DISSERTATION REPORT

ON

EVALUATING THE EFFICIENCY OF SUPPLY CHAIN MANAGEMENT OF BANGLADESH READYMADE GARMENTS INDUSTRY

A Dissertation report Submitted to the Department of Business Administration, Sonargaon University for Partial Fulfillment of the Requirements for the Degree of Masters of Supply Chain Management

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DEDICATION

This work is dedicated to my loving

Father
Md. Shawkat Ali Khandaker

&

Mother
Mst. Shamsunnahar

ACKNOWLEDGEMENT

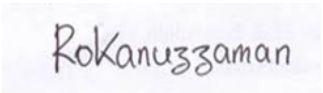
At the outset, I wish to acknowledge the immeasurable blessing and profound kindness of Almighty Allah – the supreme authority of the universe. I am indebted to a number of persons for their kind advice, suggestions, directions and co-operation.

To mention few names, I would first mention the name of my research supervisor Professor Amir Husen, Assistant Professor of Sonargaon University for his outstanding contribution and continuous support. I must make mention of Dr. N. R. Dhar, Professor, Bangladesh University of Engineering and Technology (BUET) who guided me to achieve a standard which is acceptable by the academia. I would like to pay special thanks to Brigadier General Mofazzel Mowla (Retd), Dean of Center of Higher Studies and Research (CHSR) for having confidence in me for this particular research work.

Finally, I remain ever grateful to my diseased parents who brought me in this beautiful earth and enabled me to undertake this research work. I am indebted to my better half Nayma Hassan for bearing all the inconveniences caused due to my serious commitment in the research work. I also recall the contribution made by my Friend TasniaYeaseen and Ahmad Towsif Chowdhury.

DECLARATION

I, Md. Rokanuzzaman Rokan, Team leader of Supply Chain Management department, Viyelletex Ltd – Masters of SCM Student under the Faculty of Business Administration in Sonargaon University do hereby declare that the research report "Evaluating the Efficiency of **Supply Chain Management of Bangladesh Readymade Garments Industry"** has not been submitted by me before, for any degree, diploma, title or recognition and this is an original research work.



……

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CERTIFICATE OF THE SUPERVISOR

This is to certify that, Md. Rokanuzzman Rokan, ID No:MSCM1702011002 and Session spring -2022, has prepared this Dissertation Report entitled "Evaluating the Efficiency of **Supply Chain Management of Bangladesh Readymade Garments Industry'' undermy supervision and guidance. I do hereby approve the style and content of this research report.** This is for the fulfillment of MSCM. program of the Sonargaon University, 147/1, Green Road, Panthapath,Dhaka,Bangladesh.

……..……

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LIST OF ABBREVIATIONS

ABC	:	Activity-Based Costing
ADB	:	Asian Development Bank
ANOVA	:	Analysis of Variance
BCT	:	Bay Container Terminal
BEPB	:	Bangladesh Export Promotion Bureau
BGMEA	:	Bangladesh Garments Manufacturers and Exporters Association
BGAPMEA	:	Bangladesh Garments Accessories & Packaging Manufacturers & Exporters Association
BIWTA	:	Bangladesh Inland Water Transportation Authority
BUP	:	Bangladesh University Professionals (BUP)
CMT	:	Cost of Making with Trimming
CSCMP	:	Council of Supply Chain Management Professionals
ERP	:	Enterprise Resource Planning
EVA	:	Economic Value Analysis
GDP	:	Growth Domestic Product
KPI	:	Key Performance Indicator
MPS	:	Master Production Scheduling
MRP	:	Manufacturing Requirement Planning
NMCT	:	New Mooring Container Terminal
RMG	:	Readymade Garment
SCM	:	Supply Chain Management
SCOR	:	Supply Chain Operations Reference
SPM	:	Supplier Perception Model
TCO	:	Total Cost of Ownership
TPM	:	Total Productive Maintenance
TQM	:	Total Quality Management
VSM	:	Value Stream Mapping
WTO	:	World Trade Organization

