SUPPLY CHAIN PERFORMANCE-MEASURES IN THE CONTEXT OF READY MADE GARMENTS INDUSTRY IN BANGLADESH

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ABSTRACT

The purpose of this research is to identify the supply chain performance-measures that contributed to the supply chain excellences of the RMG (Ready Made Garments) organizations in Bangladesh. A number of factors were identified from local and international literature review. A structured, close-ended questionnaire was used to reveal preference for supply chain performance-measures and samples were chosen based on both judgment and convenience. From the analysis it was found that supplier related factors are the used most, followed by customer related factors. Whereas internal supply chain related measures were focused less. Besides, factors like, Order cycle time, specialization, lead time, facility flexibility, improve data validity, information accuracy were found having positive association on supply chain (SC) performance. The article contributes to the literature on local supply chain management (SCM) and reveals the performance-measures of supply chain of RMG business in Bangladesh.

Key words: *SCM, Bangladesh, RMG Organization, Performance, Indicators.*

บทคัดย่อ

บทความนี้มีวัตถุประสงค์เพื่อระบุตัวชี้วัดผลประกอบการที่นำไปสู่ความเป็นเลิศของผู้ผลิตเสื้อผ้าสำเร็จรูปในประเทศบังคลาเทศ ปัจจัยต่าง ๆ ได้จากการสืบค้นงานวิจัยทั้งในประเทศและต่างประเทศ การใช้แบบสอบถามมีโครงสร้างปลายปิด การสุ่มตัวอย่างโดยใช้วิจารณญานและความสะดวก จากการวิเคราะห์พบว่าปัจจัยที่เกี่ยวข้องกับซัพพลายเออร์ถูกใช้มากที่สุด รองลงมาคือปัจจัยเกี่ยวกับลูกค้า ในขณะที่ปัจจัยเกี่ยวกับโซ่อุปทานภายในองค์กรไม่ค่อยมีผลต่อการพิจารณา นอกจากนี้ยังพบปัจจัยอื่น ๆ ที่มีผลเชิงบวกต่อผลประกอบการในโซ่อุปทาน อาทิเช่น รอบการสั่งสินค้า ความชำนาญ ระยะเวลา ความยืดหยุ่นของสิ่งอำนวยความสะดวก ความเที่ยงตรงและความแม่นยำของข้อมูล

คำสำคัญ: การจัดการโซ่อุปทาน บังคลาเทศ ผู้ผลิตเสื้อผ้าสำเร็จรูป ผลประกอบการ ตัวชี้วัด

INTRODUCTION

RMG industry is the largest export sector of Bangladesh. In 2016-17, this industry earned 81.23% of total export revenue. Bangladesh has become one of the global leading suppliers of RMG mainly due to its cheapest labor costs. However From the beginning of 21st century, Bangladeshi RMG industry face problems like offering high-quality low-cost products with short

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lead time, increasing competition and lack of innovation etc. Under this situation the importance of supply chain management is escalating (Hossain & Roy, 2016). Moreover, working alone is less competitive than working in collaborate with supply chain partners. By efficient use of supply chain, the RMG industries in Bangladesh would be sustainable in future. SCM provides competitive advantage by enhancing productivity and differentiation which in turn gives cost and value advantage respectively (Gunasekaran et. al, 2004; Christopher, 2011). Supply chain performance indicators are the tools for monitoring and improving the supply chain performance in order to gain competitive advantage (Taylor, 2004). They provide supply chain goals and useful information for long-term decisions making. The performance indicators are the elements, activities or variables, value of which indicates the performance for an organization to achieve its mission (Rockart & Bullen, 1981).

In spite of such importance, very few researches have been done on supply chain performance measures of RGM sector in Bangladesh. Local researches were mainly focused on lead time management. Nuruzzaman et al. (2010) investigates supply chain management (SCM) practice in textile and garments (apparel) industries from the perspective of business processes and try to find out the causes of longer lead time and its effect on supply chain. Shahriar et al. (2014) discuss about a conceptual model of RMG and they try to develop a layout and design of the procurement (raw materials, work-in-process, inventory and finished goods) from various sources to the ultimate consumer. Asgari and Hoque (2013) examined the opportunity of integrated supply chain which provide a competitive advantage to the RMG sector and based on the findings, a causal loop diagram is proposed to understand the dynamic behavior among the variables.

RESEARCH GAP

Performance indicators may differ from industry to industry and country to country. All foreign measures may not be practiced or even suitable for local situations. Therefore, It would complicated and unwise to decide on supply chain performance level based on alien supply performance indicators. As mentioned before, in Bangladesh, few researches have been done on implication of lead time factor on SCM performance. But, according to the researchers' knowledge, complete set of performance measuring indicators for RMG industry in Bangladesh that are considered useful for better supply chain performance was not prescribes so far. Therefore the researchers find it a good opportunity to fill in this gap through this research.

