| **Delivery performance** | Reliable | 76 * | -6 | 34 |
| | Consistent | 72 * | 4 | 49 |
| | Met customer requirements | 92 * | 1 | 7 |
| **Job satisfaction** | Very satisfied with job | 92 * | 4 | -10 |
| | Satisfied with kind of work done | 2 | 74 * | 6 |
| | Most on this job are satisfied | -2 | 99 * | -5 |

N=35. Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.429 are flagged by an asterisk (*).

As the table demonstrates, discriminant validity of the outcome (dependent) constructs closeness of the final offering to end-user needs and delivery performance may be open to question, at least with respect to the pretest data set. Interestingly, though, the three items of the (theoretically unrelated) job satisfaction construct loaded on a separate factor from the constructs of interest. Issues of discriminant validity have not been reported in the literature with regard to constructs closely related to those incorporated in this study, though, opening the possibility that the small sample size contributes to the apparent issues with discriminant validity. As with nomological validity, these issues will bear close observation during the final study.

### 4.1.6. Predictive and Convergent Validity

Predictive validity refers to whether a construct "can predict a criterial outcome" (Viswanathan 2005, p. 72), while convergent validity involves the degree to which a construct is correlated (in other words, whether the construct *converges*) with another measure of the same construct (Viswanathan 2005). Although mentioned here for the sake of thorough coverage of issues surrounding construct validity, neither facet of validity is directly applicable to this study

at this stage. Other measures of the constructs are not tested with this data set, and as the model has not been fully tested, its predictive validity cannot be meaningfully evaluated.

**4.2. Final Study: Procedures**

The hypothesized relationships among the proposed constructs in the model will be tested by conducting a cross-sectional survey of managers with responsibilities that include aspects of inter-firm collaborative efforts in B2B settings, with particular attention to industries marked by relatively high levels of complexity as described above. A cross-sectional survey allows the testing of hypotheses using data drawn from real-world actions and situations, thus enabling a better illumination of the propositions of theory via the light of practice.

Because the proposed model incorporates a number of potential causal relationships that are considered to take place (and therefore should be tested) simultaneously, structural equation modeling will be used to test the relationships among the model's constructs. The purpose of this study is theory development and testing rather than prediction; therefore, maximum-likelihood estimation will be used to estimate the model (Anderson and Gerbing 1988). Maximum likelihood is a full-information procedure, in contrast to partial least squares (PLS). PLS is considered less efficient than a full-information procedure, and lacks any test of overall model fit (Anderson and Gerbing 1988).

After analysis and purification as described above in the pretest, the model constructs of interest consist of a total of 44 items. According to Anderson and Gerbing (1988), a total of 150 items may be sufficient for models with at least 3 indicators for each factor. However, Bentler's recommended minimum of 5 responses per indicator (1985) yields a target n = 160 for the 32

items in the final model and instrument (assuming all items are retained for the final analysis of the theoretical structural model and alternatives to it). The Bentler rule is a more conservative criterion in the context of this study, and will be used, if possible, in preference to the more permissive Gerbing and Anderson (1988) criterion for sample size.

### 4.2.1. Final Data Collection

A total of 500 additional requests for participation were mailed to recipients from the list provided by ISM (excluding those who were contacted during the pretest phase of the study, whether or not the original contactees chose to participate). In addition, a qualified panel of 150 members was secured to complete the questionnaire online. Final data collection took place between November 2012 and March 2013, yielding an additional 156 completed and usable questionnaires from a total of 960 (including mail and panel candidates), for a total response rate of 16.3%. The data thus collected were combined with the pretest data, and missing values were supplied via multiple imputation procedures for a final N=213, comfortably in compliance with the Bentler rule (Bentler 1989). Firms participating in the sample ranged from $10,000 to $70 BN in reported annual sales, averaging just over $1.5 BN in revenue and 6,173 employees including all branches (median 195). Of the respondents reporting supplier size, the average number of employees at the key supplier is 1,509 (median 150). Industries identified in the study include construction, construction and mining equipment, electrical equipment, consumer electronics, oil and gas, fire protection equipment, industrial and municipal water treatment, computers, window manufacturing, semiconductors, textiles and apparel, sporting goods, ammunition and component manufacturing, theatre lighting manufacture, modular and

manufactured housing, construction design, construction supply, and optical networking equipment. A total of 208 of the 213 focal firms are headquartered in the USA, with two in Japan and one each in China, Germany, and India. The majority of the key suppliers (144) are also located in the USA; other countries reported more than once include China (15), Canada (6), and India (5). Country locations mentioned once include Australia, Brazil, France, Malaysia, Mexico, Nigeria, and Switzerland. Respondent job titles include owner, president, chief executive officer, buyer/planner, supply chain analysis, manager or director of information technology, project manager, government expediting manager, buyer, senior buyer, production manager, manager or director of operations, materials manager, procurement manager, purchasing manager, strategic procurement specialist, and director of strategic supply management. See Appendix A for additional descriptive statistics.

The model constructs were first inspected for internal consistency, using the newly collected data under the same procedures as were used in the pretest. Internal consistency tests (Cronbach's alpha) follow in Table 4-7 following:

**Table 4-7. Item-Total Correlations and Cronbach's Alpha for Each Construct**

| | | Item-Total Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVP** |
| Focal firm collaborative communications capability n=213 α=0.927 | Relevant | 0.800 | | | | | | | |
| | Complete | 0.788 | | | | | | | |
| | Accurate | 0.792 | | | | | | | |
| | Timely | 0.759 | | | | | | | |
| | Frequent | 0.762 | | | | | | | |
| | Bi-directional | 0.756 | | | | | | | |
| | Formal | 0.737 | | | | | | | |
| Focal firm collaborative flexibility capability n=213 α=0.904 | Increased operational flexibility via collaboration | | 0.761 | | | | | | |
| | Flexible if special needs arise | | 0.772 | | | | | | |
| | Respond quickly to customer order changes | | 0.809 | | | | | | |
| | Postpone activities until customer preferences clear | | 0.701 | | | | | | |
| Focal firm collaborative orientation n=213 α=0.901 | Desire/ability to maintain trading relation | | | 0.811 | | | | | |
| | Key supplier important to competitive advantage | | | 0.763 | | | | | |
| | Increased coordination w/ key supplier for competitive advantage | | | 0.702 | | | | | |
| Supplier collaborative communications capability n=213 α=0.928 | Timely | | | | 0.810 | | | | |
| | Complete | | | | 0.777 | | | | |
| | Relevant | | | | 0.766 | | | | |
| Supplier core offering | Highly reliable | | | | | 0.822 | | | |
| | Reject few or no products | | | | | 0.790 | | | |

| | | Item-Total Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVP** |
| capability n=213 α=0.905 | Consistent quality over time | | | | | 0.854 | | | |
| | Few or no variations in quality | | | | | 0.728 | | | |
| Supplier operations capability n=213 α=0.901 | Capacity to design desirable products | | | | | | 0.700 | | |
| | Accommodate design changes within deadline | | | | | | 0.819 | | |
| | Improve features of products purchased each year | | | | | | 0.758 | | |
| | Handle unforeseen problems | | | | | | 0.762 | | |
| Closeness of the final offering to end-user needs n=213 α=0.919 | Met customer needs | | | | | | | 0.810 | |
| | Conformed to customer specifications | | | | | | | 0.814 | |
| | Performed to customer requirements | | | | | | | 0.832 | |
| Delivery performance n=213 α = 0.907 | Reliable | | | | | | | | 0.814 |
| | Consistent | | | | | | | | 0.787 |
| | Met customer requirements | | | | | | | | 0.762 |

Correlation analysis was also run, in order to inspect the variables for multicollinearity. Very few inter-item correlation coefficients are above or near the problematic r=0.8 level that signifies excessive multicollinearity. Excessive multicollinearity in the indicators for the constructs of theoretical interest can be a problem in structural equation modeling (Hatcher 1983), and because the constructs of interest are expected to be related to one another, multicollinearity in the data is of potential concern. Its relative absence in this data set is reassuring.

### 4.2.2. Exploratory Factor Analysis

Exploratory factor analysis was conducted with the final data set in order to evaluate the unidimensionality of each of the constructs of interest, to assure that each indicator variable contributes appropriately to the factor for which it serves as an indicator, and to check for common method bias. Maximum likelihood analysis was used for the analysis of each of the model constructs. Ideally, each factor would be unidimensional, with all items loading strongly on the factor. Table 4-9 following depicts the results of exploratory factor analysis.

