The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective

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Abstract

Purpose – The purpose of this paper is to investigate a model of collaboration based on the notion of firms having strong working relationships with their suppliers and customers. Whilst issues associated with collaborative relationships between firms and their trading partners are a key theme currently being addressed in the supply chain management literature, there appears to be a lack of clear guidelines as to how such capability can be developed in a practical sense.

Design/methodology/approach – Data from 418 Australian manufacturing plants are used to test the model. Two key constructs, customer relationship and supplier involvement, are developed. For predictive validity purposes, these constructs are regressed against firm performance construct.

Findings – Results of structural equation modeling analysis show, inter alia, that there is some support for this collaboration model, with both collaboration-based constructs influencing performance.

Originality/value – The results provide an insight into how firms can develop a level of collaboration capability.

Keywords Supply chain management, Manufacturing systems, Structural design, Australia

Paper type Research paper

Introduction

Firms collaborating with their customers and suppliers has emerged as a dominant theme in the supply chain management (SCM) literature (Horvath, 2001; Handfield and Nichols, 2002; Burt et al., 2003). This interest is fueled by a growing body of evidence that suggests that effective collaboration can generate many useful outcomes. For example, there are case studies of high profile firms such as Dell (Magretta and Dell, 1998), HP (Lee and Billington, 1995) and Wal-Mart (Landry, 2003) that have close collaborative arrangements with their trading partners. Also, collaboration has been shown to enable firms to deal with the negative impacts of the “bullwhip effect” by reducing wild inventory fluctuations and becoming more responsive to the vagaries and turbulence of markets (Holweg et al., 2005). Further, a number of survey type cross-sectional studies show that collaboration has a positive impact on the financial performance of firms (Vickery et al., 2003; Wisner, 2003; Johnston et al., 2004). In addition, comparative studies show that firms in supply chains with high levels of collaboration have greater competitive advantage than those in less collaborative supply chains (Themistocleous et al., 2004; Myhr and Spekman, 2005).

While the benefits of collaboration make it an attractive concept for firms to pursue, it is also recognized that collaboration is not a completely unproblematic concept (Barratt, 2004). Much of this is due to the practical difficulties associated with implementation (Handfield et al., 2000; Johnston et al., 2004; Kwon and Suh, 2004). Firms generally struggle with issues such as the exact form of the collaborative arrangements that they need to enter into (Rudberg and Olhager, 2003; Walters, 2004), and how they can prevent and negate predatory, opportunistic and abusive actions of collaborative partners (Akkermans et al., 2004; Claycomb and Franwick, 2004; Watson, 2004).

This paper therefore attempts to shed light on what characterizes successful collaboration. We are interested in taking a holistic perspective in proposing a model that is able to explicate the nature of collaboration. Since much of the SCM literature is replete with the idea that firms should work closely with their key customers and suppliers, our collaboration model is essentially based on this principle. To inform the model, we have examined both the demand-side and supply-side literature for practices on how firms should collaborate with customers and suppliers respectively. This led to the development of two key collaboration constructs: customer relationship and supplier involvement. As the ultimate evidence for the utility of any model is its influence on performance, we have included firm performance as a third construct. This model was empirically tested with survey data from 418 Australian manufacturing firms.
The nature and effectiveness of collaboration between firms
Prakash J. Singh and Damien Power

Collaboration – definition and implementation models

Supply chain collaboration has been defined as “two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone” (Togar and Sritharan, 2002, p. 19). It is also similarly defined as “diverse entities working together, sharing processes, technologies, and data to maximize value for the whole group and the customers they serve” (Foster and Sanjay, 2005, p. 31). Daugherty et al. (2006) state that collaboration is about sharing information, jointly developing strategic plans and synchronizing operations to take advantage of vertical integration without investing in acquiring businesses.

These definitions are very broad, and it can be difficult to differentiate this term with other similar terms such as cooperation and coordination. Spekman et al. (1998) provide some clarification. Cooperation is where firms exchange basic information and have some long-term relations with a limited number of critical suppliers or customers. At a higher level is coordination where a continuous flow of critical and essential information through the use of information technology takes place. Collaboration is a stage higher still than coordination and to move to this stage, a high level of commitment, trust and information sharing is required. Therefore, according to Spekman et al. (1998), cooperation, coordination and collaboration are different concepts because each one involves different levels of trust and commitment. Golnicic et al. (2003) also provide criteria that can be used to distinguish between these terms. They suggest that relationship strength, quality and closeness be used to make a determination as to whether an inter-organizational arrangement is coordinative, cooperative or collaborative.

Based on these criteria, “collaboration connotes a higher magnitude [of relationship] between or among firms while coordination and cooperation are lower levels of relationship magnitude” (Golnicic et al., 2003, p. 65).

Given the above definitions of collaboration, many different inter-organizational forms can be used to give practical effect to this type of relationship. These include partnerships, alliances, joint ventures, franchises, license agreements, contractual relationships, outsourcing agreements, service agreements, administered agreements, hierarchical relations, equity investments, cooperative agreements, R&D consortia, cartels, subcontractor networks, industry standard groups, action sets, and market relations (Bowersox et al. 2003; Golnicic et al., 2003; Todeva and Knolke, 2005). Self-evidently, organizations have many choices when it comes to the vehicle for implementing collaborative arrangements with their supply chain partners, and the nature of the inter-action between trading partners can be subject to industry context (Matopoulos et al., 2007).