OBJECTIVE OF THE STUDY

The main objective of this study was to identify the complete set of internationally recognized supply chain performance indicators that are substantially used in Bangladesh and considered fruitful for supply chain performance improvement. This main objective can be converted into the following specific objectives:

[1] To identify internationally recognized supply chain performance–measuring factors that are used in assessing supply chain management performance

[2] To prioritize supply chain performance-measuring factors in terms of their usages in the RMG industry of Bangladesh.
[3] To measure relationships between perceived level of success in supply chain management and usages level of supply chain performance-measuring factors.

LITERATURE REVIEW

Researchers around the world categorized those supply chain performance-measures using different framework. Following Table 1 exhibits some of those frameworks.

Table 1: Frameworks for Categorizing Supply Chain Performance-Measures

Author	Categorizing Framework
Beamon (1999)	Resources, Output, Flexibility
Mazroui & Ahmad (2014)	Customer, Cost, Product, Financial, Supplier, Employee, Supply chain
Flynn et al. (2010)	Customer integration, Supplier integration, Internal Business performance, Operational performance
Otto & Kotza (2003)	System dynamics, Information technology, Logistics, Marketing, Organization, Strategy
Bhagwat & Sharma (2007a)	Finance, Customer, Internal business process learning and growth
Robb et al. (2008)	Operational dimension, Human resources factors
Gunasekaran et al. (2004)	Plan, Source, Make, Deliver
Gunasekaran et al. (2001)	Strategy, Tactical, Operational
Bigliardi & Bottani (2014)	Customer service, Finance and marketing, Innovation and learning, Internal business, Supplier performance, Transport and logistics
Nambirajan & Kumar (2010)	Operations, Supplier, Order fulfillment, Flexible manufacturing system, Delivery, Technology, New product and marketing Outsourcing, Customer, Third party logistics
Rodriguez et al. (2009)	Financial perspective, Customer perspective, Internal perspective, Learning & growth perspective
Cai et al. (2009)	Resource, Output, Flexibility, Innovativeness, Information
Sillanpää (2010)	Time, Profitability, Order book analysis, Managerial analysis
Thakkar et al. (2009)	Customer service, Finance and marketing, Internal business, Innovation and learning
Christopher (2011)	Pre-transaction, Transaction, post-transaction
Chopra & Meindl (2016)	SRM (supplier relationship management), ISCM (internal supply chain management), and CRM (customer relationship management)

Chopra and Meindl (2016)'s framework has covered all macro processes of supply chain from origin to destination and therefore, the researchers have chosen it to represent all the performance indicators/factors identified by international researches mentioned above. Those factors have been presented in the following table.

Table 2: Supply Chain Performance-Measures (Indicators/factors/metrics)

Measurement Area (framework)	Performance Indicators
SRM Related Factors	Price, Product Quality, Reliability, Lead time, Service, Reputation, Long term relationship, Performance history, Specialization, Financial stability, Efficiency of order cycle time, Flexibility, Size of delivery, Communication method, Quality standard award, Adaptability, Customer service, E–commerce, Technology, Environmental responsibility, Improved supplier risk management
ISCM Related Factors	**1. Facility:** (i) ***Efficiency:*** Profit, Production cost, ROI (return on investment), SC & logistics cost, Transaction cost (ii) ***Quality in SC:*** Safety in operation, Reuse, Product reliability, working condition, Performance, A range of product offer, Appearance, Water use, Quality standard awards, Energy use, Traceability, A defect detected per unit produced per unit purchased (iii) ***Reliability:*** Perfect order fulfillment, A/C accuracy, Constant cost, Constant time, Fill rate (iv) ***Flexibility:*** Workforce, Product, Volume **2. Inventory:** Seasonal, Average safety, A fraction of time out stock, Average inventory, Replenishment batch size, Turns, Cash to cash cycle time, Obsolete **3. Transportation:** Average incoming shipment size, Outbound cost per shipment, Inbound cost per shipment, Fraction transportation mode, Average outbound shipment size, Third-party logistics **4. Internal Integration:** Internal quick response, Information flow, Improve data validity, Information accuracy, CPFR/effectiveness of production planning techniques, Real-time monitor, Workforce productivity **5. Operation:** Process, Organic improvement, Outsourcing **6. Technology:** E-commerce, SC software
CRM Related Factors	**Pre-transaction:** Written customer service policy, Accessibility, Organization structure **Transaction:** Cost, Quality, on time delivery, Reliability, Availability, Flexibility in order, Capabilities, Order accuracy, Order status information, Customer-responsive time, Compliance, Order fill rate, Order cycle time, Product development, Product lateness, Technical expertise, Inventory availability, Delivery meets customer requirement, Function duplication Minimization **Post- transaction:** Availability of spares parts, increase customer service, Quick response to the customer complain, warranty to customer expected level, Based on response measure customer satisfaction

THEORETICAL DISCUSSION AND DEVELOPING HYPOTHESIS

Third objective of this paper is to find out the relationship of the supply chain performance indicators used by RMG organization of Bangladesh with their perceived performance on supply chain management. However, as discussed in introduction section, very limited literatures were

found regarding the usages of SCM performance indicators in Bangladesh. Therefore the researchers have taken their first research hypothesis as:

H_1: RMG sector of Bangladesh assesses Supply Chain Performance.