**Table 4-9: Exploratory Factor Analysis**

| | | Factor Loadings | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| **Focal Firm Collaborative Communications Capability n=213** | Relevant | **83** | | | | | | | |
| | Complete | **82** | | | | | | | |
| | Accurate | **83** | | | | | | | |
| | Timely | **79** | | | | | | | |
| | Frequent | **79** | | | | | | | |
| | Bi-directional | **79** | | | | | | | |
| | Formal | **77** | | | | | | | |
| **Focal Firm Collaborative Flexibility Capability n=213** | Deal with unexpected events | | **84** | | | | | | |
| | Quick response to customers | | **84** | | | | | | |
| | Increased flexibility via collaboration | | **86** | | | | | | |
| | Postpone activities until customer preferences clear | | **73** | | | | | | |
| **Focal Firm Collaborative Orientation n=213** | Desire/ability to maintain trading relation | | | **89** | | | | | |
| | Key supplier important to competitive advantage | | | **84** | | | | | |
| | Increased coordination w/ key supplier for competitive advantage | | | **79** | | | | | |
| **Supplier Collaborative** | Timely | | | | **63** | | | | |
| | Complete | | | | **72** | | | | |

| | | Factor Loadings | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTRUCT** | **Item** | **FFCCOM** | **FFFLEX** | **FFORNT** | **SPCCOM** | **SPCORE** | **SPCOPS** | **CLNEED** | **DELIVQ** |
| **Communications Capability n=213** | Relevant | | | | **86** | | | | |
| **Supplier Core Offering Capability n=213** | Highly reliable | | | | | **87** | | | |
| | Reject few or no products | | | | | **83** | | | |
| | Consistent quality over time | | | | | **90** | | | |
| | Few or no variations in quality | | | | | **76** | | | |
| **Supplier Operations Capability n=213** | Capacity to design desirable products | | | | | | **74** | | |
| | Accommodate design changes within deadline | | | | | | **87** | | |
| | Improve features of products purchased each year | | | | | | **80** | | |
| | Handle unforeseen problems | | | | | | **82** | | |
| **Closeness of Final Offering to End-User Needs n=213** | Met customer needs | | | | | | | **84** | |
| | Conformed to customer specifications | | | | | | | **85** | |
| | Performed to customer requirements | | | | | | | **89** | |
| **Delivery Performance n=213** | Reliable | | | | | | | | **88** |
| | Consistent | | | | | | | | **84** |
| | Met customer requirements | | | | | | | | **82** |

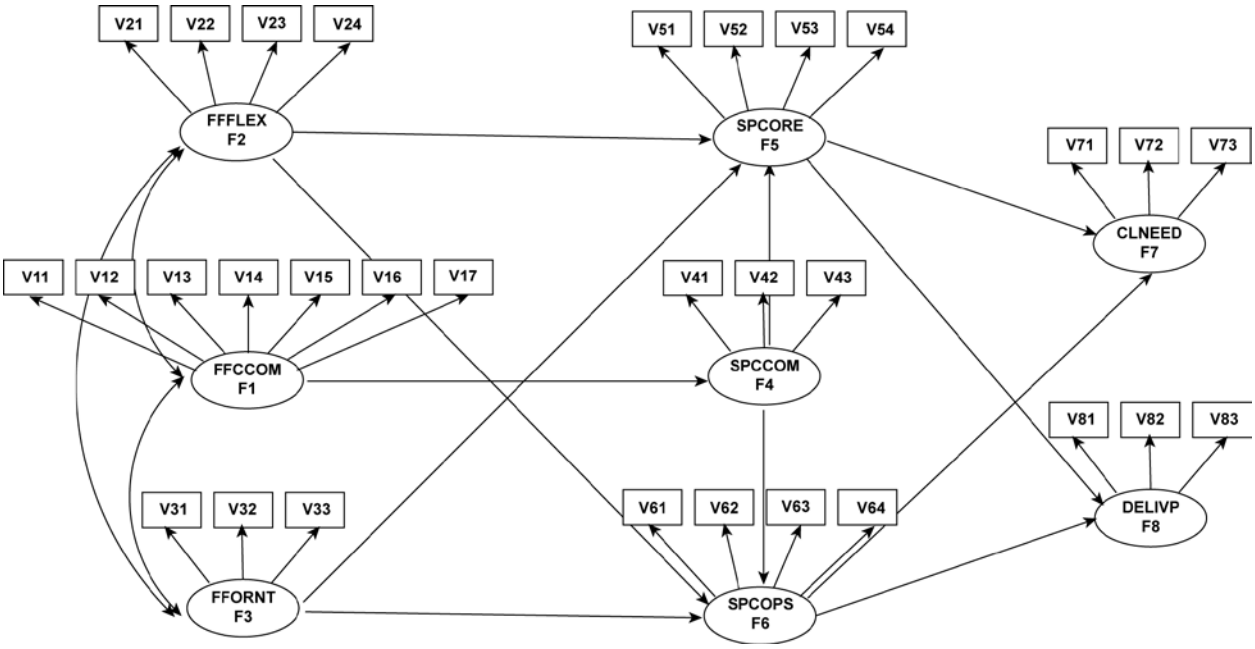
The potential for common method variance was assessed using the unrotated factor matrix for all variables using a greater-than-one eigenvalue criterion (Doty and Glick 1998; Paulraj and Chen 2007). Using Harman's single-factor test for common method bias, if a single factor accounts for more than half the variance in the factor model, common method bias exists (Doty and Glick 1998). Although one large factor did emerge in the unrotated analysis, its eigenvalue accounted for less than half the total model variance (23.43 of 50.82), and ten factors with eigenvalues greater than 1.0 were found in the unrotated factor analysis. Common method variance was accordingly determined not to be excessive.

### 4.2.3. Confirmatory Factor Analysis

Confirmatory factor analysis was next performed on the model constructs, in order to test the fit of the measurement model, as well as to assess further the factor structure of the model constructs along with the reliability and discriminant validity of the constructs. The measurement model is a standard model (Bentler 1989). In the standard model, constructs in the proposed model are reflective constructs with multiple indicators, and no latent construct is (by preference, if not hard rule) associated with fewer than three indicator variables (Anderson and Gerbing 1988). All model constructs are permitted to covary.

The original theoretical model introduced in chapter 3 (with indicator variables added) is shown here in Figure 4-1 following:

**Figure 4-1: Theoretical Model w/Indicators**




For the initial confirmatory factor model, the unrelated construct job satisfaction was also incorporated along with the constructs of interest. The initial confirmatory factor analysis did not yield satisfactory fit indices. The chi-square/*df* ratio was 2.13:1 (chi-square of 2034.601, *df* 953), greater than the recommended 2.0 figure (Hatcher 1983), while the Bentler Comparative Fit Index (0.873) and Non-Normed Fit Index (0.867) were both lower than the acceptable 0.9 level.

After dropping the job satisfaction construct and its associated indicators (because there is no theoretical reason for retaining it) from the measurement model, fit indices improved substantially: chi-square/*df* ratio was 1.80, comfortably under the acceptable figure of 2.0, while CFI and NNFI were 0.941 and 0.932 respectively. Model fit indices are within the bounds of acceptability as reported in the literature. Although some scholars call for fit indices in the 0.95 range for established measures, (Hatcher 1994), all measures in this model are assembled from extant items and based on extant measures of the constructs they are intended to assess, but none

has been tested in the form in which they appear in this dissertation. In addition, other scholars suggest a CFI of 0.93 and an NNFI of 0.92 is acceptable in most circumstances (Bagozzi and Yi 2012).

### 4.3. Construct Reliability and Discriminant Validity

Following procedures outlined in Hatcher (1994), constructs and their indicators were tested for reliability and discriminant validity. Indicator reliability coefficients were all above the 0.500 recommended guideline, and composite reliabilities of the constructs were all higher than 0.8, well above recommended levels. Constructs and their indicators therefore appear to be comfortably reliable. Table 4-11 following provides detail.

**Table 4-11: Construct and Indicator Reliability**

| Construct and Indicators | Standardized Loading | *t* | Indicator Reliability | Composite Reliability | Variance Extracted |
|---|---|---|---|---|---|
| **FFCCOM (F1)** | | | | | **0.926** |
| V11 | 0.816 | 32.053 | 0.666 | 0.334 | |
| V12 | 0.835 | 35.715 | 0.697 | 0.303 | |
| V13 | 0.850 | 39.076 | 0.723 | 0.278 | |
| V14 | 0.770 | 25.374 | 0.593 | 0.407 | |
| V15 | 0.776 | 26.078 | 0.602 | 0.398 | |
| V16 | 0.788 | 27.708 | 0.621 | 0.379 | |
| V17 | 0.763 | 24.526 | 0.582 | 0.418 | |
| **FFFLEX (F2)** | | | | | **0.887** |
| V21 | 0.876 | 42.146 | 0.767 | 0.233 | |
| V22 | 0.857 | 37.736 | 0.734 | 0.266 | |
| V23 | 0.831 | 32.785 | 0.691 | 0.309 | |
| V24 | 0.685 | 17.215 | 0.469 | 0.531 | |
| **FFORNT (F3)** | | | | | **0.881** |
| V31 | 0.881 | 43.371 | 0.776 | 0.224 | |
| V32 | 0.840 | 34.611 | 0.706 | 0.294 | |
| V33 | 0.807 | 29.076 | 0.651 | 0.349 | |
| **SPCCOM (F4)** | | | | | **0.866** |
| V41 | 0.797 | 27.569 | 0.635 | 0.365 | |
| V42 | 0.857 | 37.388 | 0.734 | 0.266 | |
| V43 | 0.826 | 31.769 | 0.682 | 0.318 | |
| **SPCORE (F5)** | | | | | **0.906** |
| V51 | 0.834 | 34.585 | 0.696 | 0.304 | |
| V52 | 0.839 | 35.706 | 0.703 | 0.297 | |
| V53 | 0.910 | 56.255 | 0.828 | 0.172 | |
| V54 | 0.775 | 25.582 | 0.601 | 0.399 | |
| **SPCOPS (F6)** | | | | | **0.892** |
| V61 | 0.728 | 20.033 | 0.530 | 0.470 | |
| V62 | 0.895 | 46.868 | 0.801 | 0.199 | |
| V63 | 0.817 | 30.398 | 0.667 | 0.333 | |
| V64 | 0.835 | 33.479 | 0.697 | 0.303 | |
| **CLNEED (F7)** | | | | | **0.895** |
| V71 | 0.853 | 36.869 | 0.728 | 0.272 | |

| Construct and Indicators | Standardized Loading | *t* | Indicator Reliability | Composite Reliability | Variance Extracted |
|---|---|---|---|---|---|
| V72 | 0.857 | 37.635 | 0.734 | 0.266 | |
| V73 | 0.871 | 40.536 | 0.759 | 0.241 | |
| **DELIVP (F8)** | | | | | **0.889** |
| V81 | 0.900 | 47.314 | 0.810 | 0.190 | |
| V82 | 0.823 | 31.241 | 0.677 | 0.323 | |
| V83 | 0.836 | 33.336 | 0.699 | 0.301 | |

Constructs were tested for discriminant validity using variance-extracted and confidence-interval tests. In the variance-extracted test, if the variance extracted from each of two latent factors is greater than the square of the correlation between the two factors, evidence of discriminant validity exists. As can be seen in Table 4-12 below, all factor pairs show evidence of discriminant validity via the variance-extracted test with the exception of F1-F3 (focal-firm collaborative communications capability and collaborative orientation), and F1-F4 (focal-firm collaborative communications capability and supplier collaborative communications capability).