Whichever practical implementation form is adopted, at a fundamental level, collaboration involves inter-organizational relationships. However, the literature on inter-organizational relationships does not necessarily clarify relativity of advantages and disadvantages. This was a conclusion reached by Barringer and Harrison (2000) who reviewed six theoretical paradigms that are widely used to explain aspects of inter-organizational relationships.

Cost economics, resource dependency, strategic choice, stakeholder theory, organizational learning and institutional theory. Recently, social capital theory has been used to demonstrate the role of social aspects for facilitating relationships within supply chains (Cousins et al., 2006; Krause et al., 2007). From this, it is obvious that inter-organizational relationships lend themselves to analyses from many diverse theoretical perspectives. However, each theoretical paradigm alone is insufficient to capture all the complexities. Further, whilst there are impressive advantages to pursuing collaboration, there are also significant disadvantages that dissuade firms from pursuing it (Barringer and Harrison, 2000).

We intend to address the potential for better explaining the collaboration concept from a holistic perspective. In the next two sub-sections, we will invoke suitable theoretical positions to explain separately both the demand-side and supply-side issues that firms face when building inter-organizational collaborative relationships.

Issues in developing demand-side collaboration

The logic of firms having strong relationships with customers, consumers and even end users is self-evident. The difficulty confronting most firms, however, is that “...physical distribution operations and responsibilities seldom terminate when ownership transfer occurs” (Bowersox, 1969, p. 67). The SCM-related reality for most firms is that the “customer” is often a channel in a distribution system charged with the task of navigating a path to the ultimate user of a product. Under this scenario both spatial and temporal factors become critical to the effective management of the channel (Forrester, 1958; Forrester, 1961; Bowersox, 1969). Developing relationships with channel partners becomes a potential source of strategic advantage when they work with a supplier to find consumers and end users (Bowersox, 1990). Developing relationships with customers can therefore involve not just collaborating with the users of products, but also with those intermediaries providing access to consumers. This can be a significant challenge.

Another difficulty relates to the practical issues in implementing collaborative relationships with customers. A number of generic management systems have been proposed. These include customer relationship management (CRM), collaborative demand planning, demand replenishment, and shared distribution systems. Most of these systems take the form of integrating information systems and processes in pursuit of competitive dimensions such as speed and efficiency (Sanders and Premus, 2005). They can also take the form of relationships where forecasts are developed through consensus (Holmstrom et al., 2002), planning and problem solving become a joint responsibility, and risks and rewards are shared (Stank et al., 2001). While it has been shown recently that firms investing in both IT infrastructure and relationships to support collaboration experience greater returns from the investment in relationships (Kahn et al., 2006), there are still considerable doubts about the efficacy of many of these off-the-shelf systems (Holmstrom et al., 2002).

For most firms, their span of control is usually limited to the immediate customers whom they trade with. As a result, most firms concentrate on developing systems that deal with these groups of customers. One challenge firms face in this area is how to improve customer satisfaction in a practical sense. Firms need to have in place formal systems to increase customer satisfaction levels (El Sawy et al., 1999). This would
The nature and effectiveness of collaboration between firms

Prakash J. Singh and Damien Power

require a firm to not only be aware of the requirements of its customers, but also to have systematic ways to measure customer satisfaction. Customer feedback is usually an important element of this, particularly if it is taken seriously and used to improve customer relations, processes, products and services (Sabath and Whipple, 2004). A final point relates to firms being highly responsive to customers (Bowersox et al., 1999; Claycomb et al., 1999). Firms with strong customer relationships would be expected to have systematic processes for handling complaints, would actively work to minimize customer service problems, and could also be expected to reflect customer needs in the values of the organization.

Whilst the difficulties associated with the ability of firms to develop collaborative arrangements with key customers can be dissuasive, on balance, we contend that the benefits can be very profitable if firms are able to develop such relationships. To test this contention, we propose that firms that develop strong relationships with customers will experience higher levels of performance that those that do not or are unable to do so:

H1. Strong customer relationships positively affect firm performance.

Issues in developing supply-side collaboration

When seeking to improve firm performance through more effective management of the supply chain, the involvement of suppliers becomes important to ensure demand and supply are properly coordinated (Mentzer et al., 2001). At the same time, it needs to be recognized that partnerships with suppliers per se may not represent a source of competitive advantage – rather that the style of involvement with suppliers needs to be developed having determined “...how close should the relationship be in order to maximize the net benefits to both parties?” (Lambert et al., 1999). In this sense, the rationale for involving suppliers in facets of a firm’s operations needs to be driven by a clear business need and a convergence of interests (Bowersox, 1990).

When developing relationships with suppliers, firms have a wide range of options to choose from. These range from the formal, codified and contractual relationships to informal, mutual relationships (Kaufman et al., 2000; Weber et al., 2000). These relationships can be summarized as being “contractual” and “relational” respectively. While many firms currently see the relational model as being inherently superior to the contractual model, recent trends such as e-auctions suggest that the contractual model may be becoming popular again.

