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The impact of supply chain management practices on competitive advantage and organizational performance

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Abstract

Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. This research conceptualizes and develops five dimensions of SCM practice (strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement) and tests the relationships between SCM practices, competitive advantage, and organizational performance. Data for the study were collected from 196 organizations and the relationships proposed in the framework were tested using structural equation modeling. The results indicate that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance. Also, competitive advantage can have a direct, positive impact on organizational performance.

Keywords: Supply chain management; Competitive advantage; Organizational performance; Structural equation modeling

1. Introduction

As competition in the 1990s intensified and markets became global, so did the challenges associated with getting a product and service to the right place at the right time at the lowest cost. Organizations began to realize that it is not enough to improve efficiencies within an organization, but their whole supply chain has to be made competitive. The understanding and practicing of supply chain management (SCM) has become an essential prerequisite for staying competitive in the global race and for enhancing profitably [1–4].

Council of Logistics Management (CLM) [5] defines SCM as the systemic, strategic coordination of the traditional business functions and tactics across these businesses functions within a particular organization and across businesses within the supply chain for the purposes of improving the long-term performance of the individual organizations and the supply chain as a whole. SCM has been defined to explicitly recognize the strategic nature of coordination between trading partners and to explain the dual purpose of SCM: to improve the performance of an individual organization, and to improve the performance of the whole supply chain. The goal of SCM is to integrate both information and material flows seamlessly across the supply chain as an effective competitive weapon [1,6].

The concept of SCM has received increasing attention from academicians, consultants, and business managers alike [4,6–8]. Many organizations have begun to recognize that SCM is the key to building sustainable competitive edge for their products and/or services in an increasingly crowded marketplace [9]. The concept of SCM has been considered

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from different points of view in different bodies of literature [7], such as purchasing and supply management, logistics and transportation, operations management, marketing, organizational theory, and management information systems. Various theories have offered insights on specific aspects or perspectives of SCM, such as industrial organization and associated transaction cost analysis [10,11], resource-based and resource-dependency theory [12], competitive strategy [13], and social–political perspective [14].

However, despite the increased attention paid to SCM, the literature has not been able to offer much by way of guidance to help the practice of SCM [15]. This has been attributed to the interdisciplinary origin of SCM, the conceptual confusion, and the evolutionary nature of SCM concept. There is no generally accepted definition of SCM in the literature [6]. The concept of SCM has been involved from two separate paths: purchasing and supply management, and transportation and logistics management [16]. According to purchasing and supply management perspective, SCM is synonymous with the integration of supply base that evolved from the traditional purchasing and materials functions [17,18]. In the perspective of transportation and logistics management, SCM is synonymous with integrated logistics systems, and hence focus on inventory reduction both within and across organizations in the supply chain [8,19–22]. Eventually, these two perspectives evolved into an integrated SCM that integrates all the activities along the whole supply chain.

The evolutionary nature and the complexity of SCM are also reflected in the SCM research. Much of the current theoretical/empirical research in SCM focuses on only the upstream or downstream side of the supply chain, or certain aspects/perspectives of SCM [23]. Topics such as supplier selection, supplier involvement, and manufacturing performance [24,25], the influence of supplier alliances on the organization [26], success factors in strategic supplier alliances [27,28], supplier management orientation and supplier/buyer performance [29], the role of relationships with suppliers in improving supplier responsiveness [30], and the antecedence and consequences of buyer–supplier relationship [31] have been researched on the supplier side. Studies such as those by Clark and Lee [32], and Alvarado and Kotzab [19], focus on the downstream linkages between manufacturers and retailers. A few recent studies have considered both the upstream and downstream sides of the supply chain simultaneously. Tan et al. [16] explore the relationships between supplier management practices, customer relations practices and organizational performance; Frohlich and Westbrook [33] investigate the effects of supplier–customer integration on organizational performance, Tan et al. [4] study SCM and supplier evaluation practices and relate the constructs to firm performance, Min and Mentzer [34] develop an instrument to measure the supply chain orientation and SCM at conceptual levels. Cigolini et al. [15] develop a set of supply chain techniques and tools for examining SCM strategies. Extensive case studies about the implementation of SCM have been conducted by the IT service providers (such as SAP, Peoplesoft, i2 and JDEdwards) and the research firms (such as Forrester Research and AMR Research) (http://www.supply-chain.org) and many case histories of successful implementations of SCM have been reported in the literature. Taken together, these studies are representative of efforts to address various diverse but interesting aspects of SCM practices. However, the absence of an integrated framework, incorporating all the activities both upstream and downstream sides of the supply chain and linking such activities to both competitive advantage and organizational performance, detracts from usefulness of the implementation of previous results on SCM.

The purpose of this study is therefore to empirically test a framework identifying the relationships among SCM practices, competitive advantage and organizational performance. SCM practices are defined as the set of activities undertaken by an organization to promote effective management of its supply chain. The practices of SCM are proposed to be a multi-dimensional concept, including the downstream and upstream sides of the supply chain. Operational measures for the constructs are developed and tested empirically, using data collected from respondents to a survey questionnaire. Structural equation modeling is used to test the hypothesized relationships. It is expected that the current research, by addressing SCM practices simultaneously from both upstream and downstream sides of a supply chain, will help researchers better understand the scope and the activities associated with SCM and allow researchers to test the antecedences and consequences of SCM practice. Further, by offering a validated instrument to measure SCM practices, and by providing empirical evidence of the impact of SCM practices on an organization's competitive advantage and its performance, it is expected that this research will offer useful guidance for measuring and implementing SCM practices in an organization and facilitate further research in this area.

The remainder of this paper is organized as follows. Section 2 presents the research framework, provides the definitions and theory underlying each dimension of SCM practices, discusses the concepts of competitive advantage and organizational performance, and develops the hypothesized relationships. The research methodology and analysis of results are then presented, followed by the implications of the study.

