

A DIMENSION LEVEL EXPLORATORY STUDY OF SUPPLY CHAIN RESPONSIVENESS AND SCM PRACTICES

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ABSTRACT

This study builds on Thatte, et al.'s (2013) research model, which found positive relationships between supply chain management (SCM) practices and supply chain responsiveness (SCR). Employing regression analyses, this paper analyzes the effects of specific SCM practices (SCMP) that impact SCR and its dimensions. The study finds that customer relationship (CR) and strategic supplier partnerships (SSP) are found to positively influence operations system responsiveness (OSR), while SSP and information sharing (IS) are found to improve supplier network responsiveness (SNR). IS, SSP, and CR between supply chain trading partners were found to increase SCR. The study did not find any support between SCMP dimensions and logistics process responsiveness (LPR).

INTRODUCTION

Leading global firms across industries have gained competitive advantages over competitors through collaboration with their supply chain members (Lee, 2004). Firms both large and small have benefitted from such partnerships and open information sharing with trading partners (Simchi-Levi et al., 2008). Supply chains seek to improve their responsiveness with respect to their customers (Hines, 2004; Melnyk et al., 2010) in order to excel. It would be useful for firms to identify the practices that can boost their SCR in one or more ways.

Thatte et al. (2013) dealt with large-scale instrument validation and hypotheses testing between SCR, SCM practices, and competitive advantage (CA) using structural equation modeling, and established a positive relationship between SCM practices and SCR, SCR and CA, and SCM practices and CA. This study extends the study of Thatte et al. (2013) by examining the dimension level relationships between SCM practices and SCR in order to understand how SCR can be improved through different SCM practices. Existing literature lacks such dimension level analyses involving SCM practice and SCR. This study aims at filling this gap by providing insight into these relationships, so meaningful practical implications for improving SCR and its three dimensions OSR, LPR, and SNR, via specific

components of supply chain practices, may be drawn. The relationships between the constructs are tested using regression analyses using data from 294 survey respondents.

CONSTRUCTS AND RESEARCH FRAMEWORK

Figure 1 presents the framework for this research. It has been adopted from Thatte et al.'s (2013) study, which developed the SCR construct and a valid and reliable measurement instrument for SCR through rigorous statistical methodologies, including pre-testing, pilot testing, confirmatory factor analysis, unidimensionality, reliability, validity, and second-order construct validation.

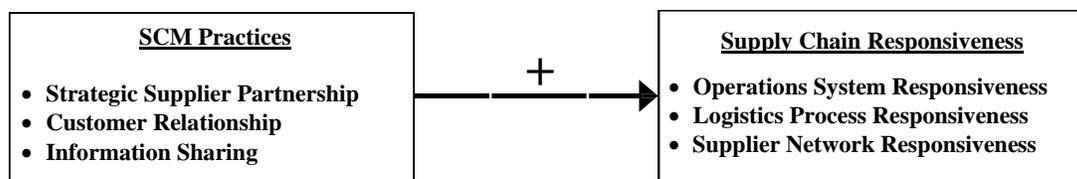


FIGURE 1. RESEARCH FRAMEWORK

SCM Practices

‘SCM practices’ is defined as “the set of activities undertaken by an organization to promote effective management of its supply chain” (Li et al., 2006, p. 109). Li et al. (2005, 2006) proposed ‘SCM practices’ as a multi-dimensional construct comprising upstream and downstream supply chain sides. This study adopts strategic supplier partnership, customer relationship, and information sharing as the three sub-constructs for SCMP as identified by Li et al. (2005, 2006). Li et al. (2005) developed a valid and reliable SCMP measuring instrument. This instrument is adopted in this study. SCMP has been shown to positively impact SCR (Thatte et al., 2013).

