EXPLORING SUPPLY CHAIN RESPONSIVENESS EFFECTS ON COMPETITIVE ADVANTAGE OF A FIRM

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ABSTRACT

This study builds on Thatte, Rao, and Ragu-Nathan's (2013) research model which found positive relationships between supply chain management (SCM) practices, supply chain responsiveness (SCR), and competitive advantage (CA). As such, utilizing regression analyses this paper analyses SCR dimensions as identified in Thatte et al. (2013) to explore how they impact CA and its dimensions. The study finds that operations system responsiveness (OSR) and supplier network responsiveness (SNR) dimensions of SCR contribute to higher levels of CA. SNR and OSR are found to positively influence a firm's ability to compete based on delivery dependability. Key OSR and SNR measures that improve CA and its components are identified and discussed.

Keywords: supply chain responsiveness, operations system, supplier network, logistic process

INTRODUCTION

As global supply chains compete with one another, achieving responsiveness in meeting consumers' needs is becoming important for businesses to stay competitive in today's internet powered and competitive business world. Firms need to aptly respond to changing customer needs in order to succeed in today's uncertain environment (Gerwin, 1987; Huber, 1984; Narasimhan & Das, 1999; Ward, P., Mccreery, Ritzman & Shamia, 1998) as well as to supply disruptions (Germain, 1989; Lee, 2004; Christopher & Peck, 2004). Consistent with Thatte et al. (2013), this research studies the SCR construct from the customer demand perspective, rather than a supply disruption perspective.

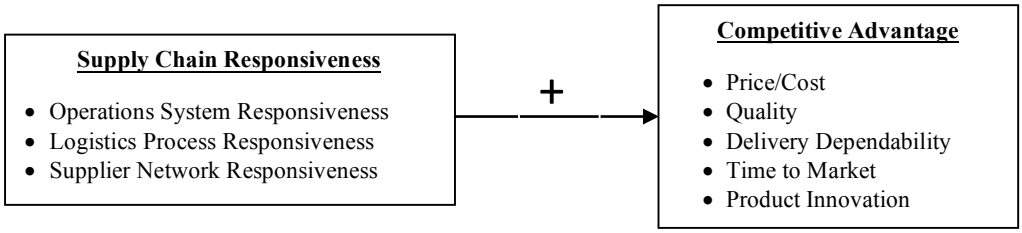
Thatte et al. (2013) dealt with large scale instrument validation and hypotheses testing between SCR, SCM practices, and CA using structural equation modeling and found positive relationship between SCR and CA, SCM practices and SCR, and SCM practices and CA. Although it would be helpful to study the effects of the specific SCM practices on specific dimensions of SCR and CA, such an inclusive study would be large for a single paper and warrants a separate study. This study extends Thatte et al.'s (2013) study by examining the dimension level relationships between SCR and CA to gain insight into how CA can be improved through SCR, in whole as well as in parts. Such dimension level analyses involving SCR and CA is lacking in existing literature and this study aims to fill that gap by offering insight into these relationships. Such an analysis can contribute towards providing more meaningful research implications for gaining CA via optimizing SCR. The relationships among the constructs are tested using regression analyses, using data collected from 294 respondents to a survey questionnaire.

The remainder of this paper is organized as follows. Section 2 presents the constructs, research framework, definitions, and the theory underlying each dimension of SCR and CA. The research methodology is described in section 3. Section 4 presents the results of data analyses while section 5 summarizes the research findings and implications. The study concludes with section 6 with limitations of the study and directions for future research.

CONSTRUCTS AND RESEARCH FRAMEWORK

Figure 1 presents the framework being investigated in this research. Thatte et al. (2013) developed the SCR construct and a valid and reliable measurement instrument for SCR through rigorous statistical methodologies, including pretest, pilot-test, confirmatory factor analysis, unidimensionality, reliability, validity, and validation of second-order construct.

Figure 1. Research Framework



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, Biehl, & Smith, 2001; Lummus, Duclos, & Vokurka, 2003; Duclos, Vokurka, & Lummus, 2003). This responsiveness is an aggregate of three first-order constructs operations system responsiveness (OSR), logistics process responsiveness (LPR), and supplier network responsiveness (SNR). SCR is the ability of the supply chain to rapidly address changes and requests in the marketplace (Holweg, 2005), which implies that speed combined with flexibility results in responsiveness (Prater, Biehl, & Smith, 2001). Thatte et al. (2013) conceptualized and operationalized OSR, LPR, and SNR as three sub-constructs of SCR.