ABSTRACT

Readymade Garment (RMG) industry is the prime foreign earning source of Bangladesh. The efficient implementation of Supply Chain Management (SCM) is imperative for this industry to remain competitive in the global market. Bangladesh is struggling with meeting customer lead time, quality improvement, and high productivity compared to other RMG producing nations of the world. However, there are few studies conducted on the evaluation of SCM efficiency of the RMG industry. This industry experienced few setbacks relating to building collapse and fire incident in the recent past for which compliance issues became heightened. The country has no other alternative but implementing efficient SCM in order to achieve the desired export goal of US$ 50 billion by 2021. This study employs both qualitative and quantitative methods for evaluating the efficiency of SCM of RMG industry of Bangladesh. Supply Chain Operations Reference Model (SCOR), a measure of supply chain efficiency, identifies that the level of SCM efficiency in RMG industry is unsatisfactory. This study provides a model for measuring SCM efficiency with eight latent factors and finds that production cost adherence is the prime factor affecting SCM efficiency. It is also found that RMG companies are reluctant in training their workforce and not very interested in trying with newer designs of product. In addition, it has been identified that buyers are giving more importance on lead time reduction followed by timely shipment and cost minimization. On the other hand, the level of collaborative planning practice in RMG industry is not also satisfactory. In analysis of efficient SCM implementation, lack of workplace safety is recognized as the most important barrier for efficient implementation of SCM in RMG industry of Bangladesh. In analysis it is also found that all the operational dimensions of SCM efficiency are linked with one another and thus, companies need to improve all dimensions for the improvement of SCM efficiency in this sector.

Keywords: Supply Chain Management, SCOR, Efficiency, RMG, Competitiveness.

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Chapter-1

Introduction

1.1 Introduction

This introductory chapter discusses about the background of the study which mainly highlights the need of efficient supply chain management in Bangladesh perspective and states the problem this thesis is trying to address. After that, the objectives of the thesis have been stated. Then, the justification of this study is provided. The hypotheses those are tested in this study are stated. Furthermore, scopes of this study and the limitations those were faced during this work are mentioned. Then, the definitions of some key words used in this thesis are listed. Finally, this chapter gives an outline of the organization of this thesis.

1.2 Background of the Study

The Readymade Garment (RMG) Industry of Bangladesh has turned into the largest foreign exchange earning sector which is exporting all kinds of apparel to the USA, Europe and other developed countries. The country started exporting apparel products in 1978, but the growth since the early 1980s has been simply extraordinary. The RMG industry of Bangladesh has become the largest foreign exchange earning sector of the country, constituting a massive USD 26 billion to the size of the economy in 2015 (**Hasnat, 2015)**. In 2016, this industry has generated USD 28.67 billion exports which was 7.76% higher than 2015. Of the total export in 2016, the knitwear constituted USD 13.74 billion and woven products USD 14.93 billion (**BGMEA, 2016)**.The industry is also playing a pivotal role in generating employment opportunity; nearly four million workers are directly associated with this industry where around one and a half million workers are women. Bangladesh is world's second biggest apparel exporter country after China. Bangladesh Government has set $37 billion export target for 2016-17 fiscal years mainly depending on appeal sector.

The export value of RMG was 76% of total export in 2008 and 80% in 2016 (**BEPB, 2016)**.

Impressive news is that Bangladesh Garments manufacturing industry is expanding at a rate of 20% per year (**Mehmood et. al., 2014)**. Bangladesh is endowed with the cheapest and low-cost use of human resources in the industrial sector including RMG. Bangladesh garments industry is completely labor intensive opposed to technology based industry. The average labor cost per hour is only $0.3 in Bangladesh (**Seddiqe and Basak, 2014)**. Since 1985, the growth rate of Bangladesh RMG sector is notable because of few privileges and opportunities, such as Multi-Fibre Arrangement (MFA), Quota and the Generalized System of Preferences (GSP) etc. (**Rahman, 2005 and Akhter, 2014)**.

Bangladesh RMG sector has a high lead time to process an order comparing to other RMG manufacturing nations (**Yunusand Yamagata. 2012)**. According to Rahman and Anwar (**2006**) the lead time for apparel export varies between 90-120 days in Bangladesh, whereas the time for Sri-Lanka is about 19-45 days, China 40-50 days and for India 50-70 days for similar products. According to BGMEA (**2016)** Bangladesh Ready-Made Garments (RMG) shows amazing growth and significant contribution in the country's economic development but still qualities are a crucial challenge. Sharmin Akhter (**2014)** argued that the theory of quality management is relatively new in Bangladesh RMG sector.