SSP is defined as “the long term relationship between the organization and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organizations to help them achieve significant ongoing benefits” (Li et al., 2006, p. 109). Croxton et al. (2001) consider SSP as a key SCM practice. Gunasekaran et al. (2001) claim that a strategic partnership emphasizes long-term partnerships and promotes mutual planning and problem-solving efforts. Organizational strategic partnerships promote shared benefits and ongoing collaboration in key strategic areas such as technology, products and markets (Yoshino and Rangan, 1995). Strategic partnerships with suppliers make it easier for organizations to work closely and effectively with a few suppliers rather than multiple suppliers selected on the basis of costs alone (Kalwani and Narayandas, 1995). Cost-effective design alternatives, help in selecting better components and technologies, and assist in design evaluation are some of the benefits of including suppliers early in the product design process

(Tan et al., 2002; Fulconis and Paché, 2005). Porter (1980) suggested that cooperation could enable partners to come together in a stronger position than they alone could. Mentzer et al. (2001) suggest that having closer ties with suppliers is the key to effective management in the global environment. Effective SCM requires cooperation between the supply chain members (Boddy et al., 2000). The past three decades have seen an increasing trend in long term, collaborative relationships by organizations with a few trusted suppliers. Vonderembse & Tracey (1999) argue that in North American supply chains, the level of supplier involvement in continuous improvement and product development efforts is low. They claim that increased involvement of the company / supplier could have a significant impact on the performance of the supply chain. Long-term relationship refers not to any specific time period, but rather to the intention that the arrangement will not be temporary (Chen and Paulraj, 2004). Through close ties, supply chain partners are willing to share risks and reward and to maintain long-term relationships (Cooper and Ellram, 1993; Stuart, 1993). The literature widely discusses the Japanese supplier partnership system (Webster, et al., 2000; Nishiguchi, 1994), where Japanese companies in various industries started to engage their suppliers in collaborative design (Nishiguchi and Brookfield, 1997).

CR is defined as “the entire array of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction” (Li et al., 2006, p. 109). CR is regarded as a key SCM practice in literature (Noble, 1997; Tan et al., 1998; Croxton et al., 2001). The CR practices of an organization can affect both their success in SCM efforts and their performance (Scott and Westbrook, 1991; Ellram, 1991; Turner, 1993). Successful SCM involves downstream customer integration and upstream supplier integration (Tan et al., 1999). Personalized customer care and better customer relationship management are of paramount importance for organizational success (Wines, 1996). Good relationships with trading partners, including clients, are key to organizations' successful SCM efforts (Moberg et al., 2002). Close customer relationships enable product differentiation from competitors, support customer loyalty, and increase customer value (Magretta, 1998). In developing effective SCM strategies, customer relationship activities have played a crucial role (Wisner, 2003).

IS refers to “the extent to which critical and proprietary information is communicated to one’s supply chain partner” (Li et al., 2006, p. 110). Mentzer et al. (2000) mention that shared information may vary in nature from strategic to tactical, and could be related to logistics, customer orders, forecasts, schedules, markets, or other. The sharing of information refers to the access to private data between trading partners, enabling them to monitor the progress of products and orders through different supply chain processes (Simatupang and Sridharan, 2002). Simatupang and Sridharan (2005) provide some of the components of IS, including data acquisition, processing, storage, presentation, recovery and transmission of demand and forecast data, inventory status and locations, order status, cost-related data and performance status. They add that the IS for key performance metrics and process data improves the visibility of the supply chain, thereby enabling effective decision-making. They also state that shared information in a supply chain is only useful if relevant, accurate, timely and reliable (Simatupang and Sridharan, 2005). IS with trading partners allows organizations to make better decisions, take action on a more visible basis (Davenport et al., 2001), and is a critical element of a positive supply chain relationship (Lalonde, 1998). The demand information flows upstream from the point of sale through information sharing, while information about product availability flows downstream (Lee and Whang, 2001; Yu et al., 2001). In addition, information sharing ensures

that the right information is available at the right place and at the right time for the right trading partner (Liu and Kumar, 2003), and aids in reducing the bullwhip effect (Lee et al., 1997; Yu et al., 2001). According to Lummus and Vokurka (1999), a first step is to gain a clear understanding of supply chain concepts and be willing to share information openly with supply chain partners in order to make the supply chain competitive. Lau and Lee (2000) maintain that creating a controlled sharing environment for business data and processes improves the effectiveness of IS among trading partners. However, organizations in supply chains are reluctant to share information with each other (Vokurka & Lummus, 2000) because of the fear of providing competitive and sensitive information, such as stock levels or production schedules (Lancioni et al., 2000; Ballou et al., 2000; Croom et al., 2000).

