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Impact of supply chain collaboration and knowledge sharing on organizational outcomes in pharmaceutical industry of Bangladesh

Mahbubul Haque, Rafikul Islam,

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# Impact of supply chain collaboration and knowledge sharing on organizational outcomes in pharmaceutical industry of Bangladesh

Supply chain  
collaboration

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Mahbubul Haque

*Department of Business Administration, University of Asia Pacific,  
Dhaka, Bangladesh, and*

Rafikul Islam

*Department of Business Administration,  
International Islamic University Malaysia, Kuala Lumpur, Malaysia*

## Abstract

**Purpose** – This study aims to investigate the proposed relationships concerning the supply chain collaboration (SCC) practices and knowledge sharing with organizational performance in the pharmaceutical industry of a developing country.

**Design/methodology/approach** – In total, 203 executives working in various pharmaceutical companies of Bangladesh participated in the study. Factor analysis and structural equation modeling were applied to test the proposed research hypotheses.

**Findings** – This study reveals that both knowledge sharing and collaboration practices in the supply chain significantly influence customer satisfaction leading to business competitiveness as evidenced in the superior product quality and new product innovation in this knowledge-intensive industry. It further reveals a statistically significant correlation between SCC and knowledge sharing practices.

**Research limitations/implications** – This study is performed only on the manufacturers in the pharmaceutical industry from the perspective of a developing country. Future studies could cover other entities operating in a pharmaceutical supply chain.

**Practical implications** – The findings of the study have significant practical implications due to the fact that the aspect of knowledge sharing exerts influence on customer satisfaction that holds the key to competitive priorities. The managers need to address this issue seriously.

**Originality/value** – Few studies have been performed *vis-a-vis* the impact of both SCC and knowledge sharing on the organizational outcomes in the pharmaceutical industry from the perspective of a developing country.

**Keywords** Knowledge sharing, Quantitative, Pharmaceuticals industry, Customer satisfaction, Business competitiveness, Supply chain collaboration

**Paper type** Research paper



## 1. Introduction

Due to globalization, firms these days are becoming increasingly prone to increased levels of uncertainty and manifold disruptive events (Tse *et al.*, 2016). In today's marketplace, as the competition is fought across supply chains, and emphasis is given toward meeting the changing demands of the end users, supply chain disruptions affect

organizational performance (Ho *et al.*, 2015). Given the exponential rate of IT diffusion across the world, traditional business practices are in dire need of synchronizing a myriad of activities across the supply chains where real-time information exchange sharing is an imperative for the firms to suit the demands of the constantly evolving current business landscape (Baig *et al.*, 2014).

Pharmaceutical industry comprises a complex supply chain characterized by a number of stakeholders (Nsamzinshuti *et al.*, 2017), where the delivery of medical commodities to the end users has to continually and seamlessly pass through various entities. As these entities in a pharmaceutical supply chain are intricately linked in providing healthcare to the people, appropriate knowledge sharing across the entire chain is thus vital for the industry to remain viable and competitive (Pinna *et al.*, 2015; Hung *et al.*, 2005).

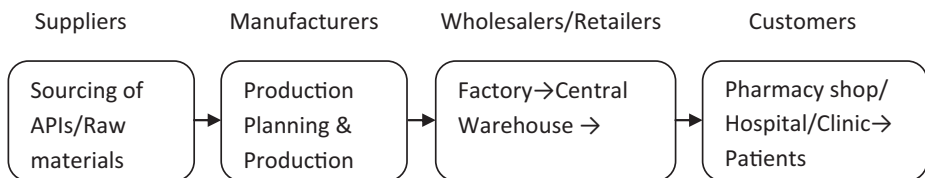
While there are studies carried out relating to the impact of supply chain collaboration (SCC) as well as knowledge sharing efforts on firm performance separately, questions remain as to how these two practices in conjunction with each other influence various facets of organizational performance. The objective of this study is to answer this question. Specifically, the objective is to test the hypotheses *vis-à-vis* the interrelationships between these practices and the firm performance in the context of the pharmaceutical industry of Bangladesh.

Following this introduction, the paper offers a brief overview of Bangladesh pharmaceutical industry and reviews the literature relating to the pertinent theories, as well as SCC practices and aspects of knowledge sharing. The development of research hypotheses as illustrated in the theoretical framework of the study is then described and followed by a detailed survey methodology. Next is provided the study findings that include the demographic profiles of the respondents, information on the companies surveyed, the descriptive statistics and reliability measures of the study variables and the relevant factor analyses. The hypotheses tested in the research are then presented through structural equation modeling (SEM) technique with a discussion of the findings. The paper concludes with some study limitations and a few directions for future research in this regard.

## 2. Bangladesh pharmaceutical industry and its supply chain

Dominated by the domestic manufacturers, Bangladesh pharmaceutical industry is growing rapidly, exporting its products to more than 90 countries around the world. The market size of the domestic pharmaceutical market in Bangladesh is valued at more than \$1.6bn (Kabir, 2016).