**Table 4-12: Variance Extracted Test for Discriminant Validity**

| Factors | R | $r^2$ | Variance Extracted | |
|---|---|---|---|---|
| | | | First Factor | Second Factor |
| F1F2 | 0.680 | 0.463 | 0.641 | 0.665 |
| F1F3 | 0.871 | **0.759** | 0.641 | 0.711 |
| F1F4 | 0.824 | **0.678** | 0.641 | 0.684 |
| F1F5 | 0.657 | 0.432 | 0.641 | 0.707 |
| F1F6 | 0.581 | 0.337 | 0.641 | 0.674 |
| F1F7 | 0.651 | 0.423 | 0.641 | 0.740 |
| F1F8 | 0.669 | 0.448 | 0.641 | 0.729 |
| F2F3 | 0.803 | 0.645 | 0.665 | 0.711 |
| F2F4 | 0.711 | 0.505 | 0.665 | 0.684 |
| F2F5 | 0.735 | 0.540 | 0.665 | 0.707 |
| F2F6 | 0.690 | 0.477 | 0.665 | 0.674 |
| F2F7 | 0.697 | 0.486 | 0.665 | 0.740 |
| F2F8 | 0.815 | 0.664 | 0.665 | 0.729 |
| F3F4 | 0.651 | 0.424 | 0.711 | 0.000 |
| F3F5 | 0.734 | 0.539 | 0.711 | 0.707 |
| F3F6 | 0.656 | 0.430 | 0.711 | 0.674 |
| F3F7 | 0.769 | 0.592 | 0.711 | 0.740 |
| F3F8 | 0.759 | 0.577 | 0.711 | 0.729 |
| F4F5 | 0.782 | 0.612 | 0.684 | 0.707 |
| F4F6 | 0.718 | 0.516 | 0.684 | 0.674 |
| F4F7 | 0.807 | 0.650 | 0.684 | 0.740 |
| F4F8 | 0.779 | 0.607 | 0.684 | 0.729 |
| F5F6 | 0.685 | 0.469 | 0.707 | 0.674 |
| F5F7 | 0.782 | 0.611 | 0.707 | 0.740 |
| F5F8 | 0.766 | 0.587 | 0.707 | 0.729 |
| F6F7 | 0.706 | 0.498 | 0.674 | 0.740 |
| F6F8 | 0.701 | 0.491 | 0.674 | 0.729 |
| F7F8 | 0.837 | 0.700 | 0.740 | 0.729 |

In the confidence-interval test, twice the standard error for each factor pair is subtracted from and added to the inter-factor correlation, in order to compute a 95% confidence interval. If the 95% confidence interval does not contain 1.0, evidence of discriminant validity is considered to exist (Hatcher 1983).

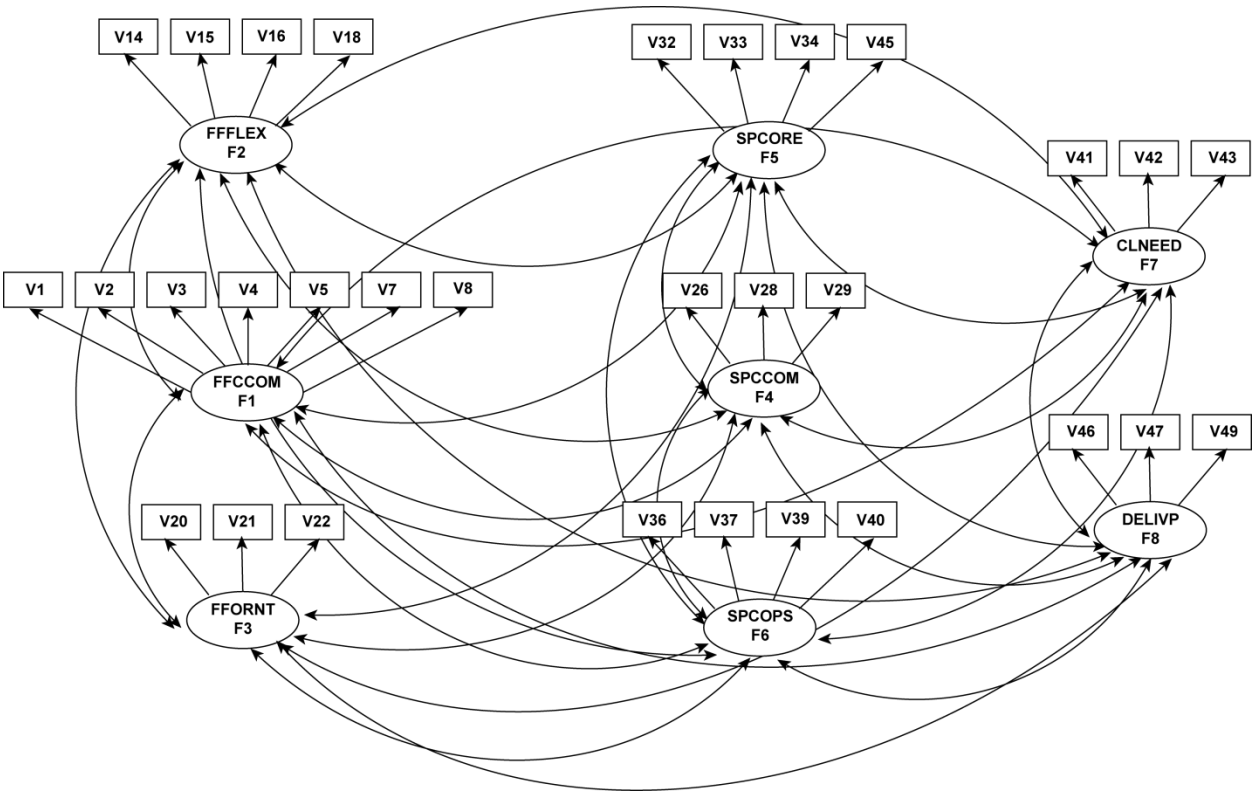
**Table 4-13: Confidence Interval Test for Discriminant Validity**

| Factors | R | Std. error | Lower Bound | Upper Bound |
|---|---|---|---|---|
| F1F2 | 0.680 | 0.044 | 0.593 | 0.768 |
| F1F3 | 0.871 | 0.025 | 0.822 | 0.921 |
| F1F4 | 0.824 | 0.031 | 0.762 | 0.885 |
| F1F5 | 0.657 | 0.045 | 0.567 | 0.747 |
| F1F6 | 0.581 | 0.052 | 0.477 | 0.685 |
| F1F7 | 0.651 | 0.047 | 0.558 | 0.744 |
| F1F8 | 0.669 | 0.045 | 0.579 | 0.759 |
| F2F3 | 0.803 | 0.045 | 0.714 | 0.892 |
| F2F4 | 0.711 | 0.034 | 0.642 | 0.780 |
| F2F5 | 0.735 | 0.041 | 0.653 | 0.818 |
| F2F6 | 0.690 | 0.039 | 0.611 | 0.769 |
| F2F7 | 0.697 | 0.044 | 0.609 | 0.785 |
| F2F8 | 0.815 | 0.044 | 0.728 | 0.902 |
| F3F4 | 0.651 | 0.034 | 0.583 | 0.719 |
| F3F5 | 0.734 | 0.039 | 0.657 | 0.812 |
| F3F6 | 0.656 | 0.048 | 0.560 | 0.752 |
| F3F7 | 0.769 | 0.041 | 0.688 | 0.851 |
| F3F8 | 0.759 | 0.048 | 0.663 | 0.855 |
| F4F5 | 0.782 | 0.037 | 0.708 | 0.857 |
| F4F6 | 0.718 | 0.039 | 0.641 | 0.796 |
| F4F7 | 0.807 | 0.043 | 0.720 | 0.893 |
| F4F8 | 0.779 | 0.037 | 0.705 | 0.853 |
| F5F6 | 0.685 | 0.040 | 0.604 | 0.766 |
| F5F7 | 0.782 | 0.032 | 0.718 | 0.846 |
| F5F8 | 0.766 | 0.035 | 0.697 | 0.836 |
| F6F7 | 0.706 | 0.043 | 0.619 | 0.793 |

| Factors | R | Std. error | Lower Bound | Upper Bound |
|---|---|---|---|---|
| F6F8 | 0.701 | 0.045 | 0.611 | 0.790 |
| F7F8 | 0.837 | 0.036 | 0.766 | 0.908 |

All indicator factor loadings were in the hypothesized direction (positive) and statistically significant. Note that no confidence interval for any of the factor pairs, including F1-F3 (focal firm collaborative communications capability and focal firm collaborative orientation) and F1-F4 (focal firm collaborative communications capability and supplier collaborative communications capability), included 1.0. Based on the results of the discriminant validity tests, there is substantial (though not quite conclusive) evidence pointing toward discriminant validity of the constructs. The results of the confirmatory factor analysis, composite reliability and discriminant validity tests indicate acceptable validity and reliability of the constructs and their associated measures. Additionally, the measurement model demonstrates good fit as depicted by the fit indices. All the preceding analyses confer sufficient confidence to proceed to analysis of the structural model. Figure 4-2 below shows the final measurement model.