OSR is defined as the ability of a firm's manufacturing system to address changes in customer demand (Thatte et al., 2013). Although it encompasses manufacturing and service operations, this study focusses on firms within the manufacturing industry. In manufacturing operations, it includes the ability to rapidly configure or reconfigure assets and operations of a manufacturing system in order to cope with consumer trends (Wu, 2001; Lummus, Duclos, & Vokurka, 2003), respond to changes in product volume, respond rapidly to unexpected events, effectively expedite emergency customer orders, and an ability to swiftly accommodate special or non-routine customer requests. OSR at each node in a supply chain is an integral component of SCR, since each entity in a supply chain is required to deliver the product or service in a timely and reliable manner, to fulfill customer demands (Duclos, Vokurka, & Lummus, 2003; Lummus et al., 2003; Holweg 2005; Holweg & Pil, 2001; Meehan & Dawson, 2002; Williamson, 1991). The items under this category measure the responsiveness associated with a specific node or firm in a supply chain

(Duclos et al., 2003; Lummus et al., 2003). Measures used to operationalize the OSR construct are: operations system's ability 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.

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 warehousing, packing and shipping, transportation planning and management (Ricker & Kalakota, 1999; Duclos et al., 2003; Lummus et al., 2003), inventory management, reverse logistics, order tracking and delivery. This study focuses on the outbound logistics of the focal firm. The responsiveness in the logistic processes is a vital component in the success of a responsive supply chain strategy (Fawcett, 1992). Fuller, O'Conner and Rawlinson (1993) suggest that a firm's logistics system is instrumental in creating value for its customers. This value creation for a firm's customers implies ensuring logistics flexibility (Duclos et al., 2003; Lummus et al., 2003) and speed within the supply chain to serve each distinct customer's needs. Responsiveness components in the logistics system include selecting logistics components that accommodate and respond to wide swings in demand over short periods, adjust warehouse capacity to address demand changes, handle a wide range of products, vary transportation carriers, have the ability to pack product-in-transit to suit discreet customers' requirements, and have the ability to customize products close to the customer (i.e. postponement), and do all of these speedily in order to gain a CA. Hise (1995) maintains that the logistics system of a firm needs to be flexible and responsive in order to be able to adjust its logistics resources rapidly for satisfying market needs. It is also important that firms have easy access to and are able to utilize different modes of transportation to be logistically flexible and responsive (Prater et al., 2001). Lummus et al. (2003) present critical logistics process flexibility aspects of a supply chain, which are vital for SCR. These aspects have been adapted for LPR to form its measures: logistics system's ability to - rapidly respond to unexpected demand change, rapidly adjust warehouse capacity to address demand changes, rapidly vary transportation carriers to address demand changes, and effectively deliver expedited shipments.

SNR is defined as the ability of a firm's major suppliers to address changes in the firm's demand (Thatte et al., 2013). The ability of firms to react quickly to customer demand is dependent on the reaction time of suppliers to make volume changes. A key to responsiveness is the presence of responsive and flexible partners upstream and downstream of the focal firm (Christopher & Peck, 2004). Supply chain networks must be ready to react to any ripple effects due to supply disruptions (Walker, 2005) as well. In order to have a CA, organizations need to meet the changing needs of customers by being able to rapidly supply products, including any demand changes in terms of product volume, mix, product variations, and new product introductions. Meeting these needs requires responsiveness in the supply chain at various stages from the raw materials to finished products to distribution and delivery. Supplier networks are the essential building blocks of a flexible system and their flexibility is an important ingredient of being responsive to customers (Slack, 1991; Holweg & Pil, 2001). In order to be responsive, organizations should be able to select suppliers who can add new products quickly and have suppliers make desired changes. Fisher, Raman and Mcclelland (2000) found that for short lifecycle products, such as fashion apparel, retailers are most successful if they can work with suppliers who can provide initial

shipments of product based on forecasts, but then rapidly increase production to the right style, color, size, etc. based on actual sales. Several studies (e.g. Choi & Hartley, 1996) suggest that supplier selection based on product development capabilities, rapid deployment capabilities or product volume flexibility positively impact the delivery time of new products. Holweg (2005) found that the lack of supplier network flexibility hampered its customer's responsiveness capability. Supplier network flexibility (Slack, 1991) and thus SNR (Thatte et al., 2013) is an important part of SCR. The measures of SNR used in this study are: major suppliers' ability to - change product mix in a relatively short time, consistently accommodate the firm's requests, provide quick inbound logistics to the firm, and effectively expedite emergency orders.