According to Chopra and Meindl (2016) the macro processes in SC are crucial for successful SCM. The three macro processes are SRM (supplier relationship management) process, ISCM (internal supply chain management) process and CRM (customer relationship management) process. Li et al. (2006) also identified five dimensions of supply chain management and concluded that effective SCM management leads to competitive advantage and better organizational performance. Laihonen and Pekkola (2016) found that usages of performance measuring system improve performance of supply chain management. Gandhi et al. (2017) also found that supply chain management practices are positively related with supply chain performance. Therefore, the researchers set their second main hypothesis as:

H_2: Use of Supply Chain Performance-Measures has an association with the supply chain performance of RMG in Bangladesh.

However, there are several dimensions/categories of these performance metrics. Therefore, following section tried to elucidate the theoretical relationships between each of the SCM macro processes and supply chain performance.

Relationship between SRM Process and Supply Chain Performance

Factors under SRM process focuses on upstream interactions between the enterprise and its suppliers. These factors mainly related with arrange and manage of supply sources of various goods and services. Main functions of this process include the selection and evaluation of suppliers, negotiation of supply terms, communication regarding products and order with suppliers. Performance metrics/factors of SRM process identified from literature review were reliability, supplier risk management, quality of product and service, long term relationship, e-commerce ability, price, flexibility, proper communication system, lead time, technology adoption etc. Bigliardi and Bottani (2014) surveyed 39 Italian firms and found that supplier performance related factors such as efficiency, response time, reliability, price offered have significantly contribution on firm's performance. Saeed et al. (2019) in their research found that supply chain agility and product modularity improves firms responsiveness and also reduce cost. Liao et al. (2010) identified strong positive relationship between supply flexibility and supply performance. Lee et al. (2007) stated that electronic ordering system and reliable delivery through supplier collaboration are effective methods for supply chain management. According to Prajogo and Olhager (2012), in Australia information technology capabilities, information sharing and long-term supplier relationships possess significant effects on performance. Thun and Hoenig (2011) found that companies that practices high level of supply chain risk management performs better. Hence the researcher took more elaborated first hypothesis under H_2 as

H_{2a1}: Use of Supplier related Performance-Measures has an association with the supply chain performance of RMG in Bangladesh.

Relationship between ISCM Process and Supply Chain Performance

Factors related to ISCM processes focus on internal operations. This part tries to fulfill the demand in a timely manner with lowest possible cost. Internal operation contains planning of internal production, storage, location, and demand and supply plan functions. Internal operation related factors were classifieds in literature into 6 dimensions. They are Facility, Inventory, Transportation, Internal integration, Operations, and Technology related factors. Each of these dimensions possesses several performance metrics that has been shown in **Table 2**. Each of those performance metrics possesses significant relationships with the supply chain performance. Li et al. (2006) in their study on 196 organizations, found significant relationship between information sharing, quality of information and postponement with organizational performance. In a study on 30 Italian companies, Bigliardi and Bottani (2014) found that product quality, cost of production, stock turnover, workforce productivity, accuracy in forecasting, quality of innovation, ROI, ROA reliability etc. are significantly used by those companies to measure their supply chain performance. Tripathy et al. (2016) found that IT, logistics and operational effectiveness contributes significantly to SCM competitive advantage. Constantino et al. (2014, 2015) and Jaksic and Rusjan (2008) in their research found that inventory policies possess significant relationship on bullwhip effect of supply chain. In a study on 202 manufacturing firms in Australia, Prajogo et al. (2018) found that internal process management achieved through integrating internal information management, positively affect both internal and external operational performance. Wiegmans and Janic (2019) made a comparative study on 'Silk road' and 'Maritime road' and found that transportation decision provides significant competitive advantage. Yuen and Thai (2016) studied the relationship between internal and external supply chain integration (SCI) with operational performance. They found that external SCI possess better impact on operational performance. Ivanov et al. (2018) made a complete analysis on different types of flexibility and their extensive literature review and found that flexibility now become one of the new driver for supply chain improvement. Due to such vast contributory relationships between ISCM and supply chain as well as organizational performance, researchers have taken their second elaborated hypothesis as

H_{2b1}: Use of Internal Supply Chain Management related Performance-Measures has an association with the supply chain performance of RMG in Bangladesh.