2. Research framework

Fig. 1 presents the SCM framework developed in this research. The framework proposes that SCM practices will have an impact on organizational performance both directly and also indirectly through competitive advantage. SCM practice is conceptualized as a five-dimensional construct. The five dimensions are strategic supplier partnership, customer relationship, level of information sharing, quality of

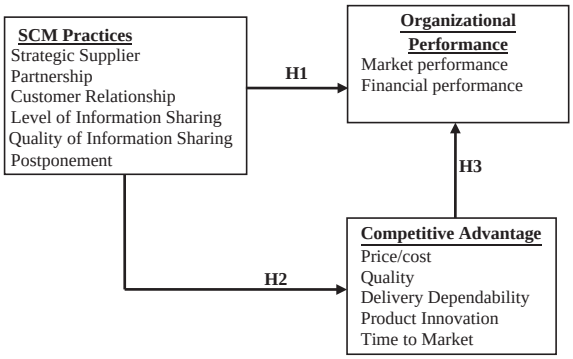

Fig. 1. Research framework.

information sharing, and postponement. A detailed description of the development of the SCM practices construct is provided in the following paragraphs. Competitive advantage and organizational performance are concepts that have been operationalized in the existing literature [35,36]. Using literature support, the expected relationships among SCM practices, competitive advantage, and organizational performance are discussed, and hypotheses relating these variables are developed.

2.1. SCM practices

SCM practices have been defined as a set of activities undertaken in an organization to promote effective management of its supply chain. Donlon [37] describes the latest evolution of SCM practices, which include supplier partnership, outsourcing, cycle time compression, continuous process flow, and information technology sharing. Tan et al. [16] use purchasing, quality, and customer relations to represent SCM practices, in their empirical study. Alvarado and Kotzab [19] include in their list of SCM practices concentration on core competencies, use of inter-organizational systems such as EDI, and elimination of excess inventory levels by postponing customization toward the end of the supply chain. Tan et al. [4] identify six aspects of SCM practice through factor analysis: supply chain integration, information sharing, supply chain characteristics, customer service management, geographical proximity and JIT capability. Chen and Paulraj [31] use supplier base reduction, long-term relationship, communication, cross-functional teams and supplier involvement to measure buyer–supplier relationships. Min and Mentzer [34] identify the concept SCM as including agreed vision and goals, information sharing, risk and award sharing, cooperation, process integration, long-term relationship and agreed supply chain leadership. Thus the literature portrays SCM practices from a variety of different perspectives with a common goal of ultimately improving organizational performance. In reviewing and consolidating the literature, five distinctive dimensions, including strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing and postponement, are selected for measuring SCM practice. The five constructs cover upstream (strategic supplier partnership) and downstream (customer relationship) sides of a supply chain, information flow across a supply chain (level of information sharing and quality of information sharing), and internal supply chain process (postponement). It should be pointed out that even though the above dimensions capture the major aspects of SCM practice, they cannot be considered complete. Other factors, such as geographical proximity, JIT/lean capability [4], cross-functional teams, logistics integration [31], agreed vision and goals, and agreed supply chain leadership [34] are also identified in the literature. Though these factors are of great interest, they are not included due to the concerns regarding the length of the survey and the parsimony of measurement instruments.

The present study, therefore, proposes SCM practices as a multi-dimensional concept. Table 1 lists these dimensions along with their definitions and supporting literature. A more detailed discussion of these dimensions is provided below.

Strategic supplier partnership: 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 [26,38,40,41,45]. A strategic partnership emphasizes direct, long-term association and encourages mutual planning and problem solving efforts [39]. Such strategic partnerships are entered into to promote shared benefits among the parties and ongoing participation in one or more key strategic areas such as technology, products, and markets [70]. Strategic partnerships with suppliers enable organizations to work more effectively with a few important suppliers who are willing to share responsibility for the success of the products. Suppliers participating early in the product-design process can offer more cost-effective design choices, help select the best components and technologies, and help in design assessment [4]. Strategically aligned organizations can work closely together and eliminate wasteful time and effort [38]. An effective supplier partnership can be a critical component of a leading edge supply chain [45].

Customer relationship: Comprises 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 [42,16]. Noble [45] and Tan et al. [16] consider customer relationship management as an important component of SCM practices. As pointed out by Day [43], committed relationships are the most sustainable advantage because of their inherent barriers to competition. The growth of mass customization and personalized service is leading to an era in which relationship management with customers is becoming crucial for corporate survival [46]. Good relationships with supply chain members, including customers, are needed for successful implementation of SCM programs

Table 1
List of sub-constructs for SCM practice

Sub-constructs	Definitions	Literature
Strategic supplier partnership	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.	[4,18,26,38–41]
Customer relationship	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.	[2,4,42–46]
Level of information sharing	The extent to which critical and proprietary information is communicated to one's supply chain partner.	[1,9,38,40,47–51]
Quality of information sharing	Refers to the accuracy, timeliness, adequacy, and credibility of information exchanged.	[2,6,40,52–59]
Postponement	The practice of moving forward one or more operations or activities (making, sourcing and delivering) to a much later point in the supply chain.	[8,60–69]

[2]. Close customer relationship allows an organization to differentiate its product from competitors, sustain customer loyalty, and dramatically extend the value it provides to its customers [44].

Level of information sharing: Information sharing has two aspects: quantity and quality. Both aspects are important for the practices of SCM and have been treated as independent constructs in the past SCM studies [2,40]. Level (quantity aspect) of information sharing refers to the extent to which critical and proprietary information is communicated to one's supply chain partner [40]. Shared information can vary from strategic to tactical in nature and from information about logistics activities to general market and customer information [48]. Many researchers have suggested that the key to the seamless supply chain is making available undistorted and up-to-date marketing data at every node within the supply chain [1,38,51,71]. By taking the data available and sharing it with other parties within the supply chain, information can be used as a source of competitive advantage [9,49]. Lalonde [47] considers sharing of information as one of five building blocks that characterize a solid supply chain relationship. According to Stein and Sweat [50], supply chain partners who exchange information regularly are able to work as a single entity. Together, they can understand the needs of the end customer better and hence can respond to market change quicker. Moreover, Tompkins and Ang [72] consider the effective use of relevant and timely information by all functional elements within the supply chain as a key competitive and distinguishing factor. The empirical findings of Childhouse and Towill [1] reveal that simplified material flow, including streamlining and making highly visible all information flow throughout the chain, is the key to an integrated and effective supply chain.

Quality of information sharing includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged [2,40]. While information sharing is important, the significance of its impact on SCM depends on what information is shared, when and how it is shared, and with whom [53,54].

Literature is replete with example of the dysfunctional effects of inaccurate/delayed information, as information moves along the supply chain [56–59]. Divergent interests and opportunistic behavior of supply chain partners, and informational asymmetries across supply chain affect the quality of information [6]. It has been suggested that organizations will deliberately distort information that can potentially reach not only their competitors, but also their own suppliers and customers [57]. It appears that there is a built-in reluctance within organizations to give away more than minimal information [52] since information disclosure is perceived as a loss of power. Given these predispositions, ensuring the quality of the shared information becomes a critical aspect of effective SCM [6]. Organizations need to view their information as a strategic asset and ensure that it flows with minimum delay and distortion.