In the Bangladesh pharmaceutical supply chain, the manufacturers source their required active pharmaceutical ingredients (APIs) and other raw materials mostly from overseas. The big firms in the industry transport their drugs through their own distribution channels to the depots in various parts of the country; their sales representatives then collect these drugs and sell off to the wholesalers or retailers from whom the end-users purchase their medical items. The medium- and small-sized firms, on the other hand, sell their drugs to the wholesalers, who collect them from their factories (Figure 1).



**Figure 1.**  
Bangladesh  
pharmaceutical  
supply chain

As this industry is a major player attracting the largest blue-collar jobs in Bangladesh economy, it is of paramount importance to gauge the influence of the factors germane to the various aspects of collaboration and knowledge sharing in this supply chain. As observed by [Ralston et al. \(2017\)](#), recognizing what kind of know-how to address by a firm in SCC would be a fertile ground for research. Besides, specifically from the standpoint of a developing country like Bangladesh, there is a dearth of studies conducted in this area. As such, this research is expected to fill this lacuna in the existing body of literature from theoretical, empirical and contextual perspectives.

### 3. Theories adopted in the study

There are a number of theories adopted in this study. These are discussed as follows:

#### 3.1 Resource-based view of the firm

Developed to explain how firms attain sustainable competitive advantages, resource-based view (RBV) focuses on those firm attributes that are difficult to imitate and that create more value to the customers and scarcity for the competitors ([Barney, 1991](#)). A firm's resources entail those assets – both tangible and intangible – that facilitate in its formulating and using value-adding strategies ([Wernerfelt, 1984](#)). Compared to tangible ones, it is the unique, intangible resources, such as knowledge that pay firms rich dividends by providing value to various other factors of production and are, therefore, more likely to create strategic advantage ([Prahalad and Hamel, 1990](#)). For this, the firms may combine both internal and external knowledge that might result into generation of novel and exclusive knowledge ([Szulanski, 2003; Zack, 2002](#)).

According to [Grant \(1996\)](#), knowledge is the key ingredient in adding value to various forms of activities. He distinguishes his view with the existing knowledge-based view of the firm that focuses more on the creation of organizational knowledge ([Nonaka, 1994](#)) by putting emphasis on the role of the individual in generating and accumulating knowledge. This is in line with the observations stated in various studies ([Beckett et al., 2000](#)) that aside from the technological aspect, there must be a recognition of human element and that of the individual members of the organization in the knowledge management (KM) processes.

#### 3.2 Systems thinking theory

As advocated by [Senge \(1990\)](#), system thinking theory takes a holistic perspective in understanding the various dynamics or inter-relationships constituting a system. From an SCM perspective, such a system generally encompasses the organization itself, its suppliers and customers, its competitors and other stakeholders that are not directly involved in its operations. A sound grasp of the sub-system interrelationships pervading this entire chain offers a better picture of the latent opportunities and threats for an organization.

In practicing KM, [Ndlela and Toit \(2001\)](#) subscribed to such aforementioned views *vis-à-vis* systems thinking. As KM entails issues that transcend across a number of functional departments, they underscore the value of viewing the relationships in their entire gamut between various enablers and processes, such as organizational culture, IT infrastructure, performance appraisal process, etc. of KM and organizational performance. Considered from this standpoint, this thinking premise throws light into the effectiveness of the impact of various dimensions relating to knowledge sharing across various supply chain entities on firm competitiveness and performance.

### 3.3 Supply chain collaboration practices

In these turbulent times, there is a growing need to adjust to the risk of disruption through collaboration among supply chain entities (Tse *et al.*, 2016). In a supply chain, such collaboration practices have been captured by different authors in various dimensions. Tan *et al.* (1998, 2002) emphasized the role of purchasing practices, quality and customer relations, sharing of information, managing customer service, geographical proximity and just-in-time (JIT) capability. On the other hand, Chen and Paulraj (2004) focused more on long-term relationship, communication, cross-functional teams, supplier involvement and its base reduction in measuring buyer–supplier relationships. This view was embraced by Min and Mentzer (2004), who incorporated the attributes of agreed vision and goals as well as risk and award sharing apart from those of information sharing, process integration and long-term relationship as mentioned in the preceding studies. Besides, product quality, information quality, the need of people dimension in a supply chain, such as leadership, training, personal relationships, increasing communication, etc. feature prominently in various studies (Li *et al.*, 2005; Ellinger and Ellinger, 2014).

Thus, the current literature captures SCC practices from various standpoints that can be lumped into two broad groups: the “soft” people-oriented dimensions related to social relationships and the “hard” system-focused dimensions focusing on the technological and infrastructural issues. SCC practices as considered in this research thus encompass both these soft and hard issues.

### 3.4 Knowledge sharing in supply chain

According to De Toni, *et al.* (2011), knowledge sharing is an important primary knowledge strategy, which is based on tacit and explicit knowledge. Imperative in this regard is not mere its physical transfer, rather a shared understanding on the part of the personnel regarding the knowledge transmitted across the departments spanning the supply chain (Fugate *et al.*, 2009; Zahra and Nielsen, 2002).