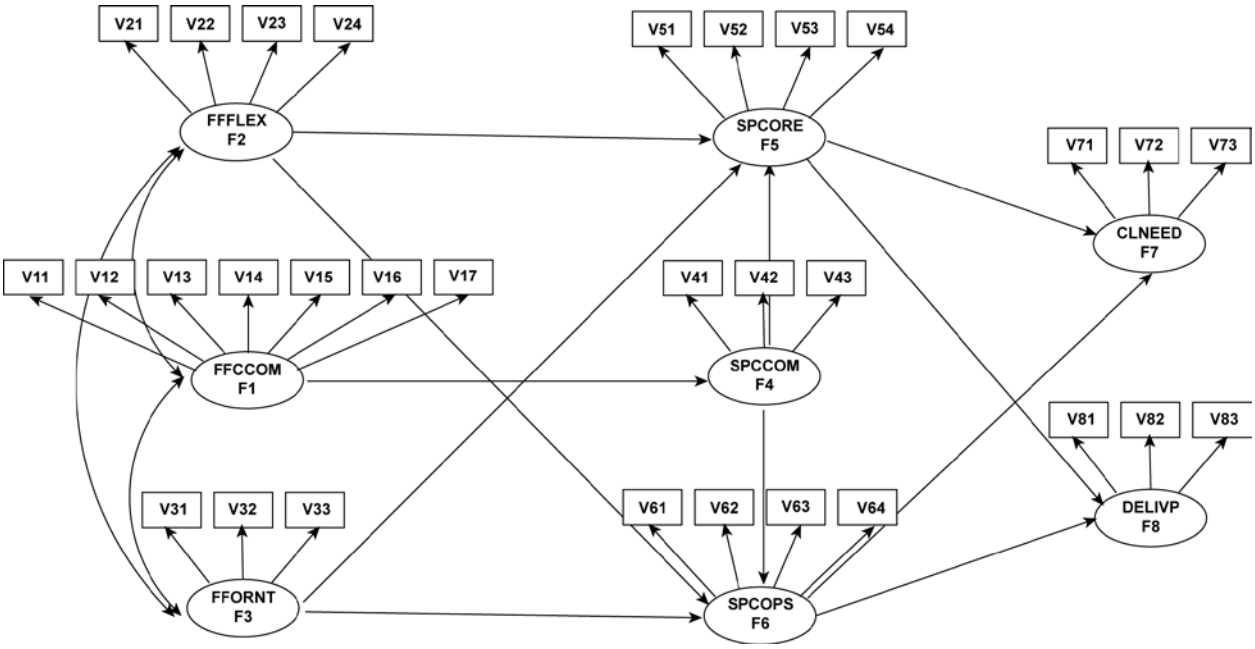
**Figure 4-2: Final Measurement Model**




### 4.4. Structural Model

The theoretical structural model (along with the indicator variables for each latent construct) is depicted in Figure 4-3 following:

**Figure 4-3: Structural Model**

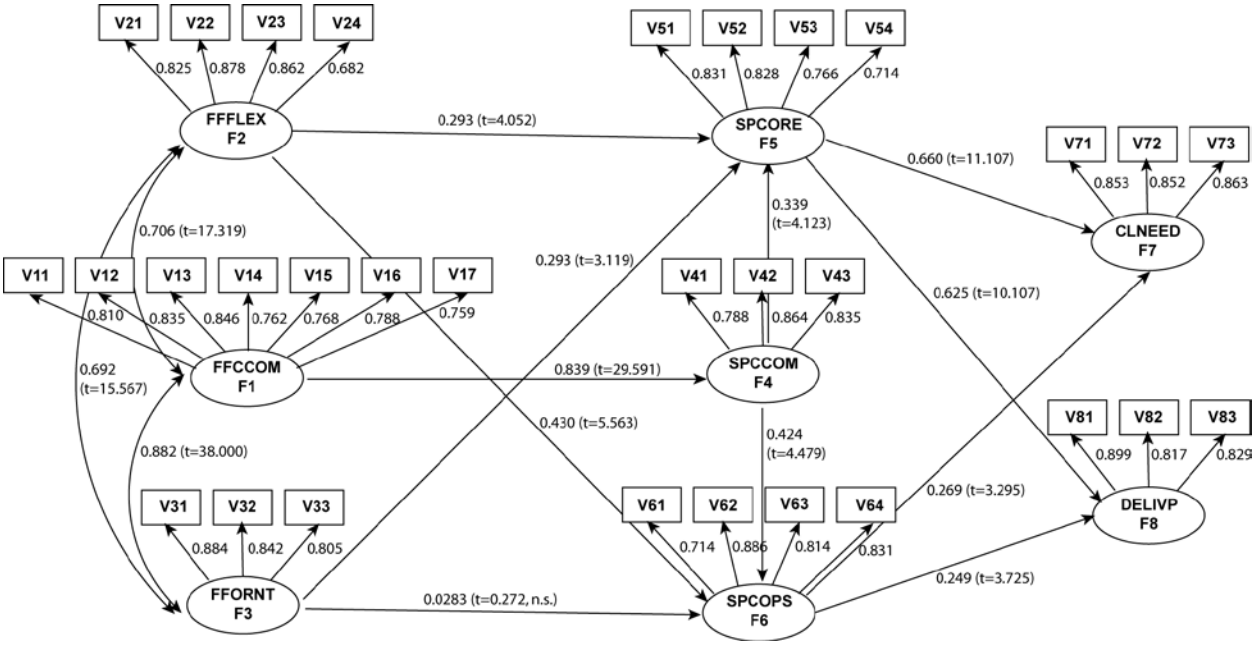



N = 213

As shown in Figure 4-3, the theoretical structural model consists of eight latent constructs, three of which (the focal-firm factors) are exogenous, and 31 manifest indicator variables. Initial analysis of the theoretical model produced generally acceptable fit indices, though some issues were also identified in the analysis. The fit indices will be considered first, before moving to other issues. The $\chi^2/df$ ratio was 1.97, slightly better than the recommended 2.0 acceptability guideline. Other fit indices were as follows: standardized root mean square (SRMR) was 0.059; RMSEA estimate was 0.068; comparative fit index (CFI) was 0.926, and Bentler-Bonett non-normed index (NNFI) was 0.918. The $\chi^2/df$ ratio, SRMR, and RMSEA are satisfactory, according to recommended guidelines (Hatcher 1994; Bagozzi and Yi 2012), but the CFI and NNFI do not quite meet the recommended standards of 0.93 and 0.92 respectively (Bagozzi and Yi 2012).

In addition, inspection of the model outputs, particularly the modification indices, suggest modifications to the path model that might improve overall model fit to the data. The model with indicator factor loadings and path coefficients is shown in Figure 4-4:

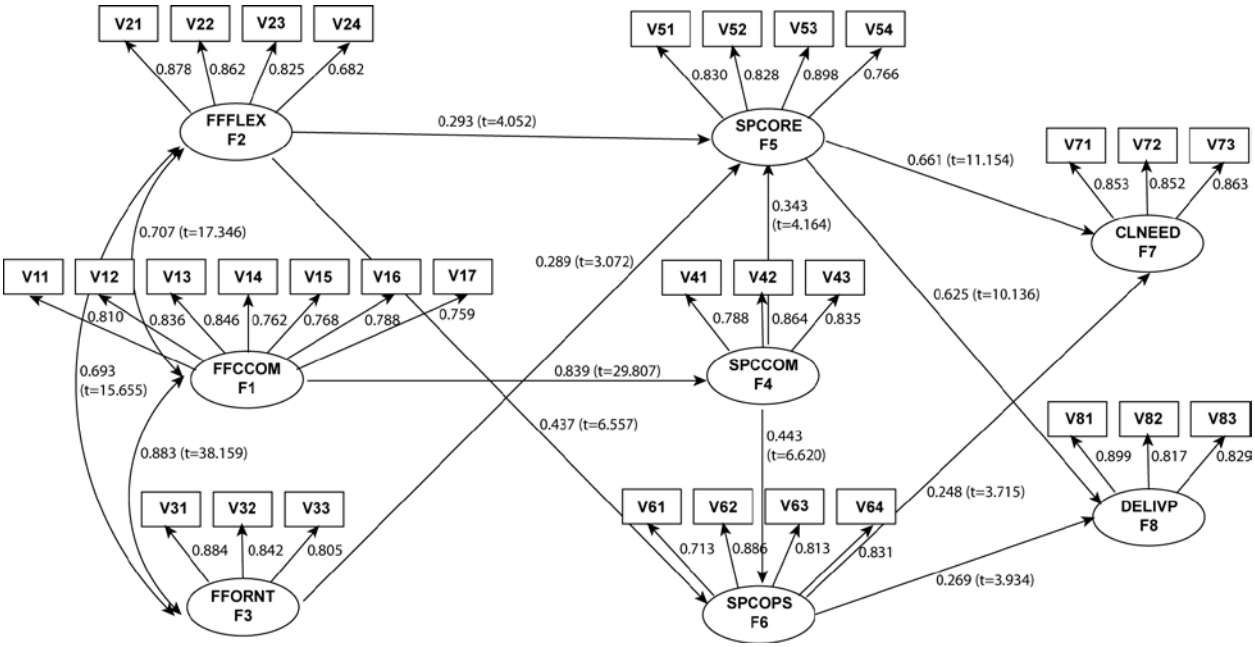
**Figure 4-4: Theoretical Model with Factor Loadings and Path Coefficients**




N = 213. All factor loadings and path coefficients (except F3-F6) are significant at 0.05 or better.