The literature is strongly suggestive that firms should seek to develop long-term stable relationships with key suppliers (Stuart, 1997; Vollmann and Cordon, 1998). In practice, this takes several forms. Firstly, when firms develop their values, they can involve their strategic suppliers in these processes (Dyer et al., 1998). Secondly, it is a fair expectation that key suppliers maintain high quality standards of products and services (Verma and Pullman, 1998). Thirdly, to complement the high degree of interaction between trading partners, the communication system would need to be able to ensure transparency in the information that is exchanged between firms and their key suppliers (Garcia-Dastugue and Lambert, 2003). This would require that firms provide suppliers with information so that they can improve their quality and responsiveness. Fourthly, it would be expected that suppliers become involved in the development of new products (Ireland, 1999), and that in order to ensure that the relationship remains fair, benefits resulting from cooperation with suppliers be shared with them (Ballou et al., 2000). Lastly, joint problem solving and planning have been found to be positively associated with levels of trust and with firm performance (Claro et al., 2003).

It has been shown in recent studies that firm performance is linked positively with practices consistent with involvement of suppliers in firm operations (Scannell et al., 2000). It is therefore reasonable to propose that involvement of suppliers in firm activities will have a positive influence on firm performance:


Developing supplier involvement and customer relationships simultaneously

There are many good reasons why some firms choose not to genuinely engage with suppliers and customers (Barringer and Harrison, 2000). These include the possibility that these arrangements could be costly, difficult to manage, lead to a loss of control, become subject to opportunistic actions, and could be illegal in some cases if competition is impaired (Cetindamar et al., 2005). However, there is a growing body of evidence that shows that working with both the key suppliers and customers is efficacious in many ways (Wisner, 2003; Lamberton et al., 2004). This is largely based on the premise that firms should develop appropriate relationships with both customers and suppliers, for focusing on one single group could be myopic and sub-optimal (Forrester, 1958; Forrester, 1961; Forrester et al., 2006).

A number of recent studies have demonstrated the importance of both supply and demand sides of the supply chain equation. The extent to which firms have integrated planning, networks and logistics with both suppliers and customers has been linked to higher levels of performance (Froehlich and Westbrook, 2001). The development of a supply chain wide approach to collaboration has also been shown to be effective in enabling suppliers to respond to the changing needs of customers in fast growing environments (Heikkila, 2002). Further, the relative importance of internal and external integration (i.e. within the firm and between firms) has been studied with “synergistic” effects being found to exist, implying that simultaneous integration may be preferable to a sequential approach (Droge et al., 2004).

The skills sets, technologies and systems within firms required for customer-end interactions are similar to those for dealing with suppliers. This is especially the case where there is a reasonably uniform corporate culture permeating throughout the organization. Therefore, one can expect that firms which have strong customer relationships would also have strong supplier involvement, i.e. there would be strong collaborative arrangements with both demand and supply sides. On balance, we propose that:

H3. Customer relationship and supplier involvement are positively related to each other.

These hypotheses can be summarized in diagrammatic form as shown in Figure 1.
Methodology

Study participants
Data for the empirical testing of the above hypotheses were obtained through a postal survey targeting organizations in the manufacturing industry in Australia. The respondents were senior managers (general, operations, quality, production, etc). The JAS-ANZ Register (Standards Australia, 2004) was used for selecting the sample of organizations. This register is a database of all plants registered to various management meta-standards, including quality, environmental, risk, safety, etc. Therefore, the unit of analysis was at the plant level. An initial list of 1,300 plants was selected from the database. Large corporations have multiple plants listed in this register. Multiple plants from the same company did not substantially bias the sample, each company was limited to one plant in the sample. When these multiple plants were removed, a final target sample size of 1,053 plants was obtained.

The survey was carried out in two stages. The first stage involved a mail out to the whole sample. This was followed up by a repeat mail out to non-respondents a month later. The final response rate was 41.3 percent ($n = 418$). Non-response bias effect was assessed using two methods. The first involved assessing the differences between respondents to the two stages of the survey. Assuming that the second stage respondents were reacting to reminder notices sent to them, and they would otherwise have been non-respondents, statistical analysis of responses between the two groups showed little differences. The second method used to assess non-response bias was through telephone interviews with managers of a randomly selected group of twenty non-responding plants. The reasons for not participating did not suggest that these non-respondents would have answered the questions in the questionnaire significantly differently to respondents. Hence, the two approaches independently suggested that the level of non-response bias was low.

Table I is a cross-tabulation of number of employees versus annual revenue turnover for the plants that participated in this study. As this table shows, the survey respondents represented predominantly small plants with almost half the plants having less than 100 employees and $A10$ million in annual revenue. Also, the plants were mainly from the machinery and equipment manufacturing (26 percent) and metal products (17 percent) manufacturing industry sub-categories.

Measuremen instrument
The measurement instrument used in this study was derived from a large study of quality and operations management practices (Singh, 2003). Since this instrument was original in many respects, a full set of tests for reliability and validity were performed to ensure that the various types of errors were within acceptable levels. These included pretest with eight practitioners and academicians and pilot test within 21 organizations. A total of 146 items were present. Each of the items was measured on a five-point Likert scale.

For this paper, a subset of the items relevant to the key constructs of customer relationship, supplier involvement and firm performance was used. For the customer relationship construct, eight items were selected. For the supplier involvement construct, six items were chosen. Performance of firms was measured along several dimensions, including operational and financial performance, to obtain a holistic perspective. A total of seven items were chosen. The three constructs along with their associated items, and together with the scales that were used, are shown in Table II.

Data analysis procedures and results
Prior to analysis of the data, the dataset was screened to ensure that there were no outliers or errors present. Missing data, which averaged 2.4 percent for the variables, were replaced with values obtained using the ‘expectation-maximization’ iterative algorithm since this method has been shown to be more accurate than other substitution and elimination techniques (Jamshidian and Bentler, 1999).