Relationship between CRM Process and Supply Chain Performance

Customer related supply chain performance factors focus on downstream interactions between the enterprise and its customers. They try to generate demand, facilitate the placement, order tracking, pricing, order management, mainly encompass those factor that influence the customer satisfaction. Researchers have categorize and presented those factors in **Table 2**. Some of those factors such as on time delivery, order accuracy, high order fill rate, order status information etc. will certainly make customer happier and strengthen supply chain performance. Marinagi et al. (2014) made a study on the 76 manufacturing firms of Greece and confirmed though empirical study that IT based CRM provides competitive advantage in supply chain management. Besides lead time, random yield and return information sharing were found beneficial for supply chain performance by Hosoda et al. (2015) too. However, Bandaly et al. (2016) found that lead always does not affect supply chain performance except for very high variability in lead time. Sillanpää (2010), in his Ph.D. dissertation reviewed that inventory availability, shorter product development time, time to market, quality of customer service, order fulfillment rate, customer

focus and customer satisfaction has significant positive relationship with supply chain performance and therefore should be used as performance metrics. Hence the third elaborated hypothesis taken by the researchers is

H_{2C1}: Use of Customer related Performance-Measures has an association with the supply chain performance of RMG in Bangladesh.

However, organization cannot use all the measures or indicators to optimize its performance. There are some factors that are more important factors than others, depending on the organizational goals, location.

METHODOLOGY OF THE STUDY

The article is descriptive and exploratory in nature. A number of potential key performance indicators for supply chain management have been identified through extensive literature review. Usage of those performance indicators in RMG industry has been surveyed using a self developed questionnaire based on mostly five point Likert scale, where 1 denoting "least used" for measuring performance and 5 denoting "highly used". Respondents were also asked to rate the performance level of their supply chain management. Later attempt was taken to find significant relationship between usages of performance indicators at RMG industry and supply chain performance using spearman coefficient of correlation.

The Primary data was collected from RMG factories enlisted in Bangladesh Garments Manufacturers and Exporters Association (BGMEA) and/or Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA). Factories mainly located in Chittagong were surveyed through a structured questionnaire. Secondary data/information was collected from different published documents such as journal paper, survey reports, books etc. that have been referenced at the end of the paper.

Figure 1: Population Map

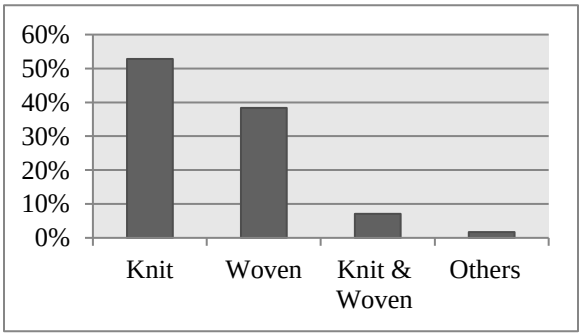
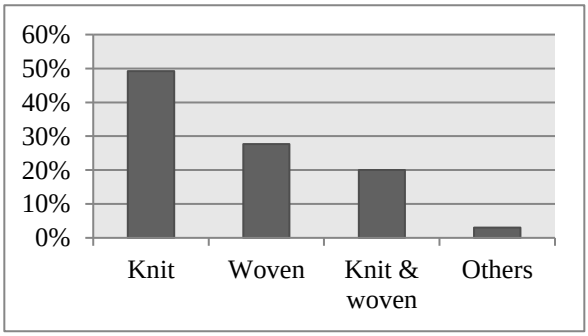


Figure 2: Sample Map



Executives related to supply chain of all types of RMG organizations (Knit, Woven, both, others) were considered as population. Samples numbers were determined using Cockhran's (1977) proportion formula for categorical variable due to the nature of the factors and responses on uses level of factors and level of supply chain performance. After considering finite population trait, out of 688 populations the resulted required number of samples becomes 62. Sixty-five samples were

selected using non-probabilistic convenience and purposive sampling method. Convenience method was used for selecting RMG organization for easy accessibility but each part of the questionnaire was filled up by the executive responsible for that part of supply chain.

It becomes important to test reliability and validity of self-administered questionnaire where the responses are the outcome of self-judgment. The Cronbach's alpha is considered most widely used method of reliability test. In general, a score of more than 0.7 is considered acceptable. The alpha values for all three categories of the questions were about well above 0.7 that ensures reliability of the study (Table 3). In order to ensure validity the researchers have chosen only those factors suggested by earlier researchers. Besides a pilot survey was also conduct in order to ensure well suited questionnaire.