Postponement is defined as the practice of moving forward one or more operations or activities (making, sourcing and delivering) to a much later point in the supply chain [8,60,64,66,68]. Two primary considerations in developing a postponement strategy are: (1) determining how many steps to postpone, and (2) determining which steps to postpone [60]. Postponement allows an organization to be flexible in developing different versions of the product in order to meet changing customer needs, and to differentiate a product or to modify a demand function [69]. Keeping materials undifferentiated for as long as possible will increase an organization's flexibility in responding to changes in customer demand. In addition, an organization can reduce supply chain cost by keeping undifferentiated inventories [65,68].

Postponement needs to match the type of products, market demands of a company, and structure or constraints within the manufacturing and logistics system [61–63,67]. In general, the adoption of postponement may be appropriate in the following conditions: innovative products [61,62]; prod-

ucts with high monetary density, high specialization and wide range; markets characterized by long delivery time, low delivery frequency and high demand uncertainty; and manufacturing or logistics systems with small economies of scales and no need for special knowledge [67].

2.2. Competitive advantage

Competitive advantage is the extent to which an organization is able to create a defensible position over its competitors [73,13]. It comprises capabilities that allow an organization to differentiate itself from its competitors and is an outcome of critical management decisions [74]. The empirical literature has been quite consistent in identifying price/cost, quality, delivery, and flexibility as important competitive capabilities [74–76]. In addition, recent studies have included time-based competition as an important competitive priority. Research by Stalk [77], Vesey [78], Handfield and Pannesi [79], Kessler and Chakrabarti [80], Zhang [36] identifies time as the next source of competitive advantage. On the basis of prior literature, Koufteros et al. [35] describe a research framework for competitive capabilities and define the following five dimensions: competitive pricing, premium pricing, value-to-customer quality, dependable delivery, and production innovation. These dimensions are also described by [74,75,81–84]. Based on the above, the dimensions of the competitive advantage constructs used in this study are price/cost, quality, delivery dependability, product innovation, and time to market.

2.3. Organizational performance

Organizational performance refers to how well an organization achieves its market-oriented goals as well as its financial goals [85]. The short-term objectives of SCM are primarily to increase productivity and reduce inventory and cycle time, while long-term objectives are to increase market share and profits for all members of the supply chain [16]. Financial metrics have served as a tool for comparing organizations and evaluating an organization's behavior over time [54]. Any organizational initiative, including supply chain management, should ultimately lead to enhanced organizational performance.

A number of prior studies have measured organizational performance using both financial and market criteria, including return on investment (ROI), market share, profit margin on sales, the growth of ROI, the growth of sales, the growth of market share, and overall competitive position [84,86,36]. In line with the above literature, the same items will be adopted to measure organizational performance in this study.

2.4. Research hypotheses

The SCM framework developed in this study proposes that SCM practice has a direct impact on the overall financial and marketing performance of an organization [29,87]. SCM practice is expected to increase an organization's market share, return on investment [29,87], and improve overall competitive position [88,89]. For example, strategic supplier partnership has been reported to yield organization-specific benefits in terms of financial performance [16,26,88–91]. Advanced design and logistic links with suppliers are related to better-performing plants [92]. Customer relation practices have also been shown to lead to significant improvement in organizational performance [16]. The higher level of information sharing is associated with the lower total cost, the higher-order fulfillment rate and the shorter-order cycle time [93].

The bottom-line impacts of SCM practices have been confirmed by real-world examples. A recent survey finds that organizations that are best at SCM hold a 40% to 65% advantage in their cash-to-cash cycle time over average organizations and the top organizations carry 50% to 85% less inventory than their competitors [41]. Based on the above it is hypothesized that:

Hypothesis 1. Firms with high levels of SCM practices will have high levels of organizational performance.

SCM practices impact not only overall organizational performance, but also competitive advantage of an organization. They are expected to improve an organization's competitive advantage through price/cost, quality, delivery dependability, time to market, and product innovation. Prior studies have indicated that the various components of SCM practices (such as strategic supplier partnership) have an impact on various aspects of competitive advantage (such as price/cost). For example, strategic supplier partnership can improve supplier performance, reduce time to market [94], and increase the level of customer responsiveness and satisfaction [3]. Information sharing leads to high levels of supply chain integration [55] by enabling organizations to make dependable delivery and introduce products to the market quickly. Information sharing and information quality contribute positively to customer satisfaction [95] and partnership quality [96,97]. Postponement strategy not only increases the flexibility in the supply chain, but also balances global efficiency and customer responsiveness [68]. The above arguments lead to

Hypothesis 2. Firms with high levels of SCM practices will have high levels of competitive advantage.

Having a competitive advantage generally suggests that an organization can have one or more of the following capabilities when compared to its competitors: lower prices, higher quality, higher dependability, and shorter delivery time. These capabilities will, in turn, enhance the organization's overall performance [48]. Competitive advantage can lead to high levels of economic performance, customer satisfaction and loyalty, and relationship effectiveness. Brands with higher consumer loyalty face less competitive switching in their target segments thereby increasing sales and profitability [98].

An organization offering high quality products can charge premium prices and thus increase its profit margin on sales and return on investment. An organization having a short time-to-market and rapid product innovation can be the first in the market thus enjoying a higher market share and sales volume. Therefore, a positive relationship between competitive advantage and organizational performance can be proposed.

Hypothesis 3. The higher the level of competitive advantage, the higher the level of organizational performance.

The above three hypotheses, taken together, support the SCM framework presented in Fig. 1.

3. Research methodology

Instrument development methods for SCM practices include four phases: (1) item generation, (2) pre-pilot study, (3) pilot study, and (4) large-scale data analysis. Instruments that measure competitive advantage and organizational performance were adopted from Zhang [36]. The items for these instruments are listed in Appendix A. In phase four, rigorous statistical analysis was used to determine the validity and reliability of the SCM practice, competitive advantage, and organizational performance instruments. The research framework in Fig. 1 and the associated hypotheses were then tested using structural equation modeling.

3.1. Item generation, pre-pilot study, and pilot study

The basic requirement for a good measurement is content validity, which means that the measurement items in an instrument cover the major content of a construct [99]. Content validity is usually achieved through a comprehensive literature review and interviews with practitioners and academicians. The items for SCM practice were generated based on previous SCM literature [16,25,26,29,40,42,96,97,100].