Note that the path coefficient linking F3 (focal firm collaborative orientation) and F6 (supplier operations capability) is not statistically significant ($t_{.05}$=0.272). The Wald modification index suggests that model fit would be improved by dropping the path from the model. A modified model was accordingly tested, with the path from F3 to F6 removed. The model diagram and coefficients are reproduced in Figure 4-5 below.

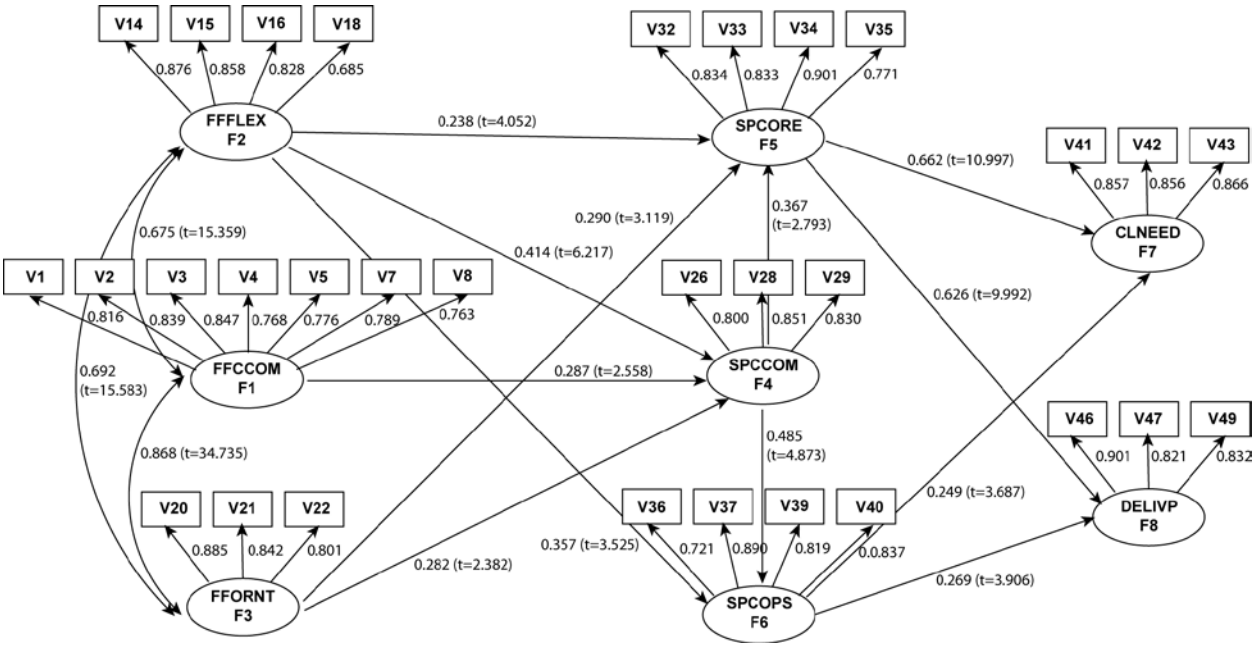
**Figure 4-5: Modified Theoretical Structural Model**




The model illustrated in Figure 4.5 exhibits fit indices little different from the original theoretical model: The $\chi^2/df$ ratio is 1.97; (SRMR) is 0.059; RMSEA estimate is 0.068; CFI was 0.926, and NNFI was 0.918. The CFI and NNFI in particular fall short of recommended levels (Bagozzi and Yi 2012). In addition, the Lagrange modification indices for both the original and modified theoretical models suggest that model fit would be improved by adding paths from F2 (focal firm collaborative flexibility capability) and F3 (focal firm collaborative orientation) to F4 (supplier collaborative communications capability). In fact, this is the form of the alternative model originally introduced in Chapter 2 (see Figure 2-2). A modified version of the model (leaving out the path from F3 to F6) was tested, and the model did produce better overall fit indices; $\chi^2/df$ ratio is 1.86; SRMR is 0.044; RMSEA is 0.0638; CFI is 0.934, and NNFI is 0.927. The $\chi^2/df$ ratio and RMSEA are better than the levels recommended as indicating good fit by

Hatcher (1994), and the other three indices surpass the levels suggested by Bagozzi and Yi (2012) as indicative of good model fit. As Figure 4-7 below indicates, all remaining model paths are significant at the 0.05 level, and in the hypothesized direction in all cases. Tables 4-14 and 4-15 following provide comparative model fit indices and path comparisons (respectively).

**Figure 4.7: Second Modified Model**




N = 213. All factor loadings and path coefficients are significant at .05 or better (t-values for the path coefficients in parentheses).

**Table 4-14: Comparative Model Fit Indices**

| Model | $\chi^2$ | Df | Fit Indices | | | | |
|---|---|---|---|---|---|---|---|
| | | | $\chi 2/df$ Ratio | SRMR | RMSEA | CFI | NNFI |
| Final measurement model | 730.4136 | 406 | 1.80 | 0.0370 | 0.0614 | 0.941 | 0.932 |
| Theoretical model | 828.3591 | 420 | 1.97 | 0.0593 | 0.0677 | 0.926 | 0.918 |
| Modified theoretical model | 828.4296 | 421 | 1.97 | 0.0594 | 0.0676 | 0.926 | 0.918 |
| Second modified model | 780.4638 | 419 | 1.86 | 0.0443 | 0.0638 | 0.934 | 0.927 |

**Table 4-15: Comparative Model Parameters**

| Path | Theoretical model (n=213) | Modified theoretical model (n=213) | Second modified model (n=213) |
|---|---|---|---|
| | β (*t* value) | | |
| Focal firm collaborative communication capability → Supplier collaborative communication capability | 0.839 (29.951)*** | 0.839 (29.807)*** | 0.287 (2.558)** |
| Focal firm collaborative flexibility capability → Supplier collaborative communication capability | N/A | N/A | 0.414 (6.217)*** |
| Focal firm collaborative flexibility capability → Supplier core offering capability | 0.293 (4.052)*** | 0.293 (4.052)*** | 0.238 (4.052)*** |
| Focal firm collaborative flexibility capability → Supplier operations capability | 0.432 (5.563)*** | 0.437 (6.557)*** | 0.357 (3.525)*** |
| Focal firm collaborative orientation → Supplier collaborative communication capability | N/A | N/A | 0.282 (2.382)** |
| Focal firm collaborative orientation → Supplier core offering capability | 0.293 (3.119)** | 0.298 (3.072)** | 0.290 (3.119)** |
| Focal firm collaborative orientation → Supplier operations capability | 0.028 (0.272)† | N/A | N/A |
| Supplier collaborative communications capability → Supplier core offering capability | 0.339 (4.123)*** | 0.343 (4.164)*** | 0.367 (2.793)** |
| Supplier collaborative communications capability → Supplier operations capability | 0.424 (4.479)*** | 0.443 (6.620)*** | 0.485 (4.873)*** |
| Supplier core offering capability → Closeness of final offering to end-user needs | 0.660 (11.107)*** | 0.661 (11.154)*** | 0.662 (10.997)*** |
| Supplier core offering capability → Delivery performance | 0.625 (10.107)*** | 0.625 (10.137)*** | 0.626 (9.992)*** |
| Supplier operations capability → Closeness of final offering to end-user needs | 0.269 (3.295)*** | 0.248 (3.715)*** | 0.249 (3.687)*** |
| Supplier operations capability → Delivery performance | 0.249 (3.725)*** | 0.269 (3.934)*** | 0.269 (3.906)*** |

* p<.05, ** p<.01, ***p<.001, † n.s.

### 4.5. Hypothesis Tests

Having established adequate fit for the structural model, it is now possible to assess the hypotheses originally proposed. Only one of the original hypotheses, $H_{3b}$, which proposed a positive relationship between focal firm collaborative orientation and supplier operations capability, was not supported. The model path coefficient was in the hypothesized direction, but was very small in magnitude and was not statistically significant. Hypothesis testing results are summarized in Table 4-16 following.