Table 3: Cronbach's Alpha Values of Reliability test

Scale	No of items	Alpha
Supplier related Performance-Measures	21	0.796
Internal operation related Performance-Measures	56	0.868
Customer related Performance-Measures	23	0.841

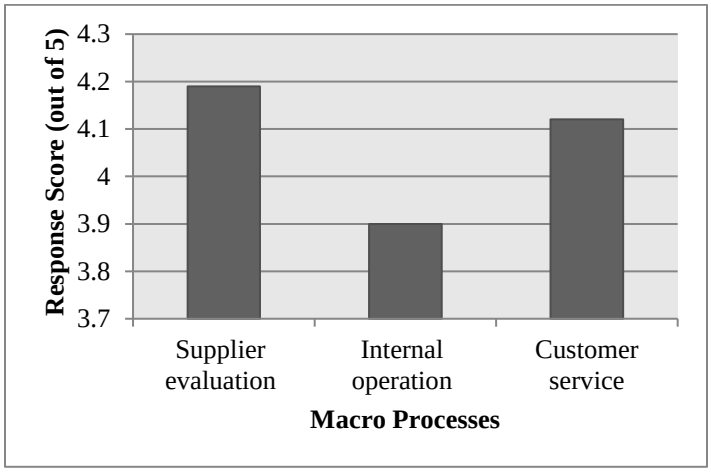
On the basis of the answer provided by the respondents' average, standard division and CV were used to prioritize supply chain performance-measures. Then spearman rank correlation method was used to identify those performance measuring factors that possess significant association with supply chain performance.

ANALYSIS AND FINDINGS

In studying current status of supply chain assessment of the RMG sector in Bangladesh, each of the samples were asked first whether they assess their supply chain performance using performance measuring factors. Their answers reveal that 94% of the organizations assess their SCM performance. However, interestingly none have separate supply chain department.

The researcher used chi square test to verify whether there is a significant difference between yes or no answer on existence of supply chain performance assessing system. The calculated Chi-square value (49.98) largely out weight critical Chi-square value (3.841) at 5% level of significance proving that significant number of RMG companies assess their supply chain performance. However, absence of separate SCM department tells that they assess under some other authority such as production, merchandizing etc. And therefore, there lies huge opportunity to improve the assessment by doing it based on macro processes under established SCM department. It was also found that among the three macro process of SC; RMG organization put highest emphasis on supplier related factors followed by customer service and internal operation related performance measuring factors (Figure 3).

Figure 3: Comparison among Macro Processes



Following Table 4, lists and prioritize the factors of all macro processes that on average scored highly used in the survey. Factors used moderately are given in the appendix (Table 6). Other factors are dropped from further analysis.

Table 4 reveals that in case of supplier selection and evaluation, RMG organizations give most emphasis on SC measures like reliability, lead time management, communication, quality standards, and services. Other highly used factors of this category are quality product, order cycle time, long term relationship, adaptability, financial stability, reputation, customer service, price, technology, and performance history.

Though it was found that comparatively least importance are given on internal operation related factors, nevertheless twenty factors of them scored above four. Among internal operation related factors, twenty one performance-measures were found highly used in RMG industry. First five of them are safety, product reliability, perfect order fulfillment, process, and accounts accuracy.

Majority of the factors of literature review related to supply chain performance-measures regarding customer interactions were found highly used in the RMG industry. It may be due to "make to order" contractual relationships mostly practiced in the sector. Among those factors highly used factors are quick response to complain, quality, warranty level, availability, customer satisfaction, order fill rate, order status information, customer response time, capabilities, inventory availability, order accuracy, cost, order cycle time, and desired delivery.

All the performance measuring factors, responded as used from moderate to highly, were tested for association with the supply chain performance of the RMG companies. Resulting spearman coefficient of correlation is given in Table 5. It shows that six factors are moderately correlated and few factors possess small correlation with the supply chain performance of RMG industry. Full list of factors having small correlation is given in the appendix (Table 7). Among those fourteen factors, four factors are related to CRM process, five factors to SRM process, and five factors to ISCM process. 'p' values of all these coefficient of correlation were found far less than 0.05 that proves that the hypothesis of no correlation between those fourteen factors with supply chain performance is wrong i.e. there exist significant correlations.