In the pre-pilot study, these items were reviewed by six academicians and re-evaluated through structured interviews with three practitioners who were asked to comment on the appropriateness of the research constructs. Based on the feedback from the academicians and practitioners, redundant and ambiguous items were either modified or eliminated. New items were added wherever deemed necessary.

In the pilot study stage, the Q-sort method was used to preassess the convergent and discriminant validity of the scales. Purchasing/production managers were requested to act as judges and sort the items into the five dimensions of SCM practice, based on similarities and differences among items. To assess the reliability of the sorting conducted by the judges, three different measures were used: the inter-judge raw agreement scores, Cohen's Kappa, and item placement ratios. Raw agreement scores were calculated by counting the number of items both judges placed in the same category. Cohen's Kappa [101] was used to evaluate the true agreement score between two judges by eliminating chance agreements. Item placement ratios were calculated by counting all the items that were correctly sorted into the target category by each of the judges and dividing them by twice the total number of items.

In the first round, the inter-judge raw agreement scores averaged .89, the initial overall placement ratio of items within the target constructs was .95, and the Cohen's Kappa score averaged .86. Following the guidelines of Landis and Koch [102] for interpreting the Kappa coefficient, the value of .86 was considered an excellent level of agreement (beyond chance) for the judges in the first round. In order to improve the Cohen's Kappa measure of agreement, an examination of the off-diagonal entries in the placement matrix was conducted. Items classified in a construct different from their target construct were identified and dropped or reworded. Also, feedback from both judges was obtained on each item and incorporated into the modification of the items.

The reworded items were then entered into a second sorting round. In the second round, the inter-judge raw agreement scores averaged .92, the initial overall placement ratio of items within the target constructs was .97, and the Cohen's Kappa score averaged .90. Since the second round achieved an excellent overall placement ratio of items within the target constructs (.97), it was decided to keep all the items for the third sorting round.

The third sorting round was used to re-validate the constructs. The third round achieved the same agreement scores as the second round, thereby indicating an excellent level of agreement between the judges in the third round and consistency of results between the second and third rounds. At this stage the statistics suggested an excellent level of inter-judge agreement indicating a high level of reliability and construct validity.

3.2. Large-scale methods

This study sought to choose respondents who can be expected to have the best knowledge about the operation and management of the supply chain in his/her organization. Based on literature and recommendations from practitioners, it was decided to choose managers who are at higher managerial levels as respondents for the current study. The respondents were asked to refer to their major suppliers or customers for relevant questions.

Mailing lists were obtained from two sources: the Society of Manufacturing Engineers (SME) in USA and the attendees at the Council of Logistics Management (CLM) conference in 2000, New Orleans, USA. Six SIC codes were covered in the study: 25 "Furniture and Fixtures", 30 "Rubber and Plastics", 34 "Fabricated Metal Products", 35 "Industrial and Commercial Machinery", 36 "Electronic and Other Electric Equipment", 37 "Transportation Equipment".

The final version of the questionnaire, measuring all the items on a five point scale, was administrated to 3137 target respondents. The survey was sent in three waves. The questionnaires with a cover letter indicating the purpose and

significance of the study were mailed to the target respondents. In the cover letter, a web-address of the online version of the survey was also provided in case the respondents wished to fill it in electronically. There were 196 complete and usable responses, representing a response rate of approximately 6.3%

A significant problem with organizational-level research is that senior and executive-level managers receive many requests to participate and have very limited time. Because this interdisciplinary research collects information from several functional areas, the size and scope of the research instruments must be large and time consuming to complete. This further contributes to the low response rate. While the response rate was less than desired, the makeup of respondent pool was considered excellent (See Appendix B). Among the respondents, almost 20% of the respondents are CEO/President/Vice President/Director. About half of the respondents are managers, some identified them as supply chain manager, plant manager, logistics manager or IT manager in the questionnaire. The areas of expertise were 30% purchasing, 47% manufacturing production, and 30% distribution/transportation/sales. It can be seen that respondents have covered all the functions across a supply chain from purchasing, to manufacturing, to distribution and transportation, and to sales. Moreover, about 30% of the respondents are responsible for more than one job function, and they are expected to have a broad view of SCM practice in their organization.

This research did not investigate nonresponse bias directly because the mailing list had only name and addresses of the individuals and not any organizational details. Hence, a comparison was made between those subjects who responded after the initial mailing and those who responded to the second/third wave [103,104]. Similar methodology has been used in prior empirical studies [2,30,31,105–107]. Using the Chi-square statistic and $P < .05$, it was found that there were no significant differences between the two groups in employment size, sales volume, and respondent's job title. An absence of non-response bias is therefore inferred.

4. Results for the measurement model

Instrument that measures SCM practices were developed by Li et al. [108]. Instruments that measure competitive advantage and organizational performance were adopted from Zhang [36]. Appendix A presents the multiple items representing each of the constructs. The following section will discuss statistical analysis used to determine the validity and reliability of each construct.

4.1. Convergent and discriminant validity

For SCM practices (SCMP), a factor analysis was conducted using the 25 items that measure the five dimensions. For simplicity, only loadings above .40 are displayed. All items loaded on their respective factors with most loadings above .70 as shown in Table 2a. The cumulative variance explained by the five factors is 63.27%.

The competitive advantage (CA) construct was initially represented by 5 dimensions and 16 items. An initial factor analysis indicated that CA/DD1 had a cross-loading of .46 with CA/PI and CA/TM1 had a cross-loading of .51 with CA/DD. After removing these two items, the remaining items were factor analyzed and the results are shown in Table 2b. It can be seen that all items loaded on their respective factors, with most of loadings greater than .80. The cumulative variance explained by the five factors is 77.61%.

When the organizational performance (OP) was factor analyzed, two factors emerged with one significant cross-loading (FP7 had loadings of .65 and .56 respectively on each factor). FP7 was removed and factor analysis was performed on the remaining items, and the results are shown in Table 2c. After an examination of the descriptions of items, the two factors were named as market performance made of OP1, OP4, and OP7 (coded as OP/MP) and financial performance made of OP2, OP5, and OP6 (coded as OP/FP).

4.2. Assessing reliability

The reliabilities of SCM practice, competitive advantage, and organizational performance were assessed with Cronbach's Alpha. Tables 3a–c report means, standard deviations, correlations, and reliability values for each of constructs. The reliability values for all constructs are all greater than .70, which are considered acceptable [109].