According to Sambasivan *et al.* (2009), there exists a strong relationship between the sharing of knowledge and organizational performance. It is vital as it helps organizations improve innovation performance and avoid duplicate learning efforts (Calantone *et al.*, 2002). In this regard, a number of other studies provide empirical support between different aspects of knowledge exchange and organizational performance along a supply chain (Baker and Sinkula, 2005; Choo *et al.*, 2007). In particular, when this knowledge forged through their experience of myriad supply chain activities such as purchasing, production and marketing get integrated with that of outside sources, it would create what is termed as the knowledge value chain (Lee and Yang, 2000). In this regard, it is worth mentioning the study done by Thiruvattal (2017) that sheds light on how customer loyalty is affected through the process of value co-creation by different stakeholders in a supply chain.

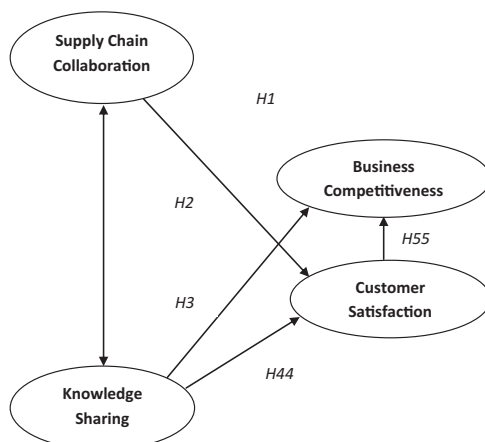
## 4. Research framework

In the proposed framework, five hypotheses are developed to test the relationships among the five constructs (Figure 2). The double-arrow between SCC and knowledge sharing indicates a correlation between the two, and therefore, is not considered a hypothesis.

The following section presents a discussion on the hypotheses developed for this study.

### 4.1 Linkage between supply chain collaboration and business competitiveness

When it comes to supply chain integration, a systems perspective is taken into cognizance (Bakker *et al.*, 2012). Integration of various operational activities through such a shared understanding with suppliers results in streamlined production, reduced lead time, waste



**Figure 2.**  
Research framework

and safety stock and superior products (Yeung, 2008). As found in the study by Yang and Wei (2013), collaboration between supply chain partners can augment firms' business competitiveness when it comes to their performance *vis-à-vis* safety, security and customs clearance in the container shipping industry. Yang (2016) further argued that integration of supply chain activities enhances competitiveness through higher market and financial performance. A prime source of a company's competitive advantage stems from its ability to use information technology and process innovation resulting into a diminished system-wide inventory and a much faster response time across the supply chain (Ellinger *et al.*, 2012). Thus, the relationship can be stated as follows:

*H1.* Supply chain collaboration exerts positive impact on business competitiveness.

#### 4.2 Linkage between supply chain collaboration and customer satisfaction

Customer satisfaction on the downstream side occupies the center stage in having an effective supply chain (Xu and Waton, 2005). Managing long-term customer relationships is considered a prime attribute of strong collaborative practices (Hudnurkar and Rathod, 2017). Such relationship comprises the entire array of practices that are deployed for purposes of forging enduring rapport with customers, addressing their complaints and enhancing their satisfaction. In their search for creating value in their business, managers need to forge lasting relationships with their customers (Fawcett and Magnan, 2002). In this regard, the theory of systems thinking or dynamics figures prominently as it fosters collaboration among different linkages through information sharing (Li *et al.*, 2005). Such collaboration would ultimately lead to overall supply chain profitability and enhanced customer satisfaction. As such, the proposed relationship between SCC and customer satisfaction is stated as follows:

*H2.* Supply chain collaboration has a positive impact on customer satisfaction.

#### 4.3 Linkage between knowledge sharing and business competitiveness

According to Barney (1991), the resources and capabilities that are valuable, rare, inimitable and non-substitutable offer a strategic benefit. In this era of knowledge economy (Nonaka

and Takeuchi (1995), proper dissemination of knowledge and continuous learning from the external environment turn into a strategic weapon for companies in setting their competitive priorities (De Toni *et al.*, 2011). In their study, Salazar *et al.* (2003) found that KM acts as a key enabler for the pharmaceutical and biotechnology firms toward gaining a viable competitive edge. In their empirical investigation in pharmaceutical manufacturing companies in Nigeria, Chiekezie *et al.* (2016) concluded that shared knowledge garnered through staff training results into firm competitiveness. The theoretical postulations and empirical evidences presented in prior studies thus support the linkage as follows:

*H3.* Knowledge sharing has a positive influence on business competitiveness.

#### *4.4 Linkage between knowledge sharing and customer satisfaction*

According to Zack *et al.* (2009), KM practices influence organizational performance, one aspect of which is customer satisfaction. In a study investigating the above on small and medium enterprises, Gholami *et al.* (2013) found that knowledge sharing being a strong component of KM practices exerts highly on customer satisfaction. In this current business landscape, mere marketing of high-volume products to various stakeholders in the pharmaceutical supply chain is not enough; rather, it is of high strategic significance to provide customized services and retain customer loyalty (Alt, 2003). With firms paying more heed to customer voice in market positioning, knowledge sharing management, being a key enabler, facilitates in deploying their knowledge-base to offer superior customer service (eGain Communications Corporation, 2004). In an empirical investigation in the Malaysian banking sector, Maziar (2015) concluded that knowledge sharing leads to improved organizational performance through satisfying customers. It is, therefore, hypothesized as follows:

*H4.* Knowledge sharing exerts a positive influence on customer satisfaction.