**Table 4-16. Hypothesis Testing**

| **Hypothesis** | **Supported?** |
|---|---|
| H1a. Focal firm collaborative orientation is positively associated with supplier core offering capability. | Supported |
| H1b. Focal firm collaborative orientation is positively associated with supplier operations capability. | Not supported |
| H1c. Focal firm collaborative orientation is positively associated with supplier collaborative communications capability (alternative model) | Supported |
| H2. Focal firm collaborative communication capability is positively associated with supplier collaborative communication capability. | Supported |
| H3a. Focal firm collaborative flexibility capability is positively associated with supplier core offering capability. | Supported |
| H3b. Focal firm collaborative flexibility capability is positively associated with supplier operations capability. | Supported |
| H3c. Focal firm collaborative flexibility capability is positively associated with supplier collaborative communications capability (alternative model) | Supported |
| H4a. Supplier communication capability is positively associated with supplier core offering capability. | Supported |
| H4b. Supplier communication capability is positively associated with supplier operations capability. | Supported |
| H5a. Supplier core offering capability is positively associated with delivery performance. | Supported |
| H5b. Supplier core offering capability is positively associated with closeness of product/service to customer needs. | Supported |
| H6a. Supplier operations capability is positively associated with delivery performance. | Supported |
| H6b. Supplier operations capability is positively associated with closeness of the final offering to customer needs. | Supported |

In addition to the supported hypotheses listed above, positive and statistically significant relationships are found between focal firm collaborative flexibility capability and supplier core offering capability, between focal firm collaborative flexibility capability and supplier operations capability, and between focal firm collaborative orientation and supplier core offering capability (a modification of the alternative to the theoretical model).

Interestingly, when the modified alternative model is considered, the focal firm collaborative capability with the strongest influence on supplier collaborative capabilities is focal firm collaborative flexibility capability. The paths from focal firm collaborative flexibility capability and focal firm collaborative orientation to supplier collaborative communication capability account for much of the variance accounted for by focal firm collaborative communications capability in the original theoretical model, with focal firm collaborative flexibility capability accounting for more variance than either of the other two focal firm collaborative capabilities in the model. As focal firm collaborative flexibility capability is the "action" capability, it may be that the supplier is influenced more by what the focal firm *does* than by what it *says* (and certainly by what it *intends*).

It is noteworthy that for the original theoretical model as well as the modified alternative model, the path coefficients from supplier core offering capability to the outcome variables are much larger than those from supplier operations capability to the outcome variables. What this phenomenon suggests is that, independent of environmental influences, managers at the focal firm may look first at the quality of the key supplier's offering (i.e. its ability to deliver the appropriate level of quality), and then at the supplier's operations (i.e., collaborative flexibility) capabilities. However, this is not to say that supplier operations capabilities are of no importance

to managers at the focal firm. Indeed, supplier operations capability is significantly associated with both outcome variables across model tests.

As Table 4-15 preceding also shows, in the original theoretical model the effect of focal firm collaborative communications capability on supplier collaborative communications capability is quite pronounced. However, when paths are added linking focal firm collaborative flexibility capability and focal firm collaborative orientation to supplier collaborative communication capability (as suggested by the Lagrange modification indices), the relationship between focal firm collaborative communication capability and supplier collaborative communication capability was attenuated. In fact, in the subsets testing greater offering complexity, relationship duration, and the two control variables in combination, the relationship between the collaborative communication capabilities of the focal firm and key supplier were not significant. The additional path relationships between focal firm constructs and supplier collaborative communication, as well as the relatively weaker than expected relationship between focal firm collaborative communications capability and supplier collaborative communications capability, will be discussed further in Chapter 5.

**4.6. Control Variable Influence**

The influence of the control variables relationship duration and relative perceived complexity of the final offering are tested by regressing the outcome variable values on the control variables. Outcome variable values are derived by collapsing the outcome indicators to the mean for each observation, and a significant relationship with each control variable is found. For closeness to end-user needs, adjusted $r^2$ of the regression model is 0.187 ($F$ = 23.03, $p$<.0001), and for delivery performance, model adjusted $r^2$ is 0.130 ($F$ = 14.09, $p$<.0001). Table

4-17 following provides beta coefficients for each of the control variables on each outcome variable:

**Table 4-17: Control-Variable Regression Results**

| Control Variable | Outcome Variable | Beta coefficient (*t* value) |
|---|---|---|
| Relationship duration | Closeness of final offering to end-user needs | 0.452 (5.35) |
| | Delivery performance | 0.366 (4.37) |
| Perceived complexity of final offering | Closeness of final offering to end-user needs | 0.157 (3.25) |
| | Delivery performance | 0.108 (2.26) |

Note that relationship duration shows a stronger effect on the collapsed outcome variables (approximately three times as strong) than does perceived complexity of the final offering. This suggests that for focal-firm managers, the duration of the collaborative relationship has more influence on product-market outcomes than does the perceived complexity of the final offering, though both control variables are of some significance. What may be implied here is that as the relationship endures, the partners are able to overcome even higher-complexity problems as needed and appropriate.

### 4.7. Mediation Tests

A key question in this dissertation is whether supplier collaborative capabilities truly mediate the relationship between focal-firm collaborative capabilities and product-market outcomes. Following procedures recommended in Baron and Kenny (1986), Sobel tests for mediation are performed on the portion of the model incorporating focal-firm collaborative flexibility capability and collaborative orientation, supplier core offering and operations capabilities, and closeness of the final-offering to end-user needs and delivery performance. Although more sophisticated mediation tests have been proposed and are available (cf. Preacher and Hayes 2004), the size of the sample suggests that the simpler Sobel test is an adequate

mediation test of the proposed model. For each of the mediating relationships tested, the Sobel Z-value indicates that supplier capability does mediate the relationship between the indicated focal-firm capability and the outcome variable in question. Table 4-18 following provides detailed results.

**Table 4.18 Sobel Tests for Mediation**

| **Path** | **Sobel Z-value (significance)** |
|---|---|
| Focal firm collaborative flexibility – supplier core offering – closeness to end-user needs | 3.825 (p<.001) |
| Focal firm collaborative flexibility - supplier core offering - delivery performance | 3.773 (p<.001) |
| Focal firm collaborative flexibility – supplier operations – closeness to end-user needs | 3.183 (p<.01) |
| Focal firm collaborative flexibility - supplier operations - delivery performance | 3.382 (p<.001) |
| Focal firm collaborative orientation - supplier core offering - closeness to end-user needs | 2.965 (p<.01) |
| Focal firm collaborative orientation - supplier core offering - delivery performance | 2.941 (p<.01) |

# CHAPTER V

# DISCUSSION

The present study joins a substantial body of research into interfirm collaboration. The results of the empirical analyses conducted during this dissertation support the majority of the hypotheses advanced herein. It appears that key suppliers, by interacting with and observing the "collaborative habits" of successful customer/partners, can enhance their own collaborative capabilities. The enhanced collaborative capabilities of key suppliers in turn contribute to desirable product-market outcomes. The mechanisms by which these improvements take place appear to follow both direct and indirect routes. The more direct route takes place as the individuals in each firm responsible for collaboration communicate regarding the collaborative effort. The more circuitous route is followed as the functional areas of key suppliers observe the customer/partner's practices, and as information is collected and circulated throughout the supplier organization, in keeping with the tenets of market orientation (specifically, interfunctional coordination). The market-oriented key supplier learns from the customer/partner and disseminates that learning throughout its own organization, enabling the supplier organization to contribute to more desirable operational outcomes: a closer fit of the final

offering to the preferences of the end user, and delivery performance that is superior in ways that matter both to the firms involved and their customers.

### 5.1. The Importance of Collaborative Communication

Most previous studies focusing on operational outcomes of interfirm collaboration are limited to the information-exchange facets of collaborative communication. Information may be exchanged well or it may be exchanged badly; it is important for scholars and managers to understand what makes information exchange effective or ineffective, good or bad. Understanding how to structure the communications component of collaboration for maximum efficiency and effectiveness offers valuable tools to managers for the purpose of supplier (or partner, from the supplier's vantage) evaluation and for more efficient and effective interfirm collaboration.

In this light, the evolution of the collaborative communications constructs in the present study is intriguing. For the focal firm, both content and process facets of collaborative communications capability are incorporated firmly into the final measurement and structural models. For the key supplier, however, what remains after a rather extensive purification process are content facets only: specifically the exchange of timely, complete, and relevant information. As speculated in the previous chapter, it may be that the other process facets of collaborative communication are dominated thoroughly by the preferences of the focal firm. The only aspect of the communications process that would apply to the key supplier, assuming the preceding supposition is true, would lie in compliance with focal firm preferences. As previously discussed, the ability to move information to where it is needed in the organization can be considered a manifestation of the interfunctional coordination dimension of market orientation.

The importance of collaborative communications lies in the role of knowledge in collaborative success: indeed, in market success. Cao et al (2010) contend that prior work in supply chain collaboration ignore important components of communication and knowledge creation (the authors' own study treats information exchange and collaborative communications as separate constructs, in contrast with the present study's treatment of collaborative communications capability as a single reflective construct consisting of both content and process facets). To be fair, Dyer and colleagues' work in the automobile industry in Japan has increasingly recognized the role of knowledge in relational success and competitive advantage, though the relatively narrow scope of their research may limit its generalizability. The present study attempts to address the communications/knowledge research gap in studies of interfirm collaboration in a way that, by incorporating data from multiple industries, may be of broad potential applicability. The present study draws on a sample beyond not only the automotive industries, but the industry groups commonly found in studies using member firms of the Institute for Supply Management exclusively. The broader sampling frame, though not without potential issues of its own, may be a contributory step to expanding the generalizability of the modified alternative structural model described herein.