Competitive Advantage (CA)

CA is defined as the "capability of an organization to create a defensible position over its competitors" (Li, Ragu-Nathan, Ragu-Nathan, and Rao, 2006, p. 111). CA comprises of distinctive competencies that sets an organization apart from competitors, thus giving them an edge in the marketplace (Tracey, Vonderembse, & Lim, 1999). CA traditionally involved the choice regarding the markets in which a firm would compete, defending market share in clearly defined segments using price and product performance attributes (Day, 1994). Competition in today's global economy depends on anticipating and quickly responding to changing market needs. Porter's approach to CA centers on a firm's ability to be a low cost producer in its industry, or to be unique in its industry in some aspects that are popularly valued by customers (Porter, 1991). Most managers agree that cost and quality will continue to remain the CA dimensions of a firm (D' Souza & Williams, 2000). Wheelwright (1978) suggests cost, quality, dependability and speed of delivery as some of the critical competitive priorities for manufacturing. 'Time' has been argued to be a dimension of CA in other research contributions (viz: Stalk, 1988; Vesey, 1991; Handfield & Pannesi, 1995; Kessler & Chakrabarti, 1996; Zhang, 2001). There is widespread acceptance of time to market as a source of CA (Holweg, 2005). Price/cost, quality, delivery dependability, and time to market have been consistently identified as important competitive capabilities (Vokurka, Zank & Lund III, 2002; Fawcett & Smith, 1995; White, 1996; Skinner, 1985; Roth & Miller, 1990; Tracey et al., 1999). In a research framework, Koufteros, Vonderembse & Doll (1997) describe competitive pricing, premium pricing, value-to-customer quality, dependable delivery, and product innovation as the five dimensions of competitive capabilities. These dimensions were further described and utilized in other contributions as well (Koufteros Vonderembse & Doll, 2002; Tracey, Vonderembse, and Lim, 1999; Rondeau, Vonderembse & Ragu-Nathan, 2000; Roth & Miller, 1990; Cleveland, Schroeder & Anderson, 1989; Safizadeh, Ritzman, Sharma, & Wood, 1996; Vickery, Calantone, & Droge, 1999, Li et al. 2006). CA has been operationalized in existing literature (Koufteros, Vonderembse, and Doll, 1997; Zhang, 2001) and the measures have been adopted in this study with minor modifications. Based on the study of Koufteros (1995), Zhang (1997), and Li et al. (2006) and as used in Thatte et al. (2013) this study uses price/cost, quality, delivery dependability, product innovation, and time to market as the five dimensions of CA.

RESEARCH METHODOLOGY

This study adopts the SCR instrument developed by Thatte et al. (2013) and the CA instrument developed by Zhang (2001) and Koufteros et al. (1997). The items for these instruments are listed in Appendix A. The unit of analysis in this study is a firm since SCR is dependent on the individual

operating firms within a supply chain. Past studies (ex: Swafford, Ghosh & Murthy, 2006a) have used a similar unit of analysis. Also, a study that encompasses the entire supply chain domain, from raw materials through production/assembly at multiple stages/organizations, through delivery via diverse distribution channels, would be complex, time consuming, and costly.

Large-scale data collection was conducted using a web-based survey grounded on 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 these organizations were most likely to engage 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. The respondents were asked to refer to their major suppliers or customers when answering the questionnaire. The final version of the questionnaire was administered by e-mail to 5498 target respondents. To ensure a reasonable response rate, the survey was e-mailed in three waves.

The response rate was calculated based on the number of click-throughs the emailing generated and the total number that was converted to a completed survey. After three waves of emailing a total of 714 click-throughs were generated and 294 completes were obtained to provide a good response rate of 41.18%. Response rate based on the click-throughs may represent a better measure for email surveys since bulk emails sent out in this manner are treated as spam by respondents' organizations' email program and may never be retrieved or viewed by the target respondent. Since it is highly difficult to track this information accurately, a more appropriate measure would be to base the analysis on the number of people who have visited the site and have had an opportunity to review the request and purpose of this study, and then may have declined to complete the survey based on any number of reasons.