#### *4.5 Linkage between customer satisfaction and business competitiveness*

The ability of a firm to meet customer satisfaction at a superior level is considered a key driver to its business strategies (Ellinger *et al.*, 2012). The RBV asserts that the key resources facilitate the firms in crafting and carrying out the strategies that offer value and satisfy the needs of the customers, thereby helping them garner sustained business competitiveness (Clulow *et al.*, 2007). According to Bowersox *et al.* (2000), customer relevancy occupies a key consideration in crafting corporate strategies. The ability of a firm to forge close relationship with its customers brings forth a great competitive advantage (Power, 2005). The competitiveness of a firm hinges greatly on how agile it is in responding to customer requirements and queries (Su, 2004). The hypothetical relationship is, therefore, deemed as follows:

*H5.* Customer satisfaction has a positive effect on business competitiveness.'

## **5. Methodology**

The objectives of this study focus on individual's perception of the impact of SCC and knowledge sharing practices on the organizational outcomes; thus, the target population comprises the managers/executives working in the pharmaceutical companies in Bangladesh, where both the managers/executives and their respective companies are to



meet some prescribed criteria to be considered as respondents and chosen organizations in the study.

The sampling frame in this study includes the names of the pharmaceutical companies that are gathered from the Bangladesh Association of Pharmaceutical Industries (BAPI). About 90 per cent of the companies are based in greater Dhaka region, the capital of Bangladesh; this is reflected in this study as well, with the vast majority of the chosen companies being situated in and around this region.

### 5.1 Sampling technique

The study uses a number of sampling techniques to carry out the survey: stratified random sampling, census sampling and simple random sampling. First, a stratified random sampling is selected; it divides the population into a number of strata based on a few stratification variables (Malhotra, 2007). Thus, the companies taken from the sampling frame are put into two broad groups based on market share: the leading ones capturing about 65 per cent of the total market share versus the others. As the numbers of the former are ten, a census sampling suitable for small population is then applied. For the rest, the simple random sampling is used. However, in doing so, there are a few certain criteria set for the selection of the companies, as well as the respondents; these are as follows:

- In the companies chosen from the sampling frame, at least 300 employees would be working to ensure a minimum operating structure of each company.
- The participants in this study comprise full-time executives working in various departments, such as supply chain, marketing, production, engineering, quality assurance, project development and all those familiar with supply chain and product development activities for more than a year.

### 5.2 Sample size

The determination of sample size in the application of SEM is an important consideration. According to Hair *et al.* (2010), adequate sample size is critical in obtaining meaningful estimations and analysis of results. According to Hoe (2008), a sample size of 200 respondents possesses and provides enough statistical power for data interpretations. Although, there are no strict stipulated rules relating to the sample size, one rule of thumb was suggested by Hair *et al.* (2010): for each parameter, take at least five observations. In conforming to this prescribed guideline, the current study would consider the number of 200 respondents as adequate.

### 5.3 Instrumentation of measurement items

A survey questionnaire was developed using previous literature reviews *vis-à-vis* four constructs of the current study. Prior to the administration of the survey, the questionnaire is reviewed for content validity by two academicians (one, professor and the other, associate professor working in the department of business administration at two universities) and five practitioners working in five different pharmaceutical companies in Bangladesh. The designations of those persons consulted with are one CFO (chief financial officer), one Vice President, operations division, one supply chain manager of an MNC, one ISO manager in quality control division and one head of product development department of a relatively new company. A few minor modifications were made in the questionnaire through such reviews. The refined questionnaire thus includes items regarding the four constructs, SCC, KNS, BCOM and CSAT (Table I). The



instrument was pre-tested by 45 managers/senior executives in different pharmaceutical companies, with the measurement items having Cronbach alpha values above the cut-off point of 0.7, thus showing adequate internal consistency. A five-point Likert scale is used whereby the respondents express their views ranging from “strongly agree” to “strongly disagree” with regard to the statements of the constructs.

**6. Findings of the study**

The study questionnaires were distributed to a total of 415 executives familiar with the SCC and knowledge sharing practices as followed in their respective companies. Out of 415 questionnaires, 225 were returned with the response rate being 54 per cent. From those responses, 22 were omitted, of which 14 owing to excessive missing values and the rest 8 to the non-fulfillment of the requirement to be used as samples, such as perceived response bias, exact responses among the different questionnaires, etc. This has resulted into a final sample size of 203 and the adjusted response rate of about 49 per cent. Table II portrays the respondents’ profile that highlights their academic background, their designations and their working departments and the length of service in the respective companies.

Of the 203 respondents, an overwhelming majority (149 or 73.4 per cent) possess masters degree followed by those with bachelors (23.2 per cent); the few remaining are PhDs and diploma holders. More than 41 per cent of them work in SC and marketing department followed by about 22 per cent each in the department of product development, and in the quality/engineering/maintenance department with the rest working in the HR or project management section.

In terms of respondents’ designations, there are a total of 85 senior executives (with 2-5 years of experience) followed by 54 in assistant/deputy managerial positions, 41 departmental heads, 21 junior executives (with less than two years of experience), with only a few being the general managers of the respective companies. As to their tenure in the company, the study reveals that 91 respondents (more than 44 per cent) have been working in the company for the last three to five years followed by 59 (around 30 per cent) having one to two years of experience. A total of 41 respondents (about 20 per cent) are employed for 6-10 years with only 12 being in their respective companies for more than 10 years.