Psychometric properties of measurement models
A series of tests were performed to ensure that the three constructs had sound psychometric properties. These tests were for content validity, multicollinearity, reliability, convergent and discriminant validity, and common methods bias.

Content validity
The lists of items assigned to the constructs were arrived at through a review of the literature (summarized in the Literature Review section earlier). This provided evidence to accept that the items associated with the three constructs had sufficient grounding in relevant literature and therefore had content validity.

Correlation coefficients and descriptive statistics
The inter-item Pearson correlation coefficients are shown in Table III. These coefficients are low to moderate in magnitude. If inter-item correlations are greater than 0.9, the possibility that multicollinearity (i.e. two or more items measure the same entity) could be existing is high (Hair et al., 2006). As none of the coefficients is greater than 0.9, multicollinearity related problems did not appear to be present. Table III also shows the mean and standard deviation values of all the items. These values suggest that the item measures did not suffer from excessive non-normality.
The Cronbach’s alpha reliability coefficients for the constructs customer relationship, supplier involvement and firm performance were 0.833, 0.797 and 0.703 respectively. These coefficients exceeded the minimum threshold level of 0.7 for acceptable reliability (Hair et al., 2006) for all the constructs. Therefore, the selected items reliably estimated the constructs.

Convergent and discriminant validities
Convergent validity (i.e. the assigned items yield roughly the same results) and discriminant validity (i.e. the items estimate only the assigned construct and not any others) were both assessed by using a confirmatory factor analysis (CFA) model testing approach. The CFA model is a structural equation model (SEM) where the constructs are all co-varied with each other. The SEM analysis was conducted using the AMOS® 5.0 (Arbuckle and Wothke, 2004) software package. The maximum likelihood (ML) estimation technique was used to fit the model to the data because it is a reasonably scale- and distribution-free procedure (Hair et al., 2006).

A number of commonly reported indices for assessing the goodness-of-fit of SEM models with data were obtained for the CFA model. These were as follows: χ² (186) = 640 with p-value < 0.001; normed χ² = 3.440; goodness-of-fit index (GFI) = 0.860; adjusted goodness-of-fit index (AGFI) = 0.826; Tucker-Lewis index (TLI) = 0.801; comparative fit index (CFI) = 0.824; root mean square residual (RMR) = 0.054; and, root mean square error of approximation (RMSEA) = 0.076.

Bollen and Long (1993) and others have proposed a graduated list of terms to describe model-data fit. These include: “perfect”, “strong”, “acceptable”, “adequate”, “weak”, “mediocre”, “poor” and “no fit”. The p-value associated with the χ² measure would need to be higher than 0.05 for good fit. Based on this, the above result suggests poor fit. However, this fit measure has a tendency to produce

<table>
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<tr>
<th>No response</th>
<th>Number of employees</th>
<th>Approximate annual turnover</th>
<th>Total</th>
<th>No response</th>
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<td>No response</td>
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<td>1-100</td>
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<td>204</td>
<td>89</td>
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<td>101-250</td>
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<td>42</td>
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<td>251 +</td>
<td>2</td>
<td>9</td>
<td>24</td>
<td>35</td>
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<td>Total</td>
<td>28</td>
<td>210</td>
<td>140</td>
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Table I Cross-tabulation of number of employees and approximate annual turnover of plants participating in this study

Table II Constructs and associated items

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item label and description</th>
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<tr>
<td>1. Customer relationship</td>
<td>CR1: The organization is aware of the requirements of its customers</td>
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<td>CR2: The organization measures customer satisfaction</td>
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<td>CR3: Processes and activities of the organization are designed to increase customer satisfaction levels</td>
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<td>CR4: Customers are encouraged to provide feedback</td>
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<td>CR5: Customer feedback is used to improve customer relations, processes, products and services</td>
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<td>CR6: The organization has systematic processes for handling complaints</td>
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<td>CR7: Misunderstandings between customers and organization about orders are rare</td>
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<td>CR8: Customers contribute to the development of the organization’s values</td>
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<td>2. Supplier involvement</td>
<td>SI1: The organization seeks long-term stable relationships with suppliers</td>
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<td>SI2: The interests of suppliers were considered when values of the organization were developed</td>
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<td>SI3: The organization seeks assurance of quality from suppliers</td>
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<td>SI4: Suppliers are provided with information so that they can improve their quality and responsiveness</td>
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<td>SI5: Suppliers are involved in the development of new products</td>
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<td>SI6: The gains resulting from cooperation with suppliers are shared with them</td>
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<td>3. Firm performance</td>
<td>FP1: Inventory levels</td>
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<td>FP2: Profits</td>
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<td>FP3: Demand for the products made by the organization</td>
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<td></td>
<td>FP4: Perceived product quality by customers</td>
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<td></td>
<td>FP5: Time for new product development</td>
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<td></td>
<td>FP6: Delivery performance</td>
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<td></td>
<td>FP7: Market share</td>
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Notes: *Survey respondents were asked to express their agreement with statements associated with constructs 1 to 2, on a five-point scale with 1 representing “strongly agree” and 5 representing “strongly disagree”. For items associated with construct 3, survey respondents were asked to express the satisfaction of the organizations with respect to the various measures of performance, using a five-point scale with 1 representing “very satisfactory” and 5 representing “very unsatisfactory”
### Table III  Correlation coefficients and distributional properties