Table 4: Supply Chain Performance Measuring Factors of RMG in Bangladesh

Supplier Related Performance Factors				Internal Operation Related Performance Factors			Customer Related Performance Factors		
SL.	**Factor**	**Avg.**	**SD**	**Factor**	**Avg.**	**SD**	**Factor**	**Avg.**	**SD**
1	Reliability	4.72	0.45	Safety	4.65	0.48	Quick response to complain	4.49	0.64
2	Lead time	4.63	0.49	Product reliability	4.63	0.49	Quality	4.46	0.75
3	Communication	4.57	0.50	Perfect order fulfillment	4.55	0.53	Warranty level	4.38	0.70
4	Quality standard	4.49	0.50	Process	4.52	0.64	Availability	4.34	0.69
5	Service	4.49	0.66	Accounts accuracy	4.45	0.69	customer satisfaction	4.34	0.76
6	Quality product	4.42	0.15	Profit	4.35	0.74	Order fill rate	4.31	0.73
7	Order cycle time	4.38	0.70	Performance standard	4.34	0.69	Order status info.	4.28	0.76
8	Long term relationship	4.32	0.77	Internal quick response	4.28	0.70	Customer responsive time	4.26	0.78
9	Adaptability	4.26	0.76	Organic	4.26	0.62	Capabilities	4.25	0.77
10	Financial stability	4.18	0.85	Data validity	4.26	0.69	Inventory availability	4.20	0.79
11	Reputation	4.11	0.83	Constant Cost	4.23	0.70	Order accuracy	4.14	0.83
12	Customer service	4.09	0.84	Constant time	4.22	0.70	Cost	4.11	0.85
13	Price	4.09	0.93	Information flow	4.18	0.77	Order cycle time	4.08	0.82
14	Technology	4.02	0.96	Appearance	4.17	0.80	Desired Delivery	4.02	0.86
15	Performance history	4.02	0.96	Quality awards standard	4.15	0.80			
16				Traceability	4.15	0.85			
17				Production cost	4.15	0.83			
18				Information accuracy	4.06	0.77			
19				CPFR	4.05	0.84			
20				Defects rate	4.02	1.07			
21				Real time monitor	4.02	0.78			

Table 5 reveals that customer's order cycle, supplier's specialization and lead time, and internal operation's flexibility, improve data validity, and information accuracy possess moderate interrelationship with successful supply chain. Besides, delivery quality, customer response time, order status information, customer service of supplier, supplier flexibility and financial stability, internal perfect order fulfillment and organic nature possess small but significant relationship with supply chain performance.

Table 5: Correlation between Supply Chain Performance Measuring Factors and Supply Chain Performance of RMG Companies in Bangladesh

Factors	Correlation	Significance
Supplier		
Specialization	0.349	0.002
Lead time	0.326	0.004
Customer service	0.279	0.012
Flexibility offer by supplier	0.257	0.019
Financial stability	0.254	0.021
Internal operation		
Flexibility (From facility group)	0.363	0.001
Improved data validity (From internal integration group)	0.330	0.004
Information accuracy (From internal integration group)	0.301	0.007
Perfect order fulfillment (From reliability group)	0.297	0.008
Organic (From operation group)	0.280	0.012
Customer		
Order cycle time	0.322	0.004
Delivery quality	0.297	0.008
Customer response time	0.249	0.023
Order status information	0.240	0.027

PROVING HYPOTHESES

Analysis and finding section has given enough information for proving the hypotheses made from theoretical discussion. Dichotomous responses of all types of respondents favored for active assessment of supply chain performance in the RMG industry. Moreover significant chi-square value strengthened that the response are not random. Hence we can accept the first alternative hypothesis (H_1) i.e. RMG sector of Bangladesh assesses supply chain performance. The second alternative hypothesis (H_2) was 'use of supply chain performance-measures has an association with the supply chain performance of RMGs in Bangladesh'. Supply chain performance-measures/factors were found of three categories – customer related, internal operation related, and supplier related factors – two factors related to supplier (H_{2a1}), three factors related to internal operations (H_{2b1}), and one factor related to customer (H_{2c1}) has been found having moderate association with the supply chain performance of RMG organizations. Therefore, it can be said that all three secondary alternative hypotheses (H_{2a1}, H_{2b1}, and H_{2c1}) under H_2 were found accepted. Hence H_2 will also be accepted and we can conclude that use of supply chain performance-measures indeed has an association with the supply chain performance of RMGs in Bangladesh. However, the factors used internationally, all of them are not used in RMGs of Bangladesh.

CONCLUSION

The practice of supply chain management has a huge difference between the organizations of developed countries and that of Bangladesh. In Bangladesh supply chain practice is in initial stage. Organizations are primarily concerned on management of lead time. The purpose of this article is to investigate the supply chain performance indicators used by RMG organizations who

perceive successful in their supply chain management. The study will help RMG firms to understand and distinguish between the factors that should get more importance and eventually will affect overall performance of the organization. The results exposed that supplier and customer related factors are the most used factors than internal operation related factors in RMG organizations. RMG organizations should expand their supply chain evaluation area and focus more on internal operational area. A dedicated supply chain department should be established to monitor and evaluate the whole supply chain processes. More scope lies for further investigation in this area. Identifying ideal supply chain performance measuring factor for other industries including other geographic area will add value in this field. Besides identifying quantitative methods to measure success level of RMG supply chain management will further contribute to academic and practical arena.

REFERENCES

Asgari, B., & Hoque, M.A. (2013). A system dynamics approach to supply chain performance analysis of the ready-made-garment industry in Bangladesh. *Ritsumeikan Journal of Asia Pacific Studies*, *32*, 51-61.

Bandaly, D., Satir, A., & Shanker, L. (2016). Impact of lead time variability in supply chain risk management. *International Journal of Production Economics*, *180*, 88-100.

Beamon, B.M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management, 19*(3), 275-292.