In this study, a total of 16 companies with their headquarters based in greater Dhaka region, the capital city of Bangladesh, are covered. As is found out, 12 companies have more than 2,000 employees each, and only one has less than 400, with the rest having a total number of employees ranging from 500-1,500. Regarding the number of years in operation, 50 per cent (8 in number) of the companies have been operating in this business for over 20 years and only one less than five years; the rest six are doing this business between 6 and 20 years. Besides, out of these 16, all but one have gained international standard certifications, such as UKMHRA, TGA Australia, ISO 9001, ISO 14000, EU GMP, etc.

Table III presents the descriptive statistics (mean and standard deviation) and the reliability measure of the four constructs considered in the study. Cronbach alpha is used as

**Table I.**  
Instrumentation of  
measurement items

Constructs	Studies reviewed
Supply chain collaboration (SCC)	Singh and Power (2009), Kannan and Tan (2005), Li <i>et al.</i> (2005), Tan <i>et al.</i> (2002), Chen and Paulraj (2004)
Knowledge sharing (KNS)	Zack <i>et al.</i> (2009), OECD (2003), Hung <i>et al.</i> (2005)
Business competitiveness (BCOM)	Tracey and Tan (2001), Han <i>et al.</i> (2007), Su (2004)
Customer satisfaction (CSAT)	Chen and Paulraj (2004), Han <i>et al.</i> (2007), Wu and Ding (2007)

Demographic variable	Frequency	(%)	Supply chain collaboration
<i>Academic qualifications</i>	4	2.0	<b>309</b>
Diploma	47	23.2	
Bachelor	149	73.4	
Masters	1	0.5	
PhD	2	1.0	
Others	203	100.0	
Total			
<i>Department</i>	34	16.7	
Supply chain	51	25.1	
Marketing/Sales	44	21.7	
Product development	44	21.7	
Engineering/Quality control	30	14.8	
Project management/HRM	203	100.0	
Total			
<i>Designation</i>	2	1.0	
General Manager	41	20.2	
Department Head	54	26.6	
Assistant/Deputy Manager	85	41.9	
Senior Executive	21	10.3	
Junior Executive	203	100.0	
Total			
<i>Length of service</i>	59	29.1	
1-2 years	91	44.8	
3-5 years	41	20.2	
6-10 years	12	5.9	
More than 10 years	203	100.0	
Total			

**Table II.**  
Demographic attributes of the respondents

Variables	Mean (item)	SD (item)	Cronbach alpha	Table III.
Supply chain collaboration (SCC) (13 items)	3.940	0.539	0.852	Descriptive statistics and reliability measures
Knowledge sharing (KNS) (7 items)	3.795	0.685	0.860	
Business competitiveness (BCOM) (5 items)	3.987	0.602	0.700	
Customer satisfaction (CSAT) (5 items)	4.137	0.629	0.837	

the measure of reliability with its threshold value of 0.7 to be considered as adequate for SEM (Hair *et al.*, 2010).

From Table III, it is seen that the means of responses of the 13 items constituting SCC practices and 7 items of knowledge sharing stand at around 3.94 and 3.79, respectively, both close to but falling below 4.0, which corresponds to “agree” in the Likert scale. This calls for paying more attention to the various aspects concerning the two practices. Regarding the two organizational outcomes, the mean of business competitiveness is close to 4.0, whereas that of customer satisfaction is above 4.0, reflecting an overall decent industry performance. With customer satisfaction having the highest mean (4.137), it goes in line with the study findings that it is the key mediating variable between the antecedents (SC collaboration and

knowledge sharing practices) and the other consequence, namely, business competitiveness. As indicated by the values of Cronbach alpha in [Table III](#), the scale items can be considered reliable with the values being the minimum of 0.70 for business competitiveness and the maximum of 0.86 for knowledge sharing practices.

6.1 Factor analysis

Prior to conducting SEM, exploratory factor analysis is performed *vis-à-vis* the variable, SCC. Items are sorted by their loading value of 0.50 and the number of factors to retain is decided by the eigenvalues being greater than 1.

Thus, the factor analysis done with regard to SCC has extracted two factors with eigenvalues above 1.0 that cumulatively account for 56.46 per cent of the total variance explained. The first factor constitutes six items: sc1 (long-term relationship with suppliers), sc2 (suppliers provided with information), sc3 (supplier performance evaluation), sc4 (customer feedback), sc5 (customer relations, processes, products and services) and sc6 (systematic processes for customer complaints); their loading values are 0.730, 0.716, 0.546, 0.780, 0.762 and 0.641, respectively. This factor is named as “collaboration and information sharing with suppliers and customers.” The second factor comprises two items; these are: sc9 (adequate investments for SC collaboration practices), sc10 (SCM software systems used); their loadings are 0.803 and 0.795, respectively. This factor is termed as “IT investments in SC.”