4.3. Validation of second-order constructs

SCM practice was conceptualized as a second-order model composed of five dimensions. Structural equation modeling (using LISREL 8.30 by Scientific Software International, Inc.) was used to determine whether a higher-order factor model is appropriate for SCM practice. The fit statistics for the second-order model were GFI = .85, AGFI = .82, and the RMSR = .05, representing a reasonable model-data fit. The λ coefficients were all significant at $P < .01$. The target coefficient, which is the ratio of the chi-square value for the first-order model to the chi-square value for the higher-order model, was calculated [110]. It indicates the percentage of variation in the first-order factors that can be explained by the second-order construct. In this case, chi-square of the first model was 386.80 and of the second model was 417.63. The target coefficient index is 92.6%, which is strong evidence of existence of a higher-order SCM practice construct.

For competitive advantage, the fit indexes for the second-order model were GFI = .88, AGFI = .82, and RMSR = .06, indicating a moderate model-data fit. The λ coefficients were all significant at $P < .01$. Chi-square of the first model was 161.34 and of the second model was 186.21. The target

Table 2
Factor analysis result for (a) SCM practice, (b) competitive advantage and (c) organizational performance

Item	F1-IS	F2-IQ	F3-SSP	F4-CRP	F5-POS
(a) *SCM practice*					
SCMP/IS1	.51				
SCMP/IS2	.69				
SCMP/IS3	.67				
SCMP/IS4	.78				
SCMP/IS5	.70				
SCMP/IS6	.76				
SCMP/IQ1		.66			
SCMP/IQ2		.81			
SCMP/IQ3		.76			
SCMP/IQ4		.72			
SCMP/IQ5		.81			
SCMP/SSP1			.59		
SCMP/SSP2			.73		
SCMP/SSP3			.83		
SCMP/SSP4			.76		
SCMP/SSP5			.73		
SCMP/SSP6			.51		
SCMP/CRP1				.69	
SCMP/CRP2				.79	
SCMP/CRP3				.80	
SCMP/CRP4				.73	
SCMP/CRP5				.68	
SCMP/POS1					.72
SCMP/POS2					.85
SCMP/POS3					.83
Eigenvalue	3.55	3.51	3.50	3.26	2.01
% of variance	14.18	14.02	13.99	13.03	8.05
Cumulative % of variance	14.18	28.20	42.19	55.22	63.27

Item	F1-QL	F2-PI	F3-TM	F4-DD	F5-PC
(b) *Competitive advantage*					
CA/QL1	.80				
CA/QL2	.86				
CA/QL3	.81				
CA/QL4	.86				
CA/PI1		.87			
CA/PI2		.82			
CA/PI3		.74			
CA/TM2			.76		
CA/TM3			.79		
CA/TM4			.81		
CA/DD2				.94	
CA/DD3				.92	
CA/PC1					.87
CA/PC2					.87
Eigenvalue	3.13	2.14	2.06	1.92	1.62
% of variance	22.38	15.27	14.70	13.69	11.57
Cumulative % of variance	22.38	37.65	52.35	66.04	77.61

Item	F1-MP	F2-FP
(c) *Organizational performance*		
OP1	.88	
OP3	.89	

Table 2 (*continued*)

Item	F1-MP	F2-FP
OP4	.80	
OP2	.43	.81
OP5	.40	.82
OP6		.89
Eigenvalue	2.60	2.42
% of variance	43.28	40.32
Cumulative % of variance	43.28	83.60

Table 3
Means, standard deviations, correlations and reliability of (a) SCM practice, (b) competitive advantage and (c) organizational performance

Variables	Mean	SD	1	2	3	4	5	Reliability
(a) *SCM practice*								
1. Strategic supplier partnership	3.70	.73	—					.86
2. Customer relationship	3.96	.69	.52**	—				.84
3. Level of information sharing	3.34	.64	.56**	.39**	—			.86
4. Quality of information sharing	3.33	.63	.39**	.33**	.59**	—		.86
5. Postponement	3.24	.88	.18*	.12	.08	.15*	—	.73
(b) *Competitive advantage*								
1. Price/cost	3.47	.78	—					.73
2. Quality	4.18	.68	.12	—				.87
3. Delivery dependability	4.03	.83	.20**	.05	—			.93
4. Product innovation	4.48	.55	.07	.40**	.28**	—		.80
5. Time to market	3.19	.74	.33**	.28**	.32**	.30**	—	.76

Variables	Mean	SD	1	2	Reliability
(c) *Organizational performance*					
1. Market performance	3.32	.75	—		.90
2. Financial performance	3.35	.76	.63**	—	.89

*Correlation is significant at the .05 level (two-tailed).
**Correlation is significant at the .01 level (two-tailed).

coefficient index is 86.6%, indicating the existence of a second-order competitive advantage construct.

5. Results for the structural model

The theoretical framework illustrated in Fig. 1 has three hypothesized relationships among the variables SCM Practices, Competitive Advantage, and Organizational Performance. Fig. 2 a displays the path diagram resulting from the structural modeling analysis using LISREL. The results exhibit that all the measurements have significant loadings to their corresponding second-order construct. Overall, the model has a satisfactory fit with GFI = .90, AGFI = .84, and CFI = .84. The RMSR is only .035, which is very good.

It should be noted that even though all the t-values of the measurements are significant at .05 level, their loadings (γ-value) to the corresponding second-order construct are different. Postponement has a low γ of .18, indicating that postponement may not be a strong indicator of SCM practice compared to the other four dimensions. This can be true. As discussed in the previous sessions, the implementation of postponement is dependent on a firm's market characteristics and the type of the products and therefore may not be applicable in all the situations. The results also show that the γ values of price/cost, product innovation, and delivery dependability are not as high as those of quality and time to market. This may indicate that quality and time to market are stronger indicators of competitive advantage than the other three dimensions.