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<tr>
<td><strong>Correlation coefficient</strong></td>
<td>Customer relationship</td>
<td>CR2 0.480** 1</td>
<td>CR3 0.496** 0.543** 1</td>
<td>CR4 0.336** 0.578** 0.483** 1</td>
<td>CR5 0.370** 0.474** 0.514** 0.661** 1</td>
<td>CR6 0.250** 0.329** 0.298** 0.317** 0.360** 1</td>
<td>CR7 0.348** 0.272** 0.398** 0.290** 0.389** 0.299** 1</td>
<td>CR8 0.271** 0.345** 0.378** 0.417** 0.402** 0.211** 0.288** 1</td>
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<td>Supplier involvement</td>
<td>SI1 0.366** 0.249** 0.329** 0.284** 0.305** 0.090 0.239** 0.201** 1</td>
<td>SI2 0.252** 0.247** 0.324** 0.299** 0.257** 0.082 0.166** 0.384** 0.447** 1</td>
<td>SI3 0.183** 0.161** 0.252** 0.197** 0.291** 0.136** 0.176** 0.215** 0.362** 0.331** 1</td>
<td>SI4 0.215** 0.225** 0.311** 0.211** 0.312** 0.066 0.244** 0.233** 0.336** 0.338** 0.510** 1</td>
<td>SI5 0.138** 0.121** 0.219** 0.190** 0.218** 0.029 0.148** 0.281** 0.264** 0.363** 0.283** 0.501** 1</td>
<td>SI6 0.155** 0.204** 0.261** 0.224** 0.216** 0.000 0.180** 0.363** 0.389** 0.538** 0.266** 0.458** 0.562** 1</td>
<td>SI7 0.202** 0.213** 0.236** 0.227** 0.166** 0.053 0.189** 0.241** 0.140** 0.115 0.108 0.197** 0.160** 0.193** 1</td>
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<td>Firm performance</td>
<td>PF1 0.118** 0.101 0.091 0.184** 0.088 0.049 0.082 0.098** 0.134** 0.099 0.058 0.043 0.056 0.081 0.346** 1</td>
<td>PF2 0.109** 0.078 0.067 0.139** 0.069 0.056 0.021 0.117** 0.127** 0.124** 0.110** 0.084 0.109** 0.116** 0.275** 0.487** 1</td>
<td>PF3 0.231** 0.144** 0.218** 0.199** 0.242** 0.112** 0.262** 0.157** 0.258** 0.183** 0.272** 0.240** 0.114** 0.135** 0.187** 0.124** 0.163** 1</td>
<td>PF4 0.202** 0.230** 0.263** 0.231** 0.204** 0.183** 0.181** 0.087 0.148** 0.117** 0.261** 0.171** 0.128** 0.095 0.308** 0.275** 0.231** 0.141** 1</td>
<td>PF5 0.237** 0.238** 0.298** 0.166** 0.235** 0.200** 0.290** 0.141** 0.220** 0.188** 0.224** 0.273** 0.130** 0.163** 0.350** 0.124** 0.149** 0.211** 0.303** 1</td>
<td>PF6 0.153** 0.144** 0.118** 0.277** 0.203** 0.093 0.128** 0.073 0.156** 0.107** 0.103** 0.094 0.120** 0.111** 0.204** 0.417** 0.492** 0.191** 0.124** 0.107** 1</td>
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### Descriptive statistics
- **Mean**: 1.72 2.35 2.06 2.22 2.08 1.74 2.17 2.55 1.77 2.75 1.89 2.21 2.67 2.89 2.33 2.65 2.27 1.84 2.81 2.06 2.54
- **Standard deviation**: 0.617 1.004 0.781 0.926 0.830 0.693 0.886 0.859 0.686 0.749 0.799 0.951 0.902 0.858 1.023 0.902 0.645 0.964 0.798 0.908

**Notes**: ** Correlation is significant at the 0.01 level (two-tailed); * Correlation is significant at the 0.05 level (two-tailed).
negative results with sample sizes greater than 200, and so can be disregarded. For all other fit indices, if the cutoff criteria proposed by Hu and Bentler (1999) are applied, then, except for RMR and RMSEA, it would be concluded that fit is generally poor. But Hu and Bentler’s cutoff criteria are considered to be excessively stringent (Schermelleh-Engel et al., 2003; Marsh et al., 2004; Sharma et al., 2005; Hair et al., 2006). Applying criteria that are less stringent, we believe that the “acceptable” descriptor reasonably accurately captures the level of fit that has been obtained here.

All the parameters associated with the CFA are shown in Table IV. As these results show, the convergent validity of the constructs was generally supported; all the estimated factor loadings of items on constructs are significant (at p-values < 0.001), the signs are all positive and only two are below 0.4, with the minimum being +0.330. Further, from the squared multiple correlation coefficient values, the variances of the items explained by their constructs are reasonably high (with the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent). As for discriminant validity, correlations between the constructs are mostly moderate, the average being 36 percent).