6.2 Confirmatory factor analysis

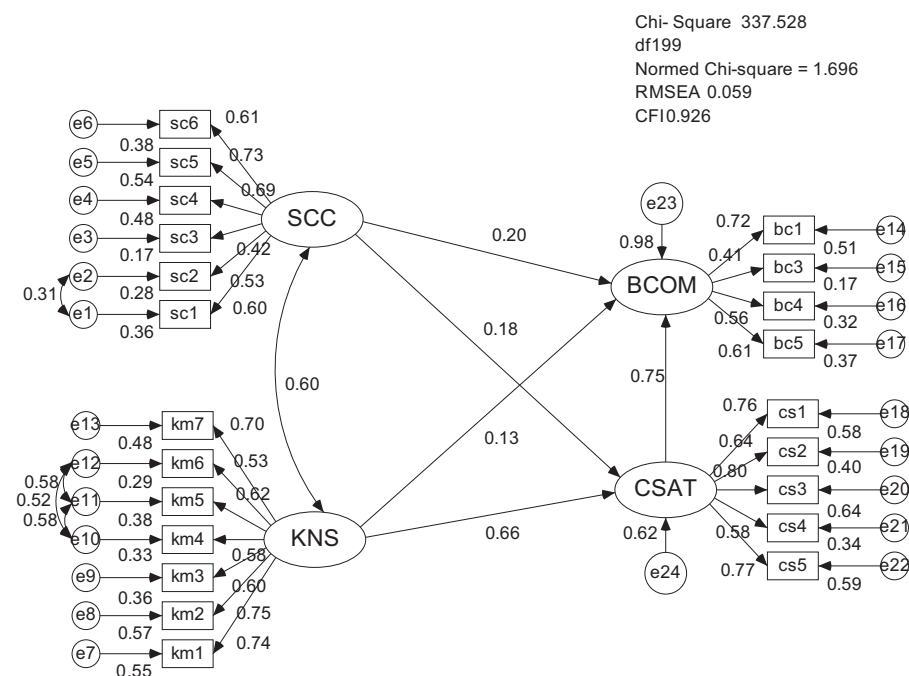
The SEM consists of two steps: first, testing the measurement model, and second, the structural model. According to [Kline \(2010\)](#), the purpose of a measurement model is to check whether the observed indicators represent a particular latent variable; this is done by confirmatory factor analysis (CFA). For this purpose, three fit indices are checked: normed chi-square, root mean square error approximation (RMSEA) and comparative fit index (CFI). The cut-off values, as suggested by [Hair et al. \(2010\)](#), for these indices are: normed chi-square and RMSEA are to be less than 5 and 0.08, respectively, whereas CFI values are to be above 0.9 ([Hair et al., 2010](#)). [Table IV](#) presents the modified CFAs (measuring the construct validity) for the four constructs, i.e. SC collaboration, knowledge sharing, business competitiveness and customer satisfaction undertaken in this research. Two items, i.e. sc9 and sc10 from SC collaboration, and one item, i.e. bc2 from business competitiveness in their initial CFAs, are dropped in the structural model due to their very low loadings of 0.24, 0.24 and 0.35, respectively.

6.3 Structural model

The full-fledged structural model shown in [Figure 3](#) includes all the latent constructs as considered in the research framework. Due to non-compliance with the threshold values of the two indices, the initial model has undergone some modifications as reflected by the

**Table IV.**  
Results of CFAs of  
the constructs

Goodness-of-fit statistics	Normed chi-square	RMSEA	CFI
SC collaboration (SCC)	1.507	0.050	0.972
Knowledge sharing (KNS)	0.670	0.000	1.000
Business competitiveness (BCOM)	2.272	0.079	0.969
Customer satisfaction (CSAT)	2.340	0.067	0.997
<i>Threshold values for the fit indices</i>	<i>&lt;5.0</i>	<i>&lt;0.08</i>	<i>&gt;0.90</i>



**Figure 3.**  
Full-fledged  
structural model

earnings put on amongst the various error items of individual constructs. Judging by the values of the fit indices, the current model now fits with the sample data as illustrated in [Figure 3](#).

From [Table V](#) and [Figure 3](#), it is observed that four path co-efficients, namely, KNS → CSAT, SCC → CSAT, CSAT → BCOM and SCC → BCOM, prove to be statistically significant at  $p < 0.001$ ,  $p < 0.05$ ,  $p < 0.001$  and  $p < 0.05$ , respectively. Thus, it can be inferred that in this study,  $H4$  (knowledge sharing has positive effect on customer satisfaction), ( $SCMP \rightarrow CSAT$ );  $H2$  (SC collaboration exerts a positive impact on customer satisfaction), ( $SCC \rightarrow CSAT$ );  $H5$  (customer satisfaction has positive effect on business competitiveness), ( $CSAT \rightarrow BCOM$ ); and  $H1$  (SCC exerts a positive impact on business competitiveness), ( $SCC \rightarrow BCOM$ ), are supported. Only  $H3$  (knowledge sharing

Path	Estimate	S.E.	C.R.	$p$	Significant
CSAT ← SCC	0.175	0.089	1.971	0.049	<0.05
CSAT ← KNS	0.556	0.088	6.331	0.000	<0.001
BCOM ← KNS	0.107	0.096	1.115	0.265	Not significant
BCOM ← SCC	0.190	0.081	2.339	0.019	<0.05
BCOM ← CSAT	0.721	0.124	5.819	0.000	<0.001

	Estimate	$p$
SCC ↔ KNS	0.601	0.000

**Note:** Correlations: Supply chain collaboration and knowledge sharing

**Table V.**  
Significance of the  
path co-efficients in  
the structural model

is positively related to business competitiveness), (KNS → BCOM), is not supported by the model (Table V).