To determine whether the model in Fig. 2a has the best fit, alternate models were evaluated by dropping one of the links between the constructs at one time (see Fig. 2b–d). In Fig. 2b, SCM practice and competitive advantage were treated as independent constructs; the LISREL path coefficients for SCM practice on organizational performance and competitive advantage on organizational performance are both significant, indicating that SCM practice and compet-

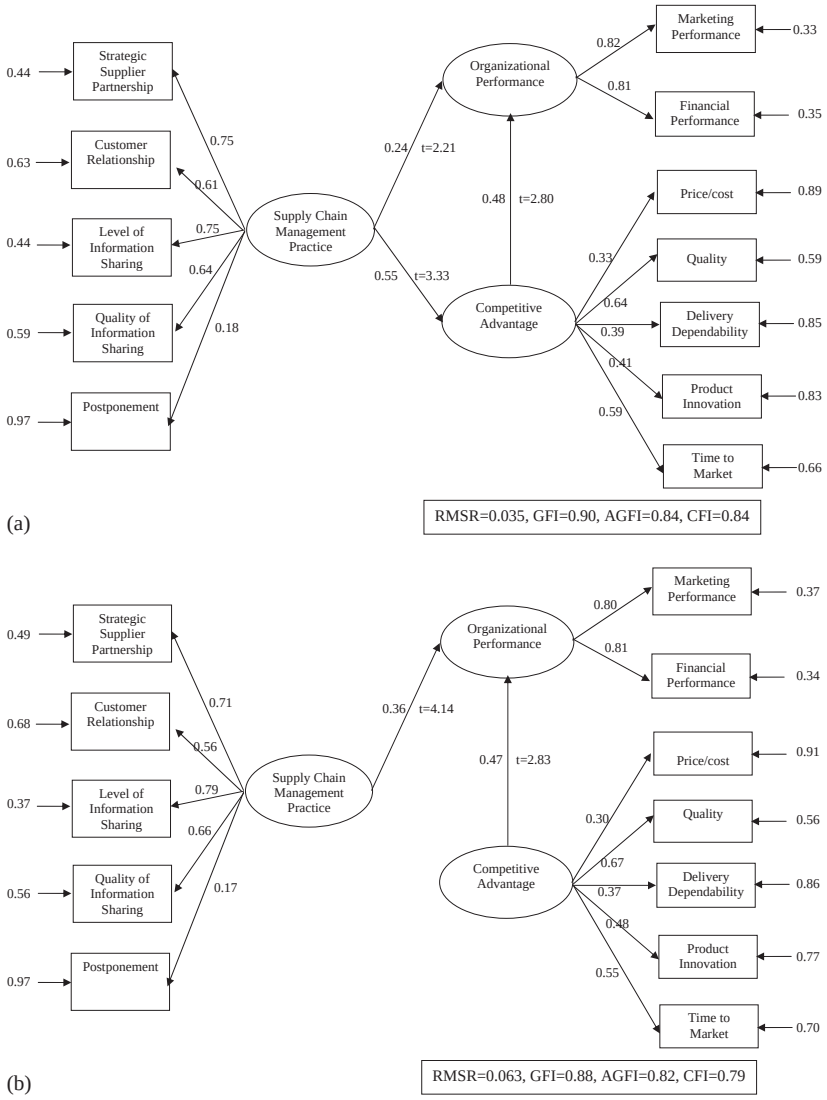

Fig. 2. (a) Proposed and (b)–(d) alternative models of SCM practices, competitive advantage, and organizational performance.

itive advantage have independent affects on organizational performance. In Fig. 2c, the direct link between SCM practice and organizational performance was dropped. The LISREL path coefficient between competitive advantage and organizational performance became much stronger. In Fig. 2d, the link between competitive advantage and organizational performance was removed, the LISREL path coefficient for SCM practice on competitive advantage and SCM practice on organizational performance are both significant, indicating that SCMP has direct impact on both competitive advantage and organizational performance. The fit statistics for the models in Fig. 2b and d were not as good as the fit statistics for the model in Fig. 2a and c. Fig. 2a and c had almost the same fit indices.

To further test whether the proposed model in Fig. 2a should be accepted compared to the three alternative models, sequential Chi-square difference tests (SCDTs) were conducted by calculating the difference between Chi-square statistic values for the proposed model (Fig. 2a) and each of the alternate models (Fig. 2b–d), with degrees of freedom equal to the difference in degrees of freedom for the two selected models [111]. The results are presented in Table 4. A significant result would indicate that the additional estimated link (parameter) in the proposed model incrementally contribute to the explanation given by the alternative model, the proposed model will be accepted. Otherwise, the alternative model will be accepted with parsimony preferred when given no difference in explanation of the

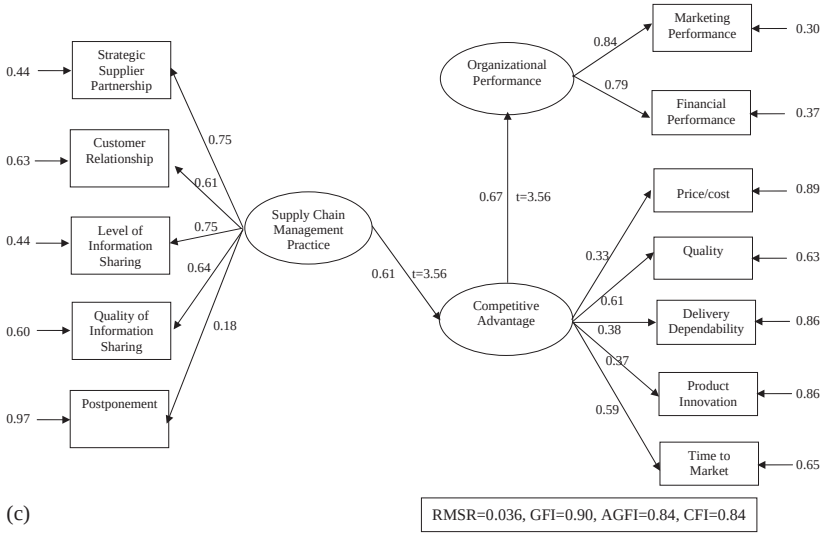

Fig. 2. (*continued*).

Table 4
Comparison of alternative models

Model	Chi-square	DF	Chi-square difference	DF difference	SCDTs ($\alpha = .05$)
Fig. 2a: Proposed model	134.04	51			
Fig. 2b: Remove the link SCMP → CA	159.39	52	25.35	1	Significant
Fig. 2c: Remove the link SCMP → OP	138.26	52	4.22	1	Significant
Fig. 2d: Remove the link CA → OP	147.76	52	13.72	1	Significant

construct covariances. Table 4 shows that the proposed model in Fig. 2a is accepted compared to the alternative model in Fig. 2b–d at a significant level of .05.