**Table IV** Maximum likelihood estimates for parameters of confirmatory factor analysis model

<table>
<thead>
<tr>
<th>Item</th>
<th>Unstandardized output</th>
<th>Standardized output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor loading (standard error, p-value)</td>
<td>Item error variance (standard error)</td>
</tr>
<tr>
<td></td>
<td>CR1 0.762 (0.087, 0.000) 0.255 (0.019, 0.000)</td>
<td>0.572</td>
</tr>
<tr>
<td></td>
<td>CR2 1.526 (0.153, 0.000) 0.508 (0.042, 0.000)</td>
<td>0.704</td>
</tr>
<tr>
<td></td>
<td>CR3 1.215 (0.120, 0.000) 0.293 (0.025, 0.000)</td>
<td>0.720</td>
</tr>
<tr>
<td></td>
<td>CR4 1.506 (0.144, 0.000) 0.370 (0.033, 0.000)</td>
<td>0.753</td>
</tr>
<tr>
<td></td>
<td>CR5 1.351 (0.130, 0.000) 0.297 (0.026, 0.000)</td>
<td>0.754</td>
</tr>
<tr>
<td></td>
<td>CR6 0.651 (0.090, 0.000) 0.388 (0.028, 0.000)</td>
<td>0.436</td>
</tr>
<tr>
<td></td>
<td>CR7 0.941 (0.118, 0.000) 0.594 (0.043, 0.000)</td>
<td>0.492</td>
</tr>
<tr>
<td></td>
<td>CR8 1.000a 0.521 (0.039, 0.000)</td>
<td>0.540</td>
</tr>
<tr>
<td></td>
<td>SI1 1.000a 0.317 (0.025, 0.000)</td>
<td>0.571</td>
</tr>
<tr>
<td></td>
<td>SI2 1.509 (0.153, 0.000) 0.473 (0.040, 0.000)</td>
<td>0.652</td>
</tr>
<tr>
<td></td>
<td>SI3 1.021 (0.121, 0.000) 0.400 (0.031, 0.000)</td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td>SI4 1.369 (0.143, 0.000) 0.350 (0.031, 0.000)</td>
<td>0.671</td>
</tr>
<tr>
<td></td>
<td>SI5 1.552 (0.170, 0.000) 0.532 (0.044, 0.000)</td>
<td>0.640</td>
</tr>
<tr>
<td></td>
<td>SI6 1.660 (0.166, 0.000) 0.389 (0.037, 0.000)</td>
<td>0.721</td>
</tr>
<tr>
<td></td>
<td>PF1 1.000a 0.525 (0.044, 0.000)</td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td>PF2 1.408 (0.184, 0.000) 0.629 (0.059, 0.000)</td>
<td>0.631</td>
</tr>
<tr>
<td></td>
<td>PF3 1.253 (0.172, 0.000) 0.484 (0.048, 0.000)</td>
<td>0.636</td>
</tr>
<tr>
<td></td>
<td>PF4 0.465 (0.088, 0.000) 0.370 (0.027, 0.000)</td>
<td>0.330</td>
</tr>
<tr>
<td></td>
<td>PF5 0.932 (0.137, 0.000) 0.745 (0.058, 0.000)</td>
<td>0.443</td>
</tr>
<tr>
<td></td>
<td>PF6 0.663 (0.109, 0.000) 0.543 (0.041, 0.000)</td>
<td>0.381</td>
</tr>
<tr>
<td></td>
<td>PF7 1.129 (0.163, 0.000) 0.556 (0.049, 0.000)</td>
<td>0.570</td>
</tr>
</tbody>
</table>

Relationship

| Customer relationship | 0.097 (0.016, 0.000) | 0.536 |
| Supplier involvement | 0.066 (0.015, 0.000) | 0.366 |
| Supplier involvement | 0.91 (0.091, 0.000) | 0.428 |

Common methods bias

Since all items were measured using a five-point Likert scale and responses were received from a single individual in the plant, there is some possibility that common methods bias could be present. To test for this, Harmon’s one factor test using a confirmatory approach (Podsakoff et al., 2003) was performed. This involved testing a one-factor congeneric model (Jöreskog, 1971), where all 21 items were loaded onto a single “common factor” construct. The SEM results of this test indicated that common methods bias was unlikely to be present, with the goodness-of-fit indices for this model indicating poor fit with data. The indices for Harmon’s one factor model were: χ²(189) = 1152; p-value < 0.001; normed χ² = 6.097; GFI = 0.755; AGFI = 0.700; TLI = 0.584; CFI = 0.626; RMR = 0.074; and, RMSEA = 0.111.

SEM results for structural model

Evaluation of goodness-of-fit indices

The hypothesized model as presented in Figure 1 consists of constructs (which are estimated with items) and multiple inter-dependent relationships between these constructs. SEM analysis procedure was used to assess these hypothesized relationships. Given that the theoretical model is tentatively...
The nature and effectiveness of collaboration between firms  
Prakash J. Singh and Damien Power

drawn and the constructs are operationalized with items that have not been validated in prior studies, a two-step procedure is recommended where measurement and structural models are tested separately (Anderson and Gerbing, 1988). This two-step procedure would control for within-construct versus between-construct effects (Anderson and Gerbing, 1988). A simplified form of the two-step procedure proposed by Anderson and Gerbing can be used for this purpose. This would involve conducting CFA in the first step. In the second step, the hypothesized model would be tested. Then the \( \chi^2 \) difference test between these models would be evaluated, with the hypothesized model accepted as having empirical support if the \( \chi^2 \) difference is significant.