Population characteristics are presented in Appendix B. As can be seen from Appendix B, 11% of the respondents are CEO/President, 45% are Vice Presidents, 25% are Directors, and 19% are titled as Managers. Thus 81% of the respondents (CEOs, VPs, and Directors) are high-level executives, implying a high reliability of the responses received, as these executives have a wider domain (job responsibility) and administrative knowledge. This is consistent with past survey-based research studies in SCM (ex: Frohlich and Westbrook, 2002). The areas of expertise were 11% executives (CEOs/Presidents), 12% purchasing, 22% SCM, 18% distribution/transportation/logistics, 20% manufacturing/production, 10% materials, and 7% belong to other category such as sales. Thus the respondents' domains cover all key functions across the supply chain ranging from purchasing, to manufacturing, to sales, to distribution. Also, since 33% of the respondents have been with the organization for over 10 years and 21% have been at their organization between 6-10years, implies that majority of the respondents have a comprehensive view of their firm's supply chain program.

This research did not investigate non-response bias directly since the email lists had only names and email addresses of individuals without the organizational details. This research compares those

subjects who responded after the first e-mailing wave and those who responded to the second/third wave. The succeeding waves of the survey were considered to be representative of non-respondents (Lambert & Harrington, 1990; Armstrong & Overton, 1977). Similar methodology has also been used in prior SCM empirical research (Li, Rao, Ragu-Nathan, and Ragu-Nathan, 2005; Chen & Paulraj, 2004; Handfield & Bechtel, 2002). Chi-square tests (χ^2 statistic) were used to make the comparisons. No significant difference in industry type (based on SIC), employment size, and respondent's job title was found between these two groups (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). Further, Chi-square tests of independence were also performed to observe if the distribution of responses across SIC codes, employment size, and respondent's job title is independent of the three waves when considered independently. No significant difference in industry type (based on SIC), employment size, and respondent's job title was found between each of the three groups / waves.

Thatte et al. (2013) found SCR to have a direct positive impact on CA of a firm and confirmed the assertion in literature that a responsive supply chain in terms of an organization's operations system, logistics, and distribution processes, and suppliers could provide firms with CA on cost, quality, delivery dependability, product innovation, and time-to-market dimensions.

RESULTS

In order to explore the specific dimensions of SCR that lead to higher levels of CA in terms of price, quality, delivery dependability, product innovation, and time to market, a dimension-level statistical analysis was performed by employing stepwise regression analysis.

Regression Analysis

Dimension-level analyses were performed utilizing stepwise multiple regression, which is often used in studies that are exploratory in nature (Aron and Aron, 1999). The individual dimensions of SCR are predictors and the study seeks to understand which of these dimensions make meaningful contributions to the overall prediction of CA.

A stepwise regression analysis is performed to determine what dimensions of SCR (viz. OSR, LPR, and SNR) are significant predictors of CA (composite score). Table 1 presents the stepwise regression results of SCR (dimension level) as the independent variable (IV) and CA (composite score) as the dependent variable (DV). Results indicate an overall model of two dimensions of SCR that reasonably predict CA, $R^2 = 0.181$, $R^2_{adj} = 0.176$, $F(2,291) = 32.246$, $p < 0.001$. The model accounted for 17.6% (R^2_{adj}) of the variance in CA. A summary of regression coefficients is presented in Table 2 and indicates the two dimensions of SCR in the order OSR ($\beta = 0.316$) and SNR ($\beta = 0.180$) that significantly predict CA. From these results, it is clear that LPR does not contribute significantly to the prediction of CA.

Table 1. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on CA

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. OSR	0.394	0.155	0.152	0.155	53.644	< 0.001	1	292
2. SNR	0.426	0.181	0.176	0.026	9.318	< 0.01	1	291

Table 2. Coefficients for SCR Dimensions (OSR and SNR) on CA

	B	β	t	p
OSR	0.167	0.316	5.376	0.000
SNR	0.110	0.180	3.053	0.002

The study further examines which SCR dimensions significantly predict CA dimensions by using stepwise regression analysis between SCR dimensions OSR, LPR, and SNR as IVs and CA dimensions price, quality, delivery dependability, product innovation, and time to market as dependent variables DVs. The results are presented in Tables 3-8.

Table 3. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on Price

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. OSR	0.215	0.046	0.043	0.046	14.218	< 0.001	1	292

As observed in Table 3 the results are not significant (R^2_{adj} = 0.043) to draw conclusions. 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 and Vannatta, 2002). The results suggest that none of the SCR dimensions predict the 'price' dimension of CA when considered by itself.

Table 4. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on Quality

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. LPR	0.192	0.037	0.034	0.037	11.161	< 0.001	1	292

Table 4 indicates that none of the dimensions of SCR predict the 'quality' dimension of CA when considered individually, as results are not significant (R^2_{adj} = 0.034, i.e. R^2_{adj} < 0.10) to draw any substantial inferences.