The evaluation of SCM efficiency is very important to take corrective and improvement measures. A common objective of efficiency and effectiveness of the entire supply chain of RMG cannot be under assessed. Efficiency improvements are achieved through Just-in-Time production and logistic supplier nets while effectiveness is achieved through customer orientation (**Möller and Törrönen, 2003)**. The value concept is related to efficiency and effectiveness (**Forsström, 2003**;**Gadde et. al., 2003**; **Håkansson, Henjesand, and Waluszewski, 2004**; **Möller and Törrönen, 2003)**. Performance measurement metrics have an important role to play in setting objectives, benchmarking, evaluating performance, and determining future courses of actions (**Gunasekaran et. al., 2004)**.

Many global players in the RMG sector started recouping the benefit of supply chain management, but the reality of Bangladesh is different. Supply chain management practices in RMG sector of Bangladesh are not as efficient as businesses would like them to be in terms of cost and quality. Entrepreneurs and managers at different levels working in the industry are either unable to attain maximum benefits from their current supply chain management practices or are not very aware of the potential benefits of organization-wide implementation of SCM practices. Bangladesh faces stiff competition from countries such as China, Sri Lanka, Vietnam, Myanmar etc. In the era of competition, as the economy changes, as competition becomes more global, it is no longer company vs. company but supply chain vs. supply chain. To survive in the competitive business environment, efficiency in SCM is becoming more competitive in the marketplace. To stay competitive with the global apparel market, Bangladeshi RMG sector needs to improve upon its supply chain management practices.

Buyers' preference is also shifting from low cost product to reduced lead time, quality and fashion. There is lacking in the required infrastructures along with poor productivity. People working for the industry lack in efficiency, mostly, they are learning through on the job training. The problems have become more aggravated when Bangladesh is facing stiff competition from other RMG producing nations including India, China, Vietnam, Cambodia, Kenya and Sri Lanka after the Rana Plaza and Tazrin Fashion incidents. Buyers are increasing compliance requirement pushing the entire industry in more challenging situation. Moreover, the industry is suffering from being competitive for winning more orders from the buyers. Bangladesh has very little option other than implementing SCM efficiently in order to remain competitive. Unfortunately, the level of practice of SCM is not satisfactory in the industry. The industry lacks in practices of efficient planning, sourcing, making, and delivery of the products to the buyers with right quality and cost efficiently while maintaining proper lead time.

1.3 Problem Statement

RMG industry of Bangladesh is suffering from competitiveness due to lower productivity. Moreover, the compliance requirement has also been heightened after the Rana Plaza incident and Tazrin Fashion fire incident. Buyers' preference has also

shifted from low cost product to reduced lead time and trendy products. To stay competitive with the global apparel market, Bangladeshi RMG sector needs to improve upon its supply chain management practices (**Razzaque, 1997; Ali and Habib, 2012; Basak et. al., 2016)**. Hence, the problem statement of this research is the measurement of accurate efficiency ratings as per the scope of the Supply Chain Operations Reference (SCOR) model. The accurate measurement of SCOR metrics shall facilitate a clear understanding of current efficiency and ultimately enable the development of strategies and tactics to achieve optimal efficiency in those areas of Bangladeshi RMG SCM practices which require improvement.

1.4 Research Objectives

Broad Objective

To evaluate the SCM efficiency in the RMG sector of Bangladesh using the SCOR model by measuring overall efficiency in the areas of Plan, Source, Make, and Deliver.

Specific Objectives

In order to fulfill the broad objective, the following specific objectives have been identified:

a) To evaluate the present state of the SCM practices in RMG sector of Bangladesh.
b) To evaluate the inherent efficiency of SCM practices prescribed to the RMG sector of Bangladesh.
c) To evaluate the feasibility of application of different performance measurement models to the RMG Sector in Bangladesh.
d) To analyze all dimensions of efficiency used in SCOR model in this sector.