In our case, since the number of relationships specified in the hypothesized model is the same as that in the CFA, the fit indices are the same for the two models. Therefore, it was not possible to perform a \( \chi^2 \) difference test. Based on the fit indices for the hypothesized model alone (i.e., \( \chi^2 = 6.40 \) with \( p \)-value < 0.001; normed \( \chi^2 = 3.440; GFI = 0.860; AGFI = 0.826; TLI = 0.801; CFI = 0.824; RMR = 0.054; and, RMSEA = 0.076), it can be concluded that the hypothesized model has acceptable level of empirical support.

**Evaluation of parameter estimates**

Table V shows the SEM output of the model with all the parameters presented in unstandardized form as well as in standardized form for the structural model. As these data show, there are no “offending” (theoretically impossible) estimates present. Further, all the relationships are statistically significant and positive as predicted in the hypothesized theoretical model. Also, the squared multiple correlation coefficient associated with the endogenous construct was 0.210, indicating that the two exogenous constructs accounted for more than twenty percent of the variance in performance.

The regression and correlation data presented in Table V were further analyzed by examining the standardized effect sizes between the constructs. Effect sizes measure the increase/decrease in the endogenous construct (in standard deviation units) when there is a one standard deviation increase in the exogenous construct. The standardized direct effects, indirect effects (calculated using the path analysis tracing rules described by Kline (2005)) and total effects of all the exogenous constructs on the endogenous construct of the model are shown in Table VI.

A couple of observations can be made. First, all effects are positive. Second, the total effect of customer relationship on firm performance was significantly larger than the magnitude of the total effect of supplier involvement on firm performance (0.429 cf. 0.367). This means that one standard deviation change in customer relationship leads to a significantly larger impact on firm performance (+0.429 standard deviation change) than does one standard deviation change in supplier involvement (+0.367).

**Analysis and discussion**

The premise of this paper is that firms that pursue supply chain collaboration should look at developing close working relationships with both customers and suppliers. Should these collaborative efforts succeed, then it is a reasonable expectation that performance improvements would result. We have described the nature of the customer relationship, supplier involvement and firm performance constructs, and the resultant conceptual model that shows the relationships between these constructs.

Whilst at one level, the justification of firms to pursue collaborative relationships with key trading partners is self-evident, the literature on inter-organizational relationships provides sound reasons why some firms would be cautious about entering such relationships (Watson, 2004; Cetindamar et al., 2005; Matopoulos et al., 2007). Further, since collaboration by definition involves more than one party, others may not be as enthusiastic about becoming partners to collaboration as the originating firm. Therefore, firms interested in developing such relationships with others need to become cognizant of all the important factors that contribute to successful collaborative outcomes. Explicating and elucidating some of these has been the central theme of this paper.

The SEM based assessment of the overall fit between our hypothesized model and data showed that there was an acceptable level of empirical support for it. Ignoring the negative \( \chi^2 \) measure result because of its sensitivity to large sample sizes, it can be seen that most other fit indices were within or close to the thresholds for acceptable fit. Further, hypothesis H1, H2 and H3 relating to the individual relationships postulated in the model were all supported. This empirical support for the model enables it to be seen as a possible route for firms to use for developing collaborative arrangements with their key trading partners.

The results show that the total effect of customer relationship on firm performance is greater than that of supplier involvement (0.429 cf. 0.367). A possible explanation for this is the way in which the performance construct is estimated. This construct includes items with a strong customer bent (i.e. apart from the “inventory levels” item, all others are more geared towards demand related

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**Table V** Relationships between constructs

<table>
<thead>
<tr>
<th>Relationships</th>
<th>Unstandardized output</th>
<th>Standardized output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression/covariance</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>coefficient</td>
<td>error</td>
</tr>
<tr>
<td>Customer relationship → Firm performance</td>
<td>0.322</td>
<td>0.086</td>
</tr>
<tr>
<td>Supplier involvement → Firm performance</td>
<td>0.224</td>
<td>0.092</td>
</tr>
<tr>
<td>Customer relationship ↔ Supplier involvement</td>
<td>0.097</td>
<td>0.016</td>
</tr>
</tbody>
</table>
relationships with customers and suppliers, since these have practitioners as to how they can implement collaborative that estimate the constructs should provide confidence to psychometric properties. The results are positive. The items rigorous confirmatory methodology to ascertain their particular, the constructs, especially customer relationship and constructs are estimated differently. From the items assigned to the constructs, it is clear that customer relationship and supplier involvement are not defined symmetrically. Therefore, one cannot assume or expect that these effects should be similar in size and strength. At a practical level it could therefore be expected that collaboration with customers is more directly related to the performance outcomes measured in this study. It is also significant that there is a strong inter-relationship between collaboration with suppliers and customers providing support for the proposition that collaboration in the supply chain needs to be approached holistically with a mindset willing to extend past simplistic dyadic relationships.

Implications for practice
The findings of this study indicate that collaborative arrangements with trading partners are important drivers of improved firm performance. In particular, the model tested in this study indicates that organizations need to be thinking beyond dyadic relationships. They will be best served by focusing on their combined relationship with customers as well as on strategies to ensure a high level of involvement with suppliers. The importance of such a balanced approach is highlighted by the significant correlation recorded between the customer relationship and supplier involvement constructs, and by the significant predictive effects on performance recorded by each. As noted earlier, the effect of customer relationship on performance is greater than supplier involvement. It is, however, important to note that the supply side activities also account for a significant proportion of the variance in performance metrics. The implication is both significant and of potential importance to firms seeking to engage in collaborative arrangements with trading partners on both supply and demand sides. When seeking to improve firm performance, a single minded focus on managing relations with customers will no doubt have some effect. Such a focus on the demand side, however, without a supporting and complementary approach on the supply side, will at best be sub-optimal and at worst, be counter-productive. The results also reinforce the importance of a balanced approach to managing supply chain activities.