The results of the proposed structural equation model analysis are also presented in Table 5 indicating support for all the hypotheses. The results support Hypothesis 1, which states that organizations with high levels of SCM practice have high levels of organizational performance. The standardized coefficient is .24 which is statistically significant at $P < .05$ ($t = 2.21$). The statistical significance of Hypoth-

Table 5
Results for proposed structural equation model

Hypothesis	Relationship	Total effects	Direct effects	Indirect effects	Hypothesis
H1	SCMP → OP	.50** (5.59)	.24* (2.21)	.26** ($t = 3.17$)	Supported
H2	SCMP → CA	.55** (3.33)	.55** (3.33)		Supported
H3	CA → OP	.48** (2.80)	.48** (2.80)		Supported
GFI = .90 AGFI = .84 CFI = .84 RMSR = .035					

Note: *Significant at $\alpha < .05$,** significant at $\alpha < .01$ (one-tailed test). t-values are in parentheses.

esis 1 confirms that SCM practice can have a bottom-line influence on the organizational performance. The implementation of SCM may directly improve an organization's financial and marketing performances in the long run.

Hypothesis 2 is also supported which indicates that SCM practice have a direct impact on competitive advantage. The standardized coefficient is .55 which is statistically significant at $P < .01 (t = 3.33)$. The implementation of various SCM practices, such as strategic supplier partnership, customer relationship building, and postponement, may provide the organization a competitive advantage on cost, quality, dependability, flexibility, and time-to-market dimensions.

The results also indicate that higher levels of competitive advantage may lead to improved organizational performance, thus confirming Hypothesis 3. The standardized coefficient is .48 which is statistically significant at $P < .01$ ($t = 2.80$).

Based on the standardized coefficients of the three hypotheses displayed in Table 5, SCM practice may have a greater direct impact on competitive advantage ($\beta = .55$) than on organizational performance ($\beta = .24$). This could be true since organizational performance is usually influenced by many factors and it is hard to see whether any one factor, such as SCM practice, will dominantly determine the overall performance of an organization. The results also show that organizational performance is more influenced by competitive advantage ($\beta = .48$) than by SCM practice ($\beta = .24$). This indicates that SCM practices produce competitive advantage to the organization in the first place, and competitive advantage will, in turn, lead to improved organizational performance. In literature, SCM practices, mostly, have been linked directly to organizational performance. The findings of this research indicate the presence of an intermediate measure of competitive advantage between SCM practice and organizational performance.

The standardized coefficient of the indirect effect of SCM practice on organizational performance is .26 ($t = 3.17$), which is significant at .01 level. Our analysis from Table 5 thus shows that SCM practices can have a direct, positive influence on organizational performance as well as an indirect one through competitive advantage.

The study focuses on the causal relationships between SCM practice, competitive advantage and organizational performance and ignores the possible recursive relationships. It is possible that enhanced competitive advantage and increased organizational performance could have improved the levels of SCM practice. The increased competitiveness of a firm may enable a firm to implement higher level of SCM practice due to the need to outperform its competitors constantly and keep its competitive position in today's dynamic business world. On the other hand, enhanced organizational performance provides a firm increased capital to implement various SCM practices. Likewise, enhanced organizational performance could have increased the competitive advantage of a firm. For example, a firm with good financial capability can afford to offer low price, which provides a cost advantage over its competitors.

6. Research implications and limitations

The present study validates the SCM practice construct that has generally been poorly defined and about whose meaning there has been a high degree of variability in people's understanding [27]. Although some organizations have realized the importance of implementing SCM, they often do not know exactly what to implement, due to a lack of understanding of what constitutes a comprehensive set of SCM practices. By proposing, developing, and validating a multi-dimensional, operational measure of the construct of SCM practice, and by demonstrating its efficacy in enhancing organizational performance and competitive advantage, the present study provides SCM managers with a useful tool for evaluating the comprehensiveness of their current SCM practices. We have shown that SCM practice forms a second-order construct composed of the first-order constructs of strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement—the five major components of SCM practice. Through the analysis of the relationship of SCM practice construct with competitive advantage (Hypothesis 2), it was demonstrated that SCM practice may directly impact competitive advantage. The findings of this research thus point to the importance of SCM practices to the organization.

As today's competition is moving from "among organizations" to "between supply chains", more and more organizations are increasingly adopting SCM practice in the hope of reducing supply chain costs and securing

competitive advantage. The findings of this research support the view that SCM practices can have discernible impact on competitive advantage and organizational performance.

It should be noted that the SCM practices may be influenced by contextual factors, such as the type of industry, firm size, a firm's position in the supply chain, supply chain length, and the type of a supply chain. For example, the level of customer relationship practice, measured by customer satisfactions and expectations, may be higher for company located at the end of a supply chain (close to the consumer). The larger organizations may have higher levels of SCM practices since they usually have more complex supply chain networks necessitating the need for more effective management of supply chain. The level of information quality may be influenced negatively by the length of a supply chain. Information suffers from delay and distortion as it travels along the supply chain, the shorter the supply chain, the less chance it will get distorted. Moreover, the higher level of postponement may be associated with make-to-order versus make-to-stock production systems.

Because of the limited number of observations (196), the revalidation of constructs was not carried out in this research. Lack of systematic confirmatory research impedes general agreement on the use of instrument. Future research should revalidate measurement scales developed through this research. As the concept of SCM is complex and involves a network of companies in the effort of producing and delivering a final product, its entire domain cannot be covered in just one study. Future research can expand the domain of SCM practice by considering additional dimensions such as geographical proximity, JIT/lean capability, cross-functional coordination, logistics integration, and agreed supply chain leadership, which have been ignored from this study. The future study can also test the relationships/dependencies among five dimensions of SCM practices. For example, information sharing may require the establishment of a strategic supplier partnership. The data for the study consisted of responses from single respondents in an organization which may be a cause for possible response bias. The results have to be interpreted taking this limitation into account. The use of single respondent may generate some measurement inaccuracy. Future research should seek to utilize multiple respondents from each participating organization to enhance the research findings. It will also be of interest to use the respondents from pairs of organizations at two ends of supply chains. By comparing different view of SCM practices from organizations across the supply chain, it is possible to identify the strength and weakness of the supply chain and also the best common SCM practice across the supply chain. Future research can study SCM issues at the supply chain level. Taking a single supply chain as an example, it is of interest to investigate the characteristics, policy, and mechanism governing this supply chain, the interactions among all the participants within the supply chain (first-tier suppliers, second-tier suppliers, manufacturers, carriers, customers, etc.), and how the SCM practices differ across each participating organization. Future studies can also examine the proposed relationships by bringing some contextual variables into the model, such as organizational size and supply chain structure. For example, it will be intriguing to investigate how SCM practice differs across organization size. It will also be interesting to examine the impact of supply chain structure (supply chain length, organization's position in the supply chain, channel structure, and so on) on SCM practice and competitive advantage.