Beamon, B.M., & Chen, V.C.P. (2001). Performance analysis of conjoined supply chains. *International Journal of Production Research, 39*(914), 3195-3218.

Bhagwat, R., & Sharma, M.K. (2007a). Performance measurement of supply chain management: A balanced scorecard approach. *Computers & Industrial Engineering, 53*, 43-62.

Bhagwat, R., & Sharma, M.K. (2007b). Performance measurement of supply chain management using the analytical hierarchy process. *Productions Planning & Control, 18*(8), 666-680.

Bigliardi, B., & Bottani, E. (2010). Performance measurement in the food supply chain: a balanced scorecard approach. *Facilities, 28*(5/6), 249-260.

Bigliardi, B., & Bottani, E. (2014). Supply chain performance measurement: a literature review and pilot study among Italian manufacturing companies. *International Journal of Engineering, Science and Technology*, *6*(3), 1-16.

Cai, J., Liu, X., Xiao, Z., & Liu, J. (2009). Improving supply chain performance management: A systematic approach to analyzing iterative KPI accomplishment. *Decision Support Systems, 46*, 512-521.

Chopra, S., & Meindl, P. (2016). *Supply Chain Management Strategy, Planning and Operation*. (6th ed.) Essex, NE: Pearson Education.

Christopher, M.L. (2011). *Logistics and Supply Chain Management.* London: Pitman Publishing.

Cockhran, W.G. (1977). *Sampling Techniques.* (3rd ed.) New York: John Wiley & Sons.

Costantino, F., Di Gravio, G., Shaban, A., & Tronci, M. (2014). The impact of information sharing and inventory control coordination on supply chain performances. *Computers & Industrial Engineering*, *76*, 292-306.

Costantino, F., Di Gravio, G., Shaban, A., & Tronci, M. (2015). A real-time SPC inventory replenishment system to improve supply chain performances. *Expert Systems with Applications, 42*(3), 1665-1683.

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management, 28*(1), 58-71.

Gandhi, A., Shaikh, A., & Sheorey, P. (2017). Impact of supply chain management practices on firm performance. *International Journal of Retail & Distribution Management, 45*(4), 366-384.

Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics, 87*(3), 333-347.

Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management, 21*(1-2), 71-87.

Hosoda, T., Disney, S. M., & Gavirneni, S. (2015). The impact of information sharing, random yield, correlation, and lead times in closed loop supply chains. *European Journal of Operational Research, 246*(3), 827-836.

Hossain, Md, & Roy, I. (2016). Supply chain management for sustainable RMG growth in Bangladesh. *International Journal of Science and Research,* 6-391.

Ivanov, D., Das, A., & Choi, T. M. (2018). New flexibility drivers for manufacturing, supply chain and service operations. *International Journal of Production Research,56*(10).

Jaksic, M., & Rusjan, B. (2008). The effect of replenishment policies on the bullwhip effect: A transfer function approach. *European Journal of Operational Research, 184*(3), 946-961.

Laihonen, H., & Pekkola, S. (2016). Impacts of usin g a performance measurement system in supply chain management: a case study. *International Journal of Production Research, 54*(18), 5607-5617.

Lee, C.W., Kwin, I.W.G., & Severance, D. (2007). Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Journal of Supply Chain Management, 12*(6), 444-452.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S., & Rao, S.S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega, 34*(2), 107-124.

Liao, Y., Hong, P., & Rao, S.S. (2010). Supply management, supply flexibility and performance outcomes: an empirical investigation of manufacturing firms. *Journal of Supply Chain Management, 46*(3), 6-22.

Marinagi, C., Trivellas, P., & Sakas, D.P. (2014). The impact of information technology on the development of supply chain competitive advantage. *Procedia-Social and Behavioral Sciences, 147,* 586-591.

Mazroui, E., & Ahmad, M.S. (2014). Performance measurement on supply chain management; a model for Iran's machine-woven carpet industry. *Indian Journal of Fundamental and Applied Life Science, 4*(S4), 1419-1438.

Nambirajan. T. & Kumar, C.G. (2010). Measurement of performance of supply chains and their impact on the competitiveness of manufacturing industries in union territory of Pondicherry (India). *In Proceedings of the 1st International Conference on Business and Information, University of Kelaniya.*

Nuruzzaman, Haque, A., & Azad, R.(2010). Is Bangladeshi RMG sector fit in the global apparel business? Analyses the Supply chain management. *The South East Asian Journal of Management, 4*(1), 65-72.

Otto, A., & Kotza, H. (2003). Does supply chain management really pay? Six perspectives to measure the performance of managing a supply chain. *European Journal of Operational Research, 144*, 306-320.

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, *135*(1), 514-522.

Prajogo, D., Toy, J., Bhattacharya, A., Oke, A., & Cheng, T.C.E. (2018). The relationships between information management, process management and operational performance: internal and external contexts. *International Journal of Production Economics*, *199*, 95-103.