Supply Chain Responsiveness (SCR)

SCR is defined as the capability of promptness and the degree to which a supply chain can address changes in customer demand (Holweg, 2005; Prater et al., 2001; Lummus et al., 2003; Duclos et al., 2003). SCR is aggregate of three first-order constructs operations system responsiveness (OSR), logistics process responsiveness (LPR), and supplier network responsiveness (SNR). OSR, LPR, and SNR were conceptualized and operationalized as the three sub-constructs of SCR in Thatte et al. (2013).

OSR is defined as the ability of a firm's manufacturing system to address changes in customer demand (Thatte et al., 2013). While OSR includes manufacturing and service operations, this study is limited to firms within the manufacturing industry. OSR at each supply chain entity is an essential constituent of SCR, as each entity is required to provide timely and reliable provisioning of products and services, to satisfy customer demand (Lummus et al., 2003; Duclos et al., 2003; Meehan and Dawson, 2002). OSR items measure the responsiveness of a specific node or firm in a supply chain (Lummus et al., 2003; Duclos et al., 2003). The items used to operationalize the OSR construct are presented in Appendix A.

LPR is defined as the ability of a firm's outbound transportation, distribution, and warehousing system (including 3PL/4PL) to address changes in customer demand (Thatte et al., 2013). These activities include packing and shipping, warehousing, transportation planning and management (Lummus et al., 2003; Duclos et al., 2003; Ricker and Kalakota, 1999), order tracking and delivery, inventory management, and reverse logistics. This study is limited to the outbound logistics of the focal firm. The LPR components include aspects such as adjusting warehouse capacity to address demand changes, accommodating and responding to volatile demand, varying transportation carriers, handling wide variety of products, the ability to pack product-in-transit to meet customer requirements, and the ability to customize products close to the customer, in order to achieve CA. It is vital that firms have easy access to various modes of transportation and are able to utilize them for improving logistics flexibility and responsive (Prater et al., 2001). Firms' logistics should be able to adjust the logistics resources speedily to satisfy market needs (Hise, 1995). Lummus et al. (2003) present logistics process flexibility facets of a supply chain, which have been adapted for LPR measures (see Appendix A).

SNR is defined as the ability of a firm's major suppliers to address changes in the firm's demand (Thatte et al., 2013). Firms' ability to be responsive to customer demand is also dependent on suppliers' ability to make volume changes. The presence of flexible and responsive partners downstream and upstream of a firm is essential for responsiveness (Christopher and Peck, 2004). Supply chains must be able to adapt swiftly to supply disruptions (Walker, 2005) as well. CA, from a responsive supply chain, can be gained through speedily meeting changing customer demands. This could be in the form of promptly supplying new products or satisfying the product volume, mix, variations, or new product introduction needs of the markets. Satisfying these requirements necessitates a responsive supply chain from raw materials to finished products and extending to distribution and delivery. Selecting suppliers who can quickly add new products, and having suppliers make desired changes is detrimental to a firm's responsiveness. Selecting suppliers based on their capabilities, such as in product development, volume flexibility, and rapid deployment, positively impacts delivery time of new products (Choi and Hartley, 1996). A firm's ability to be responsive is weakened due to the lack of supplier flexibility (Holweg, 2005). The measures of SNR used in this study are presented in Appendix A.

RESEARCH METHODOLOGY

This study adopts the SCR instrument developed by Thatte et al. (2013) and the SCM practices instrument from Li et al. (2005) and Li et al. (2006). The items for these instruments are listed in Appendix A. The unit of analysis in this study is a firm since SCMP and SCR rely on the individual operating companies within a supply chain. A similar unit of analysis has been used in previous studies (ex: Swafford et al., 2006). A study that involves the entire supply chain, from raw materials to end customer, would be complex, time consuming, and costly.