The empirical results of the present study suggest that the collaborative communications capabilities of the focal firm, both content and process facets, play a critical role in the performance of interfirm collaborative efforts, perhaps particularly in collaborative relationships not marked by long duration. The collaborative communications capability of the focal firm appears to work through not only the collaborative communication (content, at least) capability of key suppliers, but also through key suppliers' core offering capability (thus influencing the

quality of the components/subassemblies/products that go into the final offering) and operations capability (thus influencing the suppliers' ability to respond to changing requirements and circumstances).

### 5.2. The Respective Roles of Key Suppliers and Focal Firms

Scheer, Miao, and Garrett (2010) develop an elegant and useful set of supplier capabilities: core offering capabilities, operations capabilities, and communications capabilities, relating those capabilities to partner loyalty, cost-based dependence (i.e., switching costs), and benefit-based dependence. The dependence measures take operational outcomes into account, but there is an opportunity to investigate the relationship between the Scheer-Miao-Garrett supplier capability framework and direct operational outcomes, and the present study is an effort in that direction. The results of the present study indicate that the supplier capabilities embodied in the Scheer-Miao-Garrett framework are related to important operational product-market outcomes such as closeness of the final offering to end-user needs and delivery performance.

Beyond the contribution of supplier capabilities to product-market outcomes, though, is the contribution of the present study in helping demonstrate that focal-firm collaborative capabilities are in some respects antecedent to key supplier capabilities, to the enhancement of the latter and the ultimate benefit of both. Focal-firm collaborative capabilities may enable suppliers to build their own communications capabilities in the shorter run, and their core offering and operations capabilities throughout the relationship, as suggested by the results of the test of the model with the long-duration, high-complexity data subset. In the initial stages of the relationship, the desires, preferences, and knowledge of the focal firm may be delivered to the supplier on an explicit basis, with the process elements of communication determined largely if

not solely by the focal firm. The key supplier uses its collaborative communications capability to distribute the communications content received from the focal firm throughout its functional areas. As the duration of the relationship lengthens, the gaining of information and knowledge from the focal firm may come more from inference and observation than via direct instruction, as the key supplier climbs the learning curve and becomes more adept at delivering on its core offering and operations capabilities.

While the results of the empirical analysis of the measurement and structural models were largely as originally hypothesized, a notable exception is the hypothesized relationship between focal firm collaborative orientation and supplier operations capability. It may be that the apparent lack of association between focal firm collaborative orientation and supplier operations capability is that the supplier is sufficiently motivated to develop its collaborative capabilities in order to retain the relationship with the focal firm in question, provided the relationship is sufficiently beneficial to the supplier; the willingness or desire of the focal firm to participate in the relation is to some degree beside the point, so long as the checks clear.

The relationships between the collaborative communications capability of the focal firm and the core offering and operations capabilities of the key supplier were not originally hypothesized. Although collaborative relationships have been studied extensively, the links between specific focal firm capabilities and specific supplier capabilities have been less widely studied. The author's experience with interfirm collaboration in a services setting largely took place in the context of new collaborative activities, even where the firms in question had long-standing relationships. New collaborative relationships may require more intensive and explicit communications in order to deliver the requisite operational outcomes; as the relationship

extends in time, and the activities involved become more routinized, explicit, intensive communication may become less necessary to the smooth functioning of the relationship. Nevertheless, ongoing contact between the partners remains essential, not least to keep both parties abreast of changes in circumstances that might require changes in routine or offering. In a long-duration relationship, managing the relationship may depend to a considerable degree on knowing what *not* to change as well as on what might *need* to change in response to the environment.

The collaborative flexibility capabilities of the focal firm appear to be important to the success of the collaboration regardless of the circumstances. The focal firm faces the end-user customer, and presumably has the greatest stake in maintaining awareness of the market environment, with respect to both customer preferences and competitor actions. The focal firm must therefore stand ready to make whatever changes are necessary for successful operational outcomes. In the process, the focal firm leads the partnership by example, and the key supplier via communication and observation adopts, adapts, and incorporates elements of the focal firm's collaborative flexibility capabilities that appear to be of greatest potential benefit to the key supplier's core offerings and operations capabilities. As previously alluded, supplier organizations more fully aligned with the tenets of market orientation would presumably be more effective at disseminating knowledge gleaned from the focal firm to the relevant functional areas of its own organization.

### 5.3. Contributions to Scholarship

The present study makes important contributions to scholarship in interfirm collaboration. Most critically, it contributes to the capabilities literature by providing evidence of

the mediating role of supplier collaborative capabilities between focal-firm collaborative capabilities and product-market outcomes, extending the work of Dyer and colleagues. This study presents evidence in support of a model of interfirm collaboration that shows how specific collaborative capabilities of the focal firm can influence (to the benefit of the key supplier) specific collaborative capabilities of the key supplier. Working with a sample drawn from a fairly broad selection of industries, this study finds relationships between the collaborative flexibility capability and collaborative orientation of the focal firm and the core offering capability of the key supplier, as well as a relationship between the collaborative flexibility capability of the focal firm and the operations capability of the key supplier. The alternative model tested herein, with its links between the collaborative flexibility capability and collaborative orientation of the focal firm to the collaborative communication capability of the key supplier, provides additional insight into how information and knowledge move from the focal firm to the supplier before being disseminated through the supplier organization, grounding the model soundly within the bounds of market orientation as well as the supply chain literature.

Second, the present study contributes further to research in interfirm collaboration by presenting evidence that the collaborative communications capabilities of both the focal firm and the key supplier may take distinct forms and play related but distinct roles in a model of interfirm collaboration. Specifically, the collaborative communications capability of the focal firm should consider the influence of both content and process facets, while the collaborative communications capability of the key supplier may consider content facets alone. Third, it presents evidence of the importance of both the content and process facets of collaborative communications, as well as insight into what the essential content and process facets are. A

comprehensive examination of collaborative communications should consider whether collaborative communication (at least from the standpoint of the senior or leading partner in the partnership, usually the focal firm) is complete, accurate, relevant, timely, frequent, bidirectional, and formal. Fourth, this study provides evidence for the contribution of content and process facets of a collaborative communications capability to beneficial operational outcomes, cementing the place of collaborative communications capabilities in the capabilities literature as has already taken place in the relationship quality literature.

### 5.4. Contributions to Practice

The present study contributes to the practice of interfirm collaboration by demonstrating that interfirm collaboration can contribute to performance in concrete operational product-market outcomes in a variety of settings and industries. It also provides important insights into how managers in focal firm should structure the communications component of a collaborative effort, by illustrating the important content and process facets of communication that should be provided for in the communications structure. Communications that take into consideration completeness, accuracy, relevance, and timeliness of content along with a process that provides frequency, bidirectionality, and formality in process will help ensure that all parties receive the information they need when they need it, enabling greater efficiency and effectiveness of interfirm collaboration.

### 5.5. Limitations and Future Research Directions

A few of the limitations of the present study are related to challenges encountered in data acquisition. As noted in the literature (Cao et al 2010), survey response rates are low and declining. Qualified panels are a means of addressing the decline in response to traditional

survey methods, but the researcher is required to trust that the panel provider (and more to the point, the panel members) are truly qualified managers in the industries of interest in the sampling frame. Additionally, while qualified panels offer the researcher significant advantages in time and data collection, the expense is considerable, which may limit the size of the sample. The final sample size in this study was 213. Because construct purification during the confirmatory factor analysis yielded a measurement model with 31 indicator variables, the final sample met the Bentler (1989) guideline of at least 5 data points per indicator variable, but more data would be preferable.

Another limitation of the present study is its single-informant nature. Single-informant studies have been criticized as potentially contributing to common method bias (Paulraj and Chen 2007). However, given the challenges in garnering response to even a single-respondent survey may put dyadic research designs beyond the means of all but a handful of researchers (at least beyond the means of resource-limited researchers with relatively short time horizons for data collection). Nevertheless, both scholars and practitioners will continue to require quality research; researchers accordingly must learn to deal effectively with the needs of research under new data-collection circumstances.

A third limitation of the present study lies in the cross-sectional design. Although there is limited indication of an effect of relationship duration on the nature of the collaborative relationship as expressed in the structural model path coefficients, a longitudinal study would likely yield more robust insights into the mechanisms by which relationship duration influence interfirm collaborative processes and outcomes.

Despite these limitations, the present study presents some intriguing findings and offers intriguing avenues for further research. The focal-firm collaborative capability constructs may be amenable to further development. While the single-factor collaborative communications capability construct exhibits satisfactory psychometric properties, and a single-factor solution was preferred for the present study on the grounds of model parsimony, factor analysis suggests that a two-factor complex construct is a possible representation of collaborative communications. The two factors encountered included two process items on the first factor, two content items on the second, and the other four retained items loading on both factors. Additional item development and model refinement with additional data might definitively resolve the factor structure question, to the extent there is one.

Similarly, the focal firm collaborative orientation and focal firm collaborative flexibility capability constructs were adapted from existing constructs in the literature, and further development and testing might further improve the measurement properties of the constructs. The same applies even more strongly to the outcome constructs used in this study. Closeness of the final offering to end-user needs was adapted from a two-item measure and delivery performance from a three-item measure. Again, the measures exhibited adequate psychometric properties with the extant data set, but further testing and refinement with additional data would not be amiss.