As is demonstrated in Figure 3, customer satisfaction (CSAT) stands as the key mediating variable, through which both SCC practices and knowledge sharing (KNS) influence business competitiveness (BCOM). In this model, KNS holds a higher influence (0.66) than that (0.18) of SCC practices on customer satisfaction (CSAT). The combined effect of both SCC and KNS accounts for 62 per cent of the total variance in customer satisfaction, while this effect with that of customer satisfaction on business competitiveness stands at 98 per cent. Separately, the effects of knowledge sharing and SCC on business competitiveness are 13 per cent and 20 per cent, respectively. From Figure 3 and Table V, the model further highlights the fact that the correlation between SCC and KNS stands at 60 per cent, which is also statistically significant at  $p < 0.001$ .

## 7. Discussion of the findings

According to Yang (2016), organizations would attain higher performance if collaborative communications prevail in a supply chain. This finds resonance in the current study as well; the efforts undertaken by the companies in building ties, though in a limited scale, with the other players in the chain result into a superior customer satisfaction, culminating into improved business competitiveness. On the downstream side, the sharing of information, as the findings suggest, results into strong customer satisfaction. Effectively performed, customer order processing that flows through a number of supply chain spanning activities holds positive impact in garnering customer loyalty (Tracey *et al.*, 2005).

An important finding is that sharing of knowledge within the firm influences business competitiveness of this knowledge intensive pharmaceutical industry. The results of the study bring to the fore the issue of learning and the consequent product improvement in the pharmaceutical production process. This is thus in line with the study (Tahir *et al.*, 2010) that underscores the need of a culture that facilitates learning and knowledge sharing efforts; this is crucial for an enterprise to remain innovative in its various production processes and managing technologies. The production of hundreds of generic drugs by the pharmaceutical firms can, therefore, be attributed to the sharing of the knowledge and skills of their employees in drug formulation or process simplification.

The study demonstrates that the IT deployment by the companies in the pharmaceuticals industry helps the sharing of knowledge – both vertically and horizontally. The finding falls in line with Aguiar (2009) where the perceived advantages of knowledge sharing are derived from internal exchange of knowledge and information amongst the firm employees. However, it is to be noted that the current study does not find any IT effect across the supply chain entities; this echoes the views of Peng *et al.* (2016) who opined that IT investments would not necessarily boost firm performance. Furthermore, these IT networks are in place to increase operational efficiency within the organization, rather than in leveraging information exchange with the suppliers. This was shared by Cagliano *et al.* (2006) who observed that while this facilitates the purpose internally, by not taking the holistic perspective, firms are not only able to engage in productive relationships with their suppliers, they also get deprived of the benefits that these investments in IT (such as ERP or SAP) would otherwise bring to their operations.

A critical component facilitating knowledge sharing across the supply chain belongs to the trust reposed by the partners in one another. Hudnurkar and Rathod (2017) found it an important element in their study of supplier collaboration practices in Indian manufacturing multinationals. The study performed by Kwon and Suh (2004) concludes that a firm's trust in its supply chain partner is negatively correlated with the behavioral uncertainty of the

latter. With the current level of cooperation that exists between the manufacturers and suppliers in the Bangladesh pharmaceutical industry having a large supplier base, it is presumed that these partners still nurture a good deal of suspicion and behavioral uncertainty that are anchored in the deficit of trust they place in each other. This is in congruence with the study done by [Haque and Islam \(2013\)](#) who observed that a lack of trust prevails across organizational boundaries thereby impeding cross-firm collaboration in the Bangladesh pharmaceutical industry.

### 8. Managerial implications

The study advocates a number of managerial implications applicable for the pharmaceutical industry from the perspective of a developing country. These are presented below:

- The relationship between the pharmaceutical companies and their suppliers is an adversarial one resulting into withholding exchange of information on their part. With the competition being waged across supply chains, these two entities should go hand-in-hand to forge an enduring relationship based on trust and mutual benefit. This is also true for a developing country like Iran, where the fostering of mutual trust between suppliers and manufacturers is an imperative that would greatly influence the competency of the supply chain of its pharmaceutical industry ([Ghatari et al., 2013](#)). In case of India, the collaboration between the companies and their suppliers on demand planning through sharing each other's demand and replenishment plans is urgently called for which would help mitigate the forecasting errors and go a long way in meeting the requirements of the customers ([Mahendran et al., 2011](#)).
- The managers in the pharmaceutical industry should take note of the fact that knowledge sharing has a significant bearing on both business competitiveness and customer satisfaction. This is evident from the high-quality products produced by the companies and their faster delivery to the customers. The IT infrastructure that is in place has significantly helped employees in this regard. However, this sharing of knowledge should be extended beyond the organizational boundaries, and managers should take steps in exploiting their knowledge assets that can realize significant potential competitive advantage ([De Toni et al., 2011](#)).
- The companies are in need of putting an IT infrastructure in place, not for their internal operational efficiency only; this has to be tailored to the needs or requirements of the entities across the supply chain. The lean thinking on the part of employees that is focused on trimming down cost and waste across the supply chain is not at work in the companies. The leadership must cultivate a stakeholder approach and deem any sort of waste a loss to the society at large.
- The role of purchasing is considered a low-key functional activity. As sustainable sourcing translates into superior quality of products, diminished delivery lead time, increased cost savings and lasting business competitiveness, it should be recognized as a strategic weapon by the pharmaceutical manufacturers. The study by [Jensen \(2017\)](#) on strategic sourcing highlighting its cost-benefit effect is a pointer along this line. In this regard, pharmaceutical companies should address the need of logistics innovation affecting buyer-supplier relationships in the supply chain ([Su et al., 2011](#)). In this regard, having an API facility, from where the manufacturers can meet their sourcing of materials, therefore, is to be considered a strategic imperative by the industry.