Large-scale data collection was carried out using a web-based survey based on the methods of Dillman (2000). E-mail lists were purchased from The Council of Supply Chain Management (CSCMP), Rsateleservices.com, and Lead411.com. Seven SIC codes were covered in the study: 22 *Textile Mill Products*, 23 *Apparel and other Textile Products*, 25 *Furniture and Fixtures*, 34 *Fabricated Metal Products*, 35 *Industrial Machinery and Equipment*, 36 *Electrical and Electronic Equipment*, and 37 *Transportation Equipment*. The lists were limited to organizations with more than 100 employees, as they were most likely to participate in SCM initiatives. Since the focus of this study is SCM, the target respondents were the operations / manufacturing / purchasing / logistics / materials / supply chain – vice presidents, directors, and managers, as these personnel were deemed to have the best knowledge of the supply chain area. When answering the questionnaire, respondents were asked to refer to their major suppliers or customers. The final version of the questionnaire was given to 5498 target respondents by e-mail. The survey was sent by e-mail in three waves to ensure a reasonable response rate.

The response rate was calculated based on the number of clicks generated by the email and the total number converted to a completed survey. A total of 714 click-throughs were generated after three waves of emailing and 294 completes were obtained to provide a good response rate of 41.18%. Response rate based on click-throughs may be a better measure for email surveys since large amounts of emails sent in this way are treated as spam by the email program of respondent organizations and

are unable to be retrieved or viewed by the target respondent. Since it is difficult to track this information accurately, a more appropriate measure would be to base the analysis on the number of

people who visited the site and had the opportunity to review this study's request and purpose, and then decline to complete the survey on any number of grounds. As shown by the characteristics of the population (Appendix B), 11% of the respondents are CEO/President, 45% are Vice Presidents, 25% are Directors, and 19% are Managers. Thus 81 percent of the respondents (CEOs, VPs and Directors) are high-level executives, implying a high level of reliability of the responses received, as these executives have a wider domain (job responsibility) and administrative knowledge. This is in line with previous survey-based SCM studies (ex: Frohlich and Westbrook, 2002). The areas of expertise included 11% executives (CEOs/Presidents), 12% purchasing, 22% SCM, 18% distribution/transportation/logistics, 20% manufacturing/production, 10% materials and 7% other categories, such as sales. Thus, the domains of the respondents cover all key functions throughout the supply chain, from purchasing, manufacturing, sales, and distribution. Since 33% of respondents have been with the organization for more than 10 years and 21% have been with their organization for 6-10 years, the majority of respondents have a comprehensive view of the supply chain program of their company.

This research did not directly investigate non-response bias, as the email lists only had individual names and email addresses without the organizational details. This research compares those subjects who responded to the first e-mail wave and those who responded to the second/third wave. The succeeding waves of the survey were considered representative of non-respondents (Lambert & Harrington, 1990; Armstrong & Overton, 1977). In previous SCM empirical research, similar methodology was also used (Li et al., 2005; Chen & Paulraj, 2004; Handfield & Bechtel, 2002). The comparisons were made using Chi-square tests (χ^2 statistic). There was no significant difference between these two groups in the type of industry (based on SIC), the employment size, and the job title of the respondent (i.e. $p > 0.1$, when testing the null hypotheses: there is no significant difference in the distribution of responses across SIC codes/employment size/job title between groups). In addition, Chi-square independence tests were also carried out to determine whether the distribution of responses across SIC codes, employment size, and job title of the respondent is independent of the three waves when independently considered. No significant difference was found in industry type (based on SIC), employment size, or respondent's job title between the three groups / waves.

RESULTS

Thatte et al. (2013) found SCM practices to have a direct positive impact on the SCR of a firm and confirmed the assertion in literature that organizations engaged in collaborative practices with their supply partners can better respond to customer demand. In order to explore the specific dimensions of SCM practices that lead to higher levels of SCR in terms of OSR, LPR, and SNR, a dimension-level statistical analysis was performed by employing stepwise regression analysis. The stepwise multiple regression analysis is frequently used in exploratory studies (Aron and Aron, 1999). The individual dimensions of SCMP are predictors and the study seeks to understand which of these dimensions contribute significantly to the overall SCR prediction. A stepwise regression analysis is performed to determine which dimensions of SCM practices (viz. SSP, CR, and IS) are significant predictors of SCR (composite score). Table 1 presents the stepwise regression

results of SCMP (dimension level) as the independent variable $(IV)_{adj}$ and SCR (composite score) as the dependent variable (DV). Results indicate an overall model of the three dimensions of SCMP that reasonably predict SCR, $R^2 = 0.194$, $R^2 = 0.186$, $F(3,290) = 23.271$, $p < 0.001$. The model accounted for 18.6% (R^2_{adj}) of the variance in SCR. A summary of regression coefficients is presented in Table 2 and indicates the three dimensions of SCMP in the order IS ($\beta = 0.223$), SSP ($\beta = 0.203$), and CR ($\beta = 0.128$) that significantly predict SCR.