In addition, it might be desirable to develop and test non-recursive models of interfirm collaboration, in which supplier collaborative capabilities may influence focal-firm collaborative capabilities even as the focal firm's capabilities influence those of the key supplier. Models of the non-recursive type are beyond the scope of the present study, and do not appear to have been

studied extensively in the literature on interfirm collaboration, but it seems intuitive that focal firms might gain knowledge from supplier partners and put that knowledge to work for the benefit of the collaboration (in fact, such a mechanism is implicit in the work of Dyer and colleagues in the automobile industry).

Along related lines, a study that looks specifically at collaborative relationships in which the supplier is as large as or substantially larger than the focal firm might offer a particularly interesting setting in which to test a non-recursive model of interfirm collaboration. In the extreme case, it might even be the key supplier that sets the tone and direction for the collaboration, rather than the focal firm. Further study of this possibility is warranted.

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## Appendix A: Descriptive Statistics

| VBL | Item | N | Mean | Std Dev | Range |
|---|---|---|---|---|---|
| V11 | Relevant | 213 | 5.55869 | 1.37792 | 6.00000 |
| V12 | Complete | 213 | 5.47418 | 1.45548 | 6.00000 |
| V13 | Accurate | 213 | 5.61972 | 1.43441 | 6.00000 |
| V14 | Timely | 213 | 5.47418 | 1.44573 | 6.00000 |
| V15 | Frequent | 213 | 5.54460 | 1.41559 | 6.00000 |
| V16 | Bi-directional | 213 | 5.46948 | 1.38906 | 6.00000 |
| V17 | Formal | 213 | 5.36620 | 1.44626 | 6.00000 |
| V21 | Deal with unexpected events | 213 | 5.21636 | 1.39471 | 6.00000 |
| V22 | Quick response to customers | 213 | 5.19487 | 1.31741 | 6.00000 |
| V23 | Increased flexibility via collaboration | 213 | 5.16799 | 1.30446 | 6.00000 |
| V24 | Postpone activities until customer preferences clear | 213 | 5.28370 | 1.25364 | 6.00000 |
| V31 | Desire/ability to maintain trading relation | 213 | 5.61972 | 1.33565 | 6.00000 |
| V32 | Key supplier important to competitive advantage | 213 | 5.46009 | 1.38882 | 6.00000 |
| V33 | Increased coordination w/ key supplier for competitive advantage | 213 | 5.63850 | 1.31960 | 6.00000 |
| V41 | Timely | 213 | 5.41784 | 1.29187 | 6.00000 |
| V42 | Complete | 213 | 5.53521 | 1.31570 | 6.00000 |
| V43 | Relevant | 213 | 5.60094 | 1.28320 | 6.00000 |
| V51 | Highly reliable | 213 | 5.67606 | 1.27132 | 6.00000 |
| V52 | Reject few or no products | 213 | 5.47887 | 1.32315 | 6.00000 |
| V53 | Consistent quality over time | 213 | 5.55399 | 1.40858 | 6.00000 |
| V54 | Few or no variations in quality | 213 | 5.37559 | 1.50150 | 6.00000 |
| V61 | Capacity to design desirable products | 213 | 5.33803 | 1.45314 | 6.00000 |
| V62 | Accommodate design changes within deadline | 213 | 5.31925 | 1.34636 | 6.00000 |
| V63 | Improve features of products purchased each year | 213 | 5.36150 | 1.34789 | 6.00000 |
| V64 | Handle unforeseen problems | 213 | 5.46948 | 1.26836 | 6.00000 |
| V71 | Met customer needs | 213 | 5.75587 | 1.33407 | 6.00000 |
| V72 | Conformed to customer specifications | 213 | 5.65258 | 1.30364 | 6.00000 |
| V73 | Performed to customer requirements | 213 | 5.77058 | 1.21083 | 6.00000 |
| V81 | Reliable | 213 | 5.73239 | 1.25846 | 6.00000 |
| V82 | Consistent | 213 | 5.79812 | 1.25953 | 6.00000 |
| V83 | Met customer requirements | 213 | 5.87812 | 1.17083 | 6.00000 |
| V91 | Very satisfied with job | 213 | 5.56107 | 1.49715 | 6.00000 |
| V93 | Satisfied with kind of work done | 213 | 5.72322 | 1.21040 | 6.00000 |
| V94 | Most on this job are satisfied | 213 | 5.35166 | 1.37851 | 6.00000 |

**Appendix B: Regression Results (Pretest Data)**

$DELIVP = \beta_0 + \beta_{1*}SPCORE + \beta_{2*}SPCOPS + \varepsilon$

(Delivery performance) = (supplier core offering capability) + (supplier operations capability)

**Table 4.4a**

| Source | DF | SumSq | MeanSq | F Value |
|---|---|---|---|---|
| Model | 2 | 1123.95686 | 561.97843 | 119.26* |
| Error | 32 | 150.78600 | 4.71206 | |
| Corrected Total | 34 | 1274.74286 | | |

*p < .0001; adjusted $r^2 = 0.8743$

| Variable | DF | Parameter Estimate | StdErr | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| Intercept | 1 | 1.87444 | 1.81985 | 1.03 | 0.3107 |
| SPCORE | 1 | 0.70920 | 0.08298 | 8.55 | <.0001 |
| SPCOPS | 1 | 0.26363 | 0.08439 | 3.12 | 0.0038 |

$CLNEED = \beta_0 + \beta_1 SPCORE + \beta_2 * SPCOPS + \varepsilon$

(Closeness of the final offering to end-user customer needs) = (supplier core offering capability) + (supplier operations capability)

**Table 4.4b**

| Source | DF | SumSq | MeanSq | F Value |
|---|---|---|---|---|
| Model | 2 | 782.46240 | 391.23120 | 100.09* |
| Error | 32 | 125.08045 | 3.90876 | |
| Corrected Total | 34 | 907.54286 | | |

*p < .0001; adjusted $r^2 = 0.8536$

| Variable | DF | Parameter Estimate | StdErr | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| Intercept | 1 | 1.08895 | 1.65748 | 0.66 | 0.5159 |
| SPCORE | 1 | 0.70671 | 0.07558 | 9.35 | <.0001 |
| SPCOPS | 1 | 0.07398 | 0.07686 | 0.96 | 0.3430 |

$SPCORE = \beta_0 + \beta_1 * FFORNT + \beta_2 * FFFLEX + \beta_3 * SPCCOM + \varepsilon$

(Supplier core offering capability) = (focal firm collaborative orientation) + (focal firm collaborative flexibility) + (supplier collaborative communication)

**Table 4.4c**

| Source | DF | SumSq | MeanSq | F Value |
|---|---|---|---|---|
| Model | 3 | 1626.09590 | 542.03197 | 35.60* |
| Error | 54 | 822.24893 | 15.22683 | |
| Corrected Total | 57 | 2448.34483 | | |

*p < .0001; adjusted $r^2$ = 0.6455

| Variable | DF | Parameter Estimate | StdErr | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| Intercept | 1 | 0.83307 | 2.99429 | 0.28 | 0.7819 |
| FFORNT | 1 | -0.05618 | 0.13796 | -0.41 | 0.6855 |
| FFFLEX | 1 | 0.11031 | 0.10475 | 1.05 | 0.2970 |
| SPCCOM | 1 | 0.59244 | 0.08381 | 7.07 | <.0001 |

$SPCOPS = \beta_0 + \beta_1*FFORNT + \beta_2*FFFLEX + \beta_3*SPCCOM + \varepsilon$

(Supplier operations capability) = (focal firm collaborative orientation) + (focal firm collaborative flexibility) + (supplier collaborative communication)

**Table 4.4d**

| Source | DF | SumSq | MeanSq | F Value |
|---|---|---|---|---|
| Model | 3 | 1394.41524 | 464.80508 | 23.14* |
| Error | 53 | 1064.46195 | 20.08419 | |
| Corrected Total | 56 | 2458.87719 | | |

*p < .0001; adjusted r2 = 0.5426

| Variable | DF | Parameter Estimate | StdErr | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| Intercept | 1 | -0.74130 | 3.49282 | -0.21 | 0.8327 |
| FFORNT | 1 | -0.08641 | 0.15846 | -0.55 | 0.5878 |
| FFFLEX | 1 | 0.25351 | 0.12077 | 2.10 | 0.0406 |
| SPCCOM | 1 | 0.50822 | 0.09659 | 5.26 | <.0001 |

$SPCCOM = \beta_0 + \beta_1*FFCCOM + \varepsilon$

(Supplier collaborative communication) = (focal firm collaborative communication)

**Table 4.4e**

| Source | DF | SumSq | MeanSq | F Value |
|---|---|---|---|---|
| Model | 1 | 1614.50610 | 1614.50610 | 32.90* |
| Error | 56 | 2748.39045 | 49.07840 | |
| Corrected Total | 57 | 4362.89655 | | |

*$p < .0001$; adjusted $r^2 = 0.3588$

| Variable | DF | Parameter Estimate | StdErr | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| Intercept | 1 | 18.73098 | 4.52424 | 4.14 | 0.0001 |
| FFCCOM | 1 | 0.56052 | 0.09773 | 5.74 | <.0001 |