Table 5. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on Delivery Dependability

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. SNR	0.320	0.102	0.099	0.102	33.230	< 0.001	1	292
2. OSR	0.364	0.132	0.126	0.030	10.069	< 0.01	1	291

Table 6. Coefficients for SCR Dimensions (SNR and OSR)
on Delivery Dependability

	B	β	t	p
SNR	0.235	0.237	3.905	0.000
OSR	0.164	0.192	3.173	0.002

Tables 5 and 6 indicate that only two dimensions of SCR, in the order SNR (β = 0.237) and OSR (β = 0.192), significantly predict 'delivery dependability'. Results suggest that LPR does not contribute significantly to the prediction of 'delivery dependability'.

Table 7. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on Product Innovation

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. OSR	0.293	0.086	0.083	0.086	27.474	< 0.001	1	292

Table 7 results indicate that SCR dimensions do not predict the 'product innovation' dimension of CA, when considered individually (R^2_{adj} = 0.083).

Table 8. Dimension Level Stepwise Regression Results
Model Summary for SCR Dimensions on Time to Market

Step	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1. OSR	0.262	0.069	0.066	0.069	21.540	< 0.001	1	292

Finally, Table 8 shows that no SCR dimension predicts CA based on 'time to market' (R^2_{adj} = 0.066), when considered by itself.

Table 9 summarizes the regression analyses results. Construct-level regression analyses results show that SCR reasonably predicts CA and support structural equation modeling results between SCR and CA found by Thatte et al. (2013). The dimension-level regression analyses results suggest that OSR is the predominant SCR dimension that improves CA on an aggregate basis, followed by SNR.

The study thus did not find support for the impact of SCR dimensions on CA dimensions with the exception of 'delivery dependability'. This could be attributed 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. Also, SNR and OSR in that order positively impact 'delivery dependability'. LPR was not found to impact 'delivery dependability'. These findings are discussed in the following section.

Table 9. Summary of Regression Analyses Results for CA and its Dimensions

Predictor	Outcome	R^2_{adj}	Sig. (*p*)
Construct - Level Regression Analysis			
1. Supply Chain Responsiveness (SCR)	Competitive Advantage (CA)	0.259	0.000
Dimension - Level Regression Analysis			
1. Operations System Responsiveness (OSR) 2. Supplier Network Responsiveness (SNR)	Competitive Advantage (CA)	0.176	0.000
1. Supplier Network Responsiveness (SNR) 2. Operations System Responsiveness (OSR)	Delivery Dependability	0.126	0.000

RESEARCH FINDINGS AND IMPLICATIONS

This study provides researchers an insight about the specific SCR dimensions that positively impact CA of a firm. SCR was found to reasonably predict CA of a firm, supporting the findings of Thatte et al. (2013). The study finds that a firm's responsive operations system and a responsive network of suppliers can directly lead to higher levels of CA. The results did not find the responsiveness of a firm's logistics system to contribute significantly to the prediction of CA. One may argue that outbound logistics is post manufacturing and outside the firm, due to a growing trend of using 3PL companies for logistics. The responsiveness of a firm's operation system being within the domain and control of the firm, and responsiveness of a firm's suppliers dictating much of the firm's ability to be responsive, these two components of SCR were found to predominantly predict CA in this study.

The study found that none of the SCR dimensions predict the price, quality, product innovation, or time to market dimensions of CA when considered individually. The study also finds that responsiveness of a firm's supplier network and its operations system can positively influence a firm's ability to compete based on 'delivery dependability'. The responsiveness of a firm's logistics system, however, was not found to contribute significantly to the prediction of 'delivery dependability'. A plausible explanation to this is that a growing number of firms are outsourcing the logistics function to 3PL companies resulting in this dimension of responsiveness falling outside of the focal firm's purview and thus not being in its direct control. The 3PL companies maintain and often exceed their service levels to stay in business and beat the competition. Therefore there is little scope for in-house improvement of LPR by firms. The responsiveness of

the manufacturing system of an organization, however, accounted for by OSR is a parameter within an organization's purview. Also, in order to address changes in customer demand in a timely manner by a firm, much relies on the firm's suppliers' ability to address changes in the firm's demand in a timely manner. Therefore, the SNR's and OSR's impact on 'delivery dependability' is considered crucial, and also found supported by the results of our analysis.