TABLE 1. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on SCR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. IS	0.373	0.139	0.136	0.139	47.157	< 0.001	1	292
2. SSP	0.426	0.182	0.176	0.043	15.147	< 0.001	1	291
3. CR	0.440	0.194	0.186	0.012	4.457	< 0.05	1	290

TABLE 2. COEFFICIENTS FOR SCMP DIMENSIONS (IS, SSP, AND CR) ON SCR

	<i>B</i>	β	<i>t</i>	<i>p</i>
IS	0.185	0.223	3.551	0.000
SSP	0.167	0.203	3.365	0.001
CR	0.104	0.128	2.111	0.036

By using stepwise regression analyses between SCMP dimensions IS, SSP, and CR as IVs and SCR dimensions OSR, LPR, and SNR as DVs, the study further examines which dimensions of SCMP significantly predict one or more dimensions of SCR. The results are presented in Tables 3-8.

TABLE 3. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on OSR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. CR	0.295	0.087	0.084	0.087	27.841	< 0.001	1	292
2. SSP	0.339	0.115	0.109	0.028	9.119	< 0.01	1	291

TABLE 4. COEFFICIENTS FOR SCMP DIMENSIONS (CR AND SSP) ON OSR

	<i>B</i>	β	<i>t</i>	<i>p</i>
CR	0.251	0.227	3.817	0.000
SSP	0.201	0.180	3.020	0.003

Tables 3 and 4 indicate that only two dimensions of SCMP, in the order CR ($\beta = 0.227$) and SSP ($\beta = 0.180$), significantly predict OSR. Results suggest that IS does not contribute significantly to the prediction of OSR.

TABLE 5. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on LPR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. IS	0.285	0.082	0.078	0.082	25.911	< 0.001	1	292
2. CR	0.310	0.096	0.090	0.015	4.693	< 0.05	1	291

As observed in Table 5 the results are not significant ($R^2_{adj} = 0.090$) to draw conclusions with regards to LPR. It is desired that R^2_{adj} be at least 0.10 to indicate that the given IV explains at least 10% of the variance in DV, so as to draw any substantial inferences (Mertler & Vannatta, 2002). The results indicate that none of the SCMP dimensions predict the LPR dimension of SCR when considered individually.

TABLE 6. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on SNR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. SSP	0.339	0.115	0.112	0.115	37.870	< 0.001	1	292
2. IS	0.390	0.152	0.146	0.037	12.849	< 0.001	1	291

TABLE 7. COEFFICIENTS FOR SCMP DIMENSIONS (SSP AND IS) ON SNR

	<i>B</i>	β	<i>t</i>	<i>p</i>
SSP	0.233	0.242	4.004	0.000
IS	0.210	0.216	3.585	0.000

Tables 6 and 7 show that only two dimensions of SCMP in the order SSP ($\beta = 0.242$) and IS ($\beta = 0.216$), significantly predict SNR. As observed, CR does not contribute significantly to the prediction of SNR.

Table 8 summarizes the regression analyses results. Construct-level regression analysis results found direct and positive impact of SCMP on SCR, and support the structural equation modeling results between SCMP and SCR found by Thatte et al. (2013). The dimension-level regression analyses results suggest that IS, SSP, and CR, in that order, can improve SCR. Results suggest that CR and SSP, in that order, can contribute in improving OSR, while SSP and IS can improve SNR. The study did not find support for the impact of SCMP dimensions on LPR. This could be attributed partly, to the distribution of the variance explained by the IV on the DV when dimension level analyses are performed, thus leading to the reduced significance of these dimension level analyses. These findings are discussed in the following section.