7. Conclusion

This paper provides empirical justification for a framework that identifies five key dimensions of SCM practices and describes the relationship among SCM practices, competitive advantage, and organizational performance. It examines three research questions: (1) do organizations with high levels of SCM practices have high levels of competitive advantage; (2) do organizations with high level of SCM practices have high levels of organizational performance; (3) do organizations with high levels of competitive advantage have a high level of organizational performance? For the purpose of investigating these issues a comprehensive, valid, and reliable instrument for assessing SCM practices was developed. The instrument was tested using rigorous statistical tests including convergent validity, discriminant validity, reliability, and the validation of second-order constructs. This study provides empirical evidence to support conceptual and prescriptive statements in the literature regarding the impact of SCM practices.

Appendix A. Instruments for supply chain management practice, competitive advantage (CA) and organizational performance (OP)

With regard to SCM practice, please circle the number that accurately reflects your firm's present conditions.

Strategic supplier partnership (*SSP*)

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

SCMP/SSP6	We actively involve our key suppliers in new product development processes.
Customer relationship (*CR*)	
SCMP/CR1	We frequently interact with customers to set reliability, responsiveness, and other standards for us.
SCMP/CR2	We frequently measure and evaluate customer satisfaction.
SCMP/CR3	We frequently determine future customer expectations.
SCMP/CR4	We facilitate customers' ability to seek assistance from us.
SCMP/CR5	We periodically evaluate the importance of our relationship with our customers.
Level of information sharing (*IS*)	
SCMP/IS1	We inform trading partners in advance of changing needs.
SCMP/IS2	Our trading partners share proprietary information with us.
SCMP/IS3	Our trading partners keep us fully informed about issues that affect our business.
SCMP/IS4	Our trading partners share business knowledge of core business processes with us.
SCMP/IS5	We and our trading partners exchange information that helps establishment of business planning.
SCMP/IS6	We and our trading partners keep each other informed about events or changes that may affect the other partners.
Level of information quality (*IQ*)	
SCMP/IQ1	Information exchange between our trading partners and us is timely.
SCMP/IQ2	Information exchange between our trading partners and us is accurate.
SCMP/IQ3	Information exchange between our trading partners and us is complete.
SCMP/IQ4	Information exchange between our trading partners and us is adequate.
SCMP/IQ5	Information exchange between our trading partners and us is reliable.
Postponement (*POS*)	
SCMP/POS1	Our products are designed for modular assembly.
SCMP/POS2	We delay final product assembly activities until customer orders have actually been received.
SCMP/POS3	We delay final product assembly activities until the last possible position (or nearest to customers) in the supply chain.

With regard to competitive advantage of your firm, please circle the appropriate number to indicate the extent to which you agree or disagree with each statement. The item scales are five-point Likert type scales with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 6 = not applicable.

Note: Items marked by an asterisk were removed in the final instruments.

Price/cost:	*an organization is capable of competing against major competitors based on low price.*
CA/PC1	We offer competitive prices.
CA/PC2	We are able to offer prices as low or lower than our competitors.
Quality:	*an organization is capable of offering product quality and performance that creates higher value for customers.*
CA/QL1	We are able to compete based on quality.
CA/QL2	We offer products that are highly reliable.
CA/QL3	We offer products that are very durable.
CA/QL4	We offer high quality products to our customer.
Delivery dependability:	*an organization is capable of providing on time the type and volume of product required by customer(s).*
CA/DD1*	We deliver the kind of products needed.
CA/DD2	We deliver customer order on time.
CA/DD3	We provide dependable delivery.
Product innovation:	*an organization is capable of introducing new products and features in the market place.*
CA/PI1	We provide customized products.
CA/PI2	We alter our product offerings to meet client needs.
CA/PI3	We respond well to customer demand for "new" features.
Time to market:	*an organization is capable of introducing new products faster than major competitors.*
CA/TM1*	We deliver product to market quickly.
CA/TM2	We are first in the market in introducing new products.
CA/TM3	We have time-to-market lower than industry average.
CA/TM4	We have fast product development.

Please circle appropriate number which best indicate your firm's overall performance. The item scales are

five-point Likert scales with 1 = significant decrease, 2 = decrease, 3 = same as before, 4 = increase, 5 = significant increase, 6 = not applicable.

Organizational performance: how well an organization achieves its market-oriented goals as well as its financial goals.

OP1	Market share.
OP2	Return on investment.
OP3	The growth of market share.
OP4	The growth of sales.
OP5	Growth in return on investment.
OP6	Profit margin on sales.
OP7	Overall competitive position.

Appendix B. Demographic data for the respondents (sample size 196)

Variables	Total responses	First-wave	Second and third waves
	Frequency (percent)	Frequency (percent)	Frequency (percent)
Number of employees (*194*)			
100–250	74 (38.1%)	36 (38.7%)	38 (37.6%)
251–500	27 (13.9%)	12 (12.9%)	15 (14.6%)
501–1000	19 (9.8%)	7 (7.5%)	12 (11.9%)
Over 1000	74 (38.1%)	38 (40.9%)	36 (35.6%)
Sales volume in millions of $ (*190*)			
Under 10	5 (2.6%)	4 (4.4%)	1 (1.0%)
10–< 25	37 (19.5%)	18 (20.0%)	19 (19.0%)
25–< 50	28 (14.7%)	9 (10.0%)	19 (19.0%)
50–< 100	26 (13.7%)	14 (15.6%)	12 (12.0%)
Over 100	94 (49.5%)	45 (50.0%)	49 (49.0%)
Job title (*194*)			
CEO/President /Vice President	14 (7.2%)	10 (10.6%)	4 (4.0%)
Director	35 (18.0%)	17 (18.3%)	18 (17.8%)
Manager	121 (63.4%)	54 (58.1%)	67 (66.3%)
Other	24 (12.4%)	12 (12.9%)	12 (11.9%)
Years stayed at the organization (*194*)			
Under 2 years	15 (7.7%)	12 (12.9%)	3 (3.0%)
2–5 years	29 (14.9%)	12 (12.9%)	17 (16.8%)
6–10 years	32 (16.5%)	15 (16.1%)	17 (16.8%)
Over 10 years	118 (60.8%)	54 (58.1%)	64 (63.4%)

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