This study makes a significant contribution by providing a framework for decision making. Many organizations implement collaboration based on intuition, executive judgment and competitive and customer pressure. In doing so, it could well be that organizations are focusing on aspects that may not be so important, whilst those aspects that may need to be strengthened could possibly be ignored. Instead of implementing unproven frameworks, the model presented in this paper provides a validated model that can guide the actions of practitioners in terms of elements to emphasize vis-à-vis those that do not need the same level of attention. In particular, the constructs, especially customer relationship and supplier involvement, have been developed using a rigorous confirmatory methodology to ascertain their psychometric properties. The results are positive. The items that estimate the constructs should provide confidence to practitioners as to how they can implement collaborative relationships with customers and suppliers, since these have been shown to be valid measures of the constructs. Further, the importance of balancing involvement of suppliers with customer collaboration is highlighted by the framework. The implication for managers is that collaborative involvement on the supply side has the effect of creating the conditions for more effective demand side relationships. In support of this, the model predicts about 21 percent of the variance in firm performance, indicating that this combination provides significant strategic leverage. Given the intense level of competition organizations face, explanation of this level of performance would be significant for most firms. Ignoring this level of performance prediction would not be wise for most organizations.

Implications for theory
The concept of collaboration, what it means, and how it can best be applied, has been a focal point of research both in general management and SCM research (Andraski, 1998; Heiman and Nickerson, 2002). More specifically, the potential for collaboration to be used as a specific competitive strategy goes back some years both in the general management literature (Schweiger et al., 1986; Thorelli, 1986), as well as in the domain of SCM research (Bowersox, 1990). This literature shows that the pursuit of collaboration between supply chain partners can be traced to factors such as: the growing complexity of business combined with resource limitations (Lambert et al., 1999); rapid developments in information technology (Sanders and Premus, 2005); the importance of being able to “visualize” the wider supply chain (Xu and Dong, 2004); and the pursuit of simultaneous objectives such as cost reduction and increased levels of service (Stank et al., 2001). In our model, most of these factors have been incorporated. In doing so, our model takes a holistic view of the drivers (through the specific measurement items) that contribute to deep and long-term engagement of firms with their trading partners as part of collaborative efforts. Further, the ideas encapsulated within our model operate at a level such that it is largely unaffected by the actual vehicle that is used for facilitating collaboration (i.e. partnership, alliance, etc.) In this sense, our model is generic in its application.

The various theories in the inter-organizational relationship knowledge domain provide some insights into the nature of results obtained in this study. However, there are some other theories that ask more questions than provide answers. For example, is collaboration a “resource” that makes it valuable, unique and inimitable (Stewart and O’Brien, 2005), in the manner described by the resource based view of the firm? The strategy literature more usually provides other options than collaboration for firms that can be used to develop competitive advantage, through technological “leapfrogs,” vertical integration, etc. Similarly, contingency theory would suggest that it would be necessary to assess the applicability of collaborative arrangements for industry type, firm size, social, economic and political contexts, and other moderating factors. Furthermore, given the popularity of the SCM concept, it is possible that many firms are engaging in collaboration only as a fad (Staw and Epstein, 2000; Van Hoek, 2001). The extent to which institutional theory based coercive, mimetic and normative influences are affecting the decisions of firms to collaborate is unclear.
Conclusion

Many organizations are systematically developing collaborative arrangements with their suppliers and customers. In most cases, this is part of a greater SCM initiative. If this growth rate in interest is maintained, many more organizations will be doing the same in the foreseeable future.

In this paper, we have presented a simple but effective model for how firms can realistically and meaningfully pursue collaborative relationships with multiple trading partners beyond a one to one dyadic focus. This model is based on the notion that strong, deep, meaningful and long-term engagements with customers and suppliers produce performance improvements. The advantage of this model is that it does not depend on the vehicle that organizations chose to use for their collaborative arrangements. Instead, the model operates at a deeper level of engagement. As such, this model does not necessarily require large investments of resources, development of special infrastructure, creation of new entities, dramatic re-alignment of how business is done, etc. Rather, the empirical support for our model re-affirms the value of doing simple things and using existing infrastructure. In this way, our model can be thought of as being generic in application and providing a focus on the integrity of the relationship rather than promoting investment in systems.

The model presented in this paper provides opportunities to build on its theoretical base. This could include developing better measures for the three constructs by incorporating suggestions from literature (Lambert and Pohlen, 2001; Keller et al., 2002; Min and Mentzer, 2004). Also, we believe that this model can be considered as being at an early stage on the maturity model, for other more “sophisticated” models have been presented (e.g., Min and Mentzer (2004) and, Chen and Paulraj (2004)). It would be useful if these models could be assembled and analyzed for their requirements, so that organizations can get a realistic idea of the effort required to make these work for them. Further, some of the inter-organizational theories (e.g., resource based view of the firm, contingency theory, institutional theory) raise more questions than provide answers relating to why and how organizations collaborate. More specific studies that sought to clarify these quandaries would assist in developing a better understanding of the concept.

References


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