TABLE 8. SUMMARY OF REGRESSION ANALYSES RESULTS FOR SCR AND ITS DIMENSIONS

Predictor	Outcome	R ² _{adj}	Sig. (p)
Construct - Level Regression Analysis			
1. SCM Practices (SCMP)	Supply Chain Responsiveness (SCR)	0.278	0.000
Dimension - Level Regression Analyses			
SCMP: 1. Information Sharing (IS) Strategic Supplier Partnership (SSP) Customer Relationship (CR)	Supply Chain Responsiveness (SCR)	0.186	0.000
SCMP: 1. Customer Relationship (CR) 2. Strategic Supplier Partnership (SSP)	Operations System Responsiveness (OSR)	0.109	0.000
SCMP: Practically NS*	Logistics Process Responsiveness (LPR)	0.090	0.000
SCMP: 1. Strategic Supplier Partnership (SSP) 2. Information Sharing (IS)	Supplier Network Responsiveness (SNR)	0.146	0.000

RESEARCH FINDINGS AND IMPLICATIONS

This study provides researchers insight about the specific SCM practice dimensions that positively impact SCR of a firm. SCMP was found to reasonably predict SCR of a firm, supporting the findings of Thatte et al. (2013). The study found that information sharing and effective relationships with

customers and suppliers can directly lead to higher levels of SCR. This finding supports prior literature (ex: Qrunfleh & Tarafdar, 2013; Frohlich & Westbrook, 2001; Clinton & Closs, 1997; Gunasekaran & Yusuf, 2002; Van Hoek et al., 2001; Handfield & Nichols, 2002). In addition, effective relationships with customers and suppliers will positively influence a firm's ability to be operationally responsive to demand changes by customers. This finding is consistent with Magretta's (1998) case study analyses of Dell Corp. Also, effective relations with suppliers, and quality and timely information sharing, as found by Lambert and Cooper (2000) in their case study research, with supply chain trading partners were found to directly and positively lead to increased supplier responsiveness. This result suggests that organizations must select suppliers based on the potential for close long-term relationships, which is in accordance with Choi and Hartley's (1996) findings. The study did not find IS to improve OSR. The study also did not find CR to improve SNR. Furthermore, the study found that none of the dimensions of SCMP significantly predict LPR.

For managers and organizations, the findings imply that organizations that are involved in IS practices are instrumental in achieving a SCR. These practices include: informing trading partners in advance of changing needs two-way sharing of proprietary information between trading partners, keeping one another informed about issues that affect business, two-way sharing of business knowledge and processes, exchanging information that helps to establish business planning, and keeping one another informed about events or changes that may affect the other partners.

Organizations that are engaged in SSP initiatives can achieve higher levels of SCR wherein organizations set goals and targets, as well as plan and solve problems jointly with suppliers to meet such targets, select suppliers based on quality, include suppliers in continuous improvement programs, and involve key suppliers in new product development initiatives.

Additionally, firms that frequently interact with customers to set reliability, responsiveness, and other standards, regularly measure and evaluate customer satisfaction and determine future customer expectations, facilitate customers' ability to seek assistance from them, and periodically evaluate the importance of the relationship with their customers, can achieve higher levels of SCR.

The results found CR and SSP to predict OSR. This implies that having close customer and supplier relations develops a better understanding between trading partners, and is instrumental in increasing a firm's ability to respond rapidly to demand changes by customer. The study finds that through CR and SSP *mentioned* practices, organizations can be more operationally responsive in terms of being able to respond rapidly to changes in product volume demanded by customers, effectively expedite emergency customer orders, rapidly reconfigure equipment to address demand changes, rapidly reallocate people to address demand changes, and rapidly adjust capacity to address demand changes.

Finally, the study also found that firms' suppliers can be more responsive, in terms of being able to change product mix in a short time, consistently accommodate the focal firm's requests, provide quick inbound logistics to the focal firm, and effectively expedite the focal firm's emergency orders, by engaging in the aforementioned IS practices and SSP with the focal firm. Thus, SSP is the predominant SCMP dimension that is instrumental in the improvement of SCR as well as two of its dimensions - OSR and SNR. This study thus supports the findings of Qrunfleh and Tarafdar (2013), which found that close relationships with suppliers form the pathway through which supply chains

can be responsive to customer demands. Further, a plausible explanation for the lack of support between the dimensions of SCMP and LPR could be that 59.86% respondents in this study indicated that they outsourced outbound logistics to a moderate to high extent. This outsourcing transfers the LPR capabilities to the 3PL companies and outside the purview of the focal firm; thus the focal firms do not have direct control over LPR capability. The 3PL companies maintain and often exceed customer expectations. There is thus little scope for in-house improvement of LPR by firms. This finding also gives future researchers food for thought.