The findings imply that organizations may be able to improve CA through a more responsive supply chain. Organizations can improve their overall competitive position and their delivery performance through a responsive operations system in terms of the five measures of OSR and through responsive supplier networks in terms of the four measures of SNR (see Appendix B). The findings may encourage practitioners and firms to boost these SCR components to increase CA and delivery dependability, and stay ahead in business. The study also provides a research framework and insight for future research in the area of SCR and CA.

LIMITATIONS AND FUTURE RESEARCH

This research has extended past research in several ways, by building on theoretical and empirical studies. Although this research has contributions from both theoretical and practical point of views, it also has some limitations, which are described below and which may be addressed in future research.

The individual respondents (high-level executives from purchasing, operations, materials, and logistics functions) in an organization were asked to respond to complex SCM issues dealing with all the participants along the supply chain, including upstream suppliers and downstream customers. However, no person in an organization is in charge of the entire supply chain. Therefore, the use of single respondent may generate some measurement inaccuracy. In addition, this study was limited to the industries (SIC codes – 22, 23, 25, 34, 35, 36, 37) used for this research. This could limit the generalizability of results to other industry types. Future research may extend or replicate the study for other industry types to enhance generalizability. Future research should apply multiple methods of obtaining data. The use of single respondent to represent intra or inter-organization wide variables may generate some inaccuracy, more than the usual amount of random error (Koufteros, 1995). Future research could seek to utilize multiple respondents from each participating organization to enhance the reliability of research findings. Future research may test the relationships across countries. Thus SCR dimensions impacting CA in different countries can be compared and country-specific SCM issues can be identified.

Additionally, future research may develop additional dimensions of SCR such assembly responsiveness and inbound logistics responsiveness and study their impact on CA. Future research may study SCR and its dimensions at the supply chain level. Observing a complete supply chain, it may be interesting to investigate the various SCR components across supply chains operating in different industries (e.g. electronic and computer, heavy machinery manufacturing, fashion and apparel, and consumer goods) and their role in creating CA. A MANOVA type data analysis may be performed in future studies to provide additional insights and reveal further details on the how CA and its dimensions can be effected by high and low levels of SCR components. Such a study would be useful in drawing additional practical and theoretical implications.

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Appendix A. Instrument for supply chain responsiveness and competitive advantage

Supply Chain Responsiveness*

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

Competitive Advantage*

Please select the number that accurately reflects the extent of your firm's competitive advantage on each of the following.

Price/Cost (PC)

PC1 We offer competitive prices
PC2 We are able to offer prices as low or lower than our competitors

Quality (QL)

QL1 We are able to compete based on quality
QL2 We offer products that are highly reliable
QL3 We offer products that are very durable
QL4 We offer high quality products to our customers

Delivery dependability (DD)

DD1 We deliver customer orders on time
DD2 We provide dependable delivery

Product innovation (PI)

PI1	We provide customized products
PI2	We alter our product offerings to meet client needs
PI3	We cater to customer needs for "new" features

Time to market (TTM)

TM1	We are first in the market in introducing new products
TM2	We have time-to-market lower than industry average
TM3	We have fast product development

* 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 specifically 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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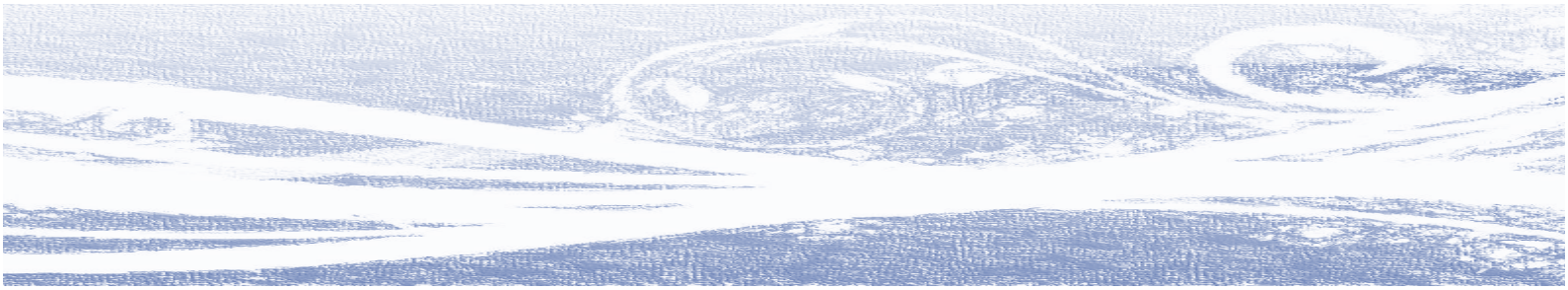

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