## 9. Conclusions, limitations and suggestions for future research

The current study is carried out to ascertain the impact of the SCC and knowledge sharing on the performance of pharmaceutical companies from the perspective of a developing country, namely, Bangladesh. Specifically, the objective is to test the hypotheses *vis-à-vis* the interrelationships between the two antecedents (SCC and knowledge sharing) and two organizational outcomes i.e. business competitiveness and customer satisfaction in the above context. For this purpose, questionnaires were distributed to a total of 415 executives familiar with the SCC and knowledge sharing practices as followed in their respective companies. Out of 415, responses from a sample size of 203 were used with a response rate of about 49 per cent. The instrument of the measurement scale items of the four constructs was pre-tested and as the values of Cronbach alpha show that all the scale items cross the threshold value with a minimum of 0.70 for business competitiveness to a maximum of 0.86 for knowledge sharing practices.

SEM using AMOS version 16.0 was used to test the five hypotheses *vis-à-vis* the interrelationships among the constructs of the study. The results of the study indicate that both knowledge sharing and SCC significantly affect customer satisfaction. The joint effect of both accounts for 62 per cent of the total variance in customer satisfaction, whereas in the case of business competitiveness, it stands at 98 per cent. An important finding is the significance of the knowledge sharing that influences business competitiveness as evidenced in the superior product quality and new product innovation in this knowledge intensive industry. Also noteworthy is the fact that sharing of knowledge results into customer satisfaction as manifested into having a strong pharmaceutical base among all the least developed countries. It further reveals a statistically significant correlation between SCC and knowledge sharing practices.

The limitations of the present study and possible areas of future work are presented below:

- The current study uses cross-sectional data. In any future study, longitudinal surveys could be used to provide value to further refining the measurement instruments as well as theory building in these areas. For example, in this study, systems thinking approach has been cited as the theoretical foundation; however, researchers could go beyond systems thinking premise and apply, as argued by Nilsson and Gammelgaard (2012), complexity-based approaches in future studies. In case of knowledge sharing, there could be items such as organization structures that might affect these practices. Besides, the study involves only the drug manufacturers of the Bangladesh pharmaceutical industry. To have a comprehensive overview, views and opinions of other members, like suppliers on the upstream side and distributors on the downstream side of the supply chain, should be incorporated in future studies. These would complement to the research findings, and to the current body of literature as well.
- The present study applies quantitative research methodology; however, there are many soft issues in both SCC and knowledge sharing practices that might be better portrayed, should a qualitative explication through interviews and focus-group discussions be carried out as well. Any future research would, therefore, be of much significance if a mixed-method approach is undertaken in this regard. Besides, the studies might perform structural invariance to test the presence of moderating effects of a number of variables, such as managerial positions and boundary-spanning roles of the executives.



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Items

*Scale items (supply chain collaboration)*

1	Long-term stable relationships with suppliers
2	Suppliers provided with information
3	Supplier performance evaluation
4	Customers feedback
5	Customer relations, processes, products and services
6	Systematic processes for handling customer complaints
7	Greater level of trust among supply chain members
8	Compatible communication/Information system for supply chain members
9	Adequate investments made in developing technology for SCM practice
10	SCM software systems used
11	Integration of activities across supply chains
12	Waste reduction through just-in-time (JIT)
13	Reduction of set-up time and response time across supply chain

*Scale items (knowledge sharing)*

1	Increase in innovation
2	Learning more about technologies, internal operations, & customers
3	Prevention of duplicate research and development
4	User-friendly IT system for knowledge sharing
5	IT system increasing knowledge sharing vertically
6	IT system increasing knowledge sharing horizontally
7	Sharing of knowledge rewarded

*Scale items (business competitiveness)*

1	High quality products to the customers
2	Products at lower cost
3	Purchasing as competitive weapon
4	Quick response to the customers' demands
5	New product innovation

*Scale items (customer satisfaction)*

1	Increase in customer praise
2	Increase in the number of repeat customers
3	Customers satisfied with the products
4	Decrease in the number of customer complaints
5	Overall high customer satisfaction

**Table A1.**  
Scale items of the  
constructs

**Corresponding author**

Rafikul Islam can be contacted at: [rislam@iium.edu.my](mailto:rislam@iium.edu.my)

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