As today's competition is moving from between firms to between supply chains, more and more organizations are increasingly adopting SCM practices in the pursuit of competitive advantage. The findings of this research assure practitioners that SCM is an effective way of competing, and the implementation of SCM practices does have a strong impact on SCR. This study provides predominant SCM practices that directly impact SCR on an aggregate basis, as well as on one or more of its dimensions.

The findings imply that organizations may be able to improve their overall SCR through IS, SSP, and CR. Organizations can be operationally more responsive through collaborative, inclusive, and win-win relationship practices with upstream and downstream supply chain trading partners, in terms of the five measures of CR and the six measures of SSP (see Appendix A). Also, firms' suppliers can be more responsive through strategic partnership practices in terms of the six measures of SSP, and two-way information sharing in terms of the six measures of IS (see Appendix A), with the focal firm downstream. The findings may encourage practitioners and firms to emphasize on these SCM practices to boost SCR, OSR, and SNR. It could be in the best interest of firms to improve their SCR, OSR, and SNR as these abilities have been found to improve firm competitive advantage (Thatte & Agrawal, 2017; Thatte et al., 2018). The study also provides a research framework that identifies positive and significant relationships between SCMP and SCR. It provides an insight for future research in the area of SCR and SCMP.

LIMITATIONS AND FUTURE RESEARCH

Building on theoretical and empirical studies, this research has extended *past research* in several ways. While this research has contributions from both theoretical and practical perspectives, it also has some limitations that can be addressed in future research as described below.

In this research, the revalidation of constructs was not performed due to the limited number of observations (294). In future research, this may be addressed. To improve the response rate, new mailing lists and research methods can be used. Individual respondents (high-level administrators from procurement, operations, materials, and logistics functions) in an organization were asked to respond to complex SCM issues involving all supply chain participants, including upstream suppliers and downstream customers. No person in an organization, however, is responsible for the entire supply chain. Therefore, some measurement inaccuracy may be generated by using a single respondent. In order to enhance generalizability, future research may extend or replicate the study for other types of industry. Future research may also apply multiple methods of obtaining data. The

use of single respondent to represent intra or inter-organization wide variables may generate some inaccuracy (Koufteros, 1995). Future research may seek to use multiple respondents from each participating organization to improve the reliability of the research findings. Future research may test the relationships in different countries identifying country-specific SCM issues. Because the study found no support for the impact of SCMP dimensions on LPR, future studies can further investigate this aspect.

In future studies, the effects of additional SCMP dimensions on SCR not studied in this research can be studied. Future research may study SCMP and SCR at the supply chain level. To find out how SCM practices differ by industry in improving SCR, investigating the different SCMP and SCR components across supply chains operating in different industries may be interesting. Future studies may perform item-level data analyses to identify which individual SCM practices boost different dimensions of SCR. Such studies would be useful in drawing additional practical and theoretical implications.

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Appendix A. Instrument for Supply Chain Responsiveness and SCM Practices

The instrument used in this study is presented below. It has been adopted from Thatte et al. (2013) and has been included herein for clarity.

SCM Practices (SCMP)*

Please circle the number that accurately reflects the extent of your firm's current level of SCM practices.