Robb, D. J., Xie, B., & Arthanari, T. (2008). Supply chain and operations practice and performance in Chinese furniture manufacturing. *International Journal of Production Economics, 112*, 683-699.

Rockart, J., & Bullen, C. (1981). *A primer on critical success factors*. *Center for Information Systems Research Working Paper No 69*. Cambridge.

Rodriguez, R.R., Saiz, J.J.A., & Bas, A.O. (2009*).* Quantitative relationships between key performance indicators for supporting decision-making processes. *Computers in Industry, 60*, 104-113.

Saeed, K.A., Malhotra, M.K., & Abdinnour, S. (2019). How supply chain architecture and product architecture impact firm performance: an empirical examination. *Journal of Purchasing and Supply Management*, *25*(1), 40-52.

Shahriar, M.F., Pathik, B.B., & Habib, M.M. (2014). A research framework of supply chain management in ready made garments industry of Bangladesh. *International Journal of Business and Economics research*, *3*(6-1), 38-44.

Sillanpää, I. (2010). *Supply chain performance measurement in the manufacturing industry: a single case study research to develop a supply chain performance measurement framework. PhD Dissertation, University of Oulu, Faculty of Technology, Department of Industrial Engineering and Management, Finland.*

Taylor, D.A. (2004). *Supply chains: a manager's guide*. Boston: Addison-Wesley.

Thakkar, J., Kanda, A., & Deshmukh, S.G. (2009). Supply chain performance measurement framework for small and medium scale enterprises. *Benchmarking: An International Journal*, *16*(5), 702-723.

Thun, J.H., & Hoenig, D. (2011). An empirical analysis of supply chain risk management in the German automotive industry. *International Journal of Production Economics*, *131*(1), 242-249.

Tripathy, S., Aich, S., Chakraborty, A., & Lee, G.M. (2016). Information technology is an enabling factor affecting supply chain performance in Indian SMEs: a structural equation modelling approach. *Journal of Modelling in Management*, *11*(1), 269-287.

Wang, W.Y.C., Heng, M.S.H., & Chau, P.Y.K. (2007). *Supply chain Management: issues in the new era of collaboration and competition*. London: Idea group.

Wiegmans, B., & Janic, M. (2019). Analysis, modeling, and assessing performances of supply chains served by long-distance freight transport corridors. *International Journal of Sustainable Transportation*, *13*(4), 278-293.

Yuen, K.F., & Thai, V.V. (2016). The relationship between supply chain integration and operational performances: A study of priorities and synergies. *Transportation Journal*, *55*(1), 31-50.

Appendix

Table 6: List of Moderately Used Performance Measuring Factors

Moderately used Factors from supplier perspective:
Flexibility, E-commerce, Improved supplier risk mgt, Size, Specialization , Environmental responsibility
Moderately used Factors from customer perspective:
Compliance, Product development, Product lateness, Spares increase customer service, Reliability, Technical expertise, Flexibility, Damages
Moderately used Factors from internal supply chain perspective:
Facility : Accuracy in demand forecasting, Flexibility
Efficiency : ROI , SC & logistics cost , Transaction cost
Flexibility : Work force, Product , Volume
Quality: Reuse, Working condition , Range of product offer , Water use , Energy use
Reliability: Fill rate
Transportation : Average incoming shipment size, Inbound cost per shipment, Outbound shipment size, Outbound cost per shipment, Fraction transportation mode, Third party logistics
Internal chain: Workforce productivity
Operation : Outsourcing

Table 7: Coefficient of Correlations of All Significant Factors

Factors	Correlation	Significance
Customer		
Order cycle time	0.322	0.004
Delivery quality	0.297	0.008
Customer response time	0.249	0.023
Order status information	0.240	0.027
Meets customer requirement	0.238	0.028
Supplier		
Specialization	0.349	0.002
Lead time	0.326	0.004
Customer service	0.279	0.012
Flexibility offer by supplier	0.257	0.019
Financial stability	0.254	0.021
Efficiency of order cycle time	0.248	0.023
Quality	0.235	0.030
Long term relationship	0.213	0.045
Technology	0.212	0.045
Facility (flexibility)	0.363	0.001
Internal integration(improve data validity)	0.330	0.004
Internal integration(information accuracy)	0.301	0.007
Reliability (perfect order fulfillment)	0.297	0.008
Operation (organic)	0.280	0.012
Reliability (constancy cost)	0.248	0.023
Facility (accuracy in demand forecasting)	0.245	0.025
Quality in Sc(safety)	0.242	0.026
Internal integration(internal quick response)	0.238	0.028
Operation (outsourcing)	0.228	0.034
Transportation (outbound cost per shipment)	0.221	0.039
Internal integration (workforce productivity)	0.212	0.045
Transportation (inbound cost per shipment)	0.210	0.047
Transportation (outbound shipment size)	0.209	0.048
Flexibility (product)	0.208	0.048