Strategic supplier partnership (SSP)

- SSP1 We consider quality as our number one criterion in selecting suppliers
- SSP2 We regularly solve problems jointly with our suppliers
- SSP3 We have helped our suppliers to improve their product quality
- SSP4 We have continuous improvement programs that include our key suppliers
- SSP5 We include our key suppliers in our planning and goal- setting activities
- SSP6 We actively involve our key suppliers in new product development processes

Customer relationship (CR)

- CR1 We frequently interact with customers to set reliability, responsiveness, and other standards for us
- CR2 We frequently measure and evaluate customer satisfaction
- CR3 We frequently determine future customer expectations
- CR4 We facilitate customers' ability to seek assistance from us
- CR5 We periodically evaluate the importance of our relationship with our customers

Information sharing (IS)

- IS1 We inform trading partners in advance of changing needs
- IS2 Our trading partners share proprietary information with us
- IS3 Our trading partners keep us fully informed about issues that affect our business
- IS4 Our trading partners share business knowledge of core business processes with us
- IS5 We and our trading partners exchange information that helps establishment of business planning
- IS6 We and our trading partners keep each other informed about events or changes that may affect the other partners

Supply Chain Responsiveness (SCR)*

Please circle the number that accurately reflects the extent of your supply chain's current level of responsiveness.

Operations system responsiveness (OSR)

- OSR1 Our operations system responds rapidly to changes in product volume demanded by customers
- OSR2 Our operations system effectively expedites emergency customer orders
- OSR3 Our operations system rapidly reconfigures equipment to address demand changes
- OSR4 Our operations system rapidly reallocates people to address demand changes
- OSR5 Our operations system rapidly adjusts capacity to address demand changes

Logistics process responsiveness (LPR)

- LPR1 Our logistics system responds rapidly to unexpected demand change
- LPR2 Our logistics system rapidly adjusts warehouse capacity to address demand changes
- LPR3 Our logistics system rapidly varies transportation carriers to address demand changes
- LPR4 Our logistics system effectively delivers expedited shipments

Supplier network responsiveness (SNR)

- SNR1 Our major suppliers change product mix in a relatively short time
- SNR2 Our major suppliers consistently accommodate our requests
- SNR3 Our major suppliers provide quick inbound logistics to us
- SNR4 Our major suppliers effectively expedite our emergency orders

* All items are measured using a 5-point Likert scale measured from 1-not at all to 5-to a great extent

Appendix B. Characteristics of the Respondents

1.	Job Titles (290)	
	CEO/President	10.69% (31)
	Vice President	44.83% (130)
	Director	25.17% (73)
	Manager	19.31% (56)
2.	Job Functions (291)	
	Corporate Executive	42.27% (123)
	Purchasing	4.47% (13)
	Manufacturing / Production	8.59% (25)
	Distribution / Logistics	13.06% (38)
	SCM	16.84 (49)
	Transportation	1.37% (4)
	Materials	0.69% (2)
	Operations	6.19% (18)
Other	6.53% (19)	
3.	Years worked at the organization (290)	
	Under 2 years	19.31% (56)
	2-5 years	26.55% (77)
	6-10 years	20.69% (60)
	Over 10 years	33.45% (97)

Appendix C. Characteristics of the Surveyed Organizations

1.	Organizations that have embarked upon a program aimed specially at implementing “Supply Chain Management” (294).	
	Yes:	63.27% (186)
	No:	36.73% (108)
	Average length of implementation: 4.15 years	
2.	Primary production system (283)	
	Engineer to Order	10.60% (30)
	Make to Order	35.69% (101)
	Assemble to Order	20.85% (59)
	Make to Stock	32.86% (93)
3.	Industry – SIC (278)	
	Textile mill Products (SIC 22)	0.00% (0)
	Apparel and Other Textile Products (SIC 23)	1.44% (4)
	Furniture and Fixtures (SIC 25)	2.52% (7)
	Fabricated Metal Products (SIC 34)	10.43% (29)
	Industrial Machinery and Equipment (SIC 35)	10.07% (28)
	Electrical and Electronic Equipment (SIC 36)	39.57% (110)
	Transportation Equipment (SIC 37)	9.35% (26)
	Other	26.62% (74)
4.	Number of employees (291)	
	1-50	4.12% (12)
	51-100	6.87% (20)
	101-250	12.03% (35)
	251-500	12.37% (36)
	501-1000	8.59% (25)
	Over 1000	56.01% (163)
	5.	Annual sales in millions of \$ (278)
Under 5		2.52% (7)
5 to 10		3.60% (10)
10 to <25		7.19% (20)
25 to <50		8.99% (25)
50 to <100		6.83% (19)
>100		70.86% (197)



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