1.5 Rationale of the Study

Bangladesh is one of the most important global players in the readymade apparel trade in the world followed by only China in terms of national export revenues in dollars. By exporting a huge amount of apparel products to the developed

countries like Europe, USA and other developed countries, the RMG sector has become the prevalent in earning foreign exchange. Country's successful transition to a major exporting economy has been fueled by innovative initiative and private business entrepreneurship. Bangladesh has progressed amazingly since the late 1970s when it first sent apparel exports and then, progress in early 1980s was mostly remarkable. In addition, this sector also provides a formal employment platform for many people, especially for women.

Success of Apparel industry relies on the precise delivery because of its time sensitive nature. Thus, it is needed a rapid response as it deals with trendy fashion products whereas consumer taste plays a significant role. In the fashion industry, change of seasons and occasions along with other factors influence the consumer choice. Consequently, apparel retailers are constantly offering balanced products that reflect the ever-changing tastes of the industry by reducing lead times to facilitate consumers' satisfaction.

In the Bangladeshi RMG sector, lead time requirement was 120 to 150 days during the early 1990s. Presently, it becomes 90 to 100 days whereas India and Pakistan's requirements are between 45 to 60 days. At the same time, because of well-built backward linkage facilities and export friendly management and support policy the Chinese manufacturers require only 30 days (**Kader and Akter, 2014)**. Thus, improving Supply Chain efficiency is a must in this regard to increase competitiveness.

To improve the efficiency of supply chain in RMG sector, there needs to conduct comprehensive research targeting at identifying the existing problems in this area. But, researches in this area in Bangladesh perspective are limited in numbers. So, this research work aims at contributing in this area. The research outcome of this study would help policy makers including Government of Bangladesh and industry leaders in formulating required policies for the industry. Moreover, it also would help the academician and researchers in undertaking further research endeavor in SCM of the industry.

1.6 Research Questions

The following research questions have been formulated on the basis of literature.

- What is the present state of SCM practices in the RMG sector of Bangladesh?
- To what extent the SCM of RMG industry is efficient?
- To what extent, RMG sector of Bangladesh uses effective supply chain efficiency measurement model?
- What are the different dimensions of efficiency used in RMG sector of Bangladesh?

1.7 Research Hypotheses

Comparing with the global counterparts, Bangladeshi RMG sector is not efficient enough in planning and execution of SCM practices. Therefore, it requires an accurate system for measuring their level of efficiency in identifying weaknesses and developing strategies for improvement. Following five hypotheses have been formulated with the purpose of accomplishing all the research objectives and to find out the answers of all the research questions:

H_{01} *: The SCM practice of Bangladesh RMG sector is not efficient.*
H_{A1} *: The SCM practice of Bangladesh RMG sector is efficient.*

H_{02} *: The dimensions identified in SCOR Model of SCM are not independent.*
H_{A2} *: The dimensions identified in SCOR Model of SCM are independent.*

H_{03} *: RMG sector of Bangladesh does not use effective supply chain efficiency measurement model.*
H_{A3} *: RMG sector of Bangladesh uses effective supply chain efficiency measurement model.*

H_{04} *: Bangladesh RMG industry does not use collaborative SCM practices satisfactorily.*
H_{A4} *: Bangladesh RMG industry uses collaborative SCM practices satisfactorily.*

H_{05} *: All components of SCOR model used in measuring the supply chain efficiency in RMG sector of Bangladesh are not sufficient.*
H_{A5} *: All components of SCOR model used in measuring the supply chain efficiency in RMG sector of Bangladesh are sufficient.*

1.8 Scope and Limitations of the Study

The study has been conducted with few limitations. The main limitation was the time required for respondents to answer the questions. In all cases respondents were extremely busy with their jobs and could hardly give quality time for giving out the required information. They had to be contacted number of times for getting their schedule for the interview. The other limitations were interviewer or administrator bias, the tendency of respondents to inflate positive results and refrain from exposing weaknesses in their organizations. Additionally, respondents have naturally demonstrated caution against any possible transfer of trade secrets that may benefit their competitors. The study mostly focuses on the SCM practices of RMG organizations and other issues of SCM have received less focus.

Additionally, support services such as human resource management, and management information systems have also not been considered as part of this organizational evaluation. These processes may have the effect of compensating for weaknesses in an organization's SCM practices. The study mainly focuses on the Bangladeshi Readymade Garments companies (woven) located in Savar, Gazipur, Naranyanganj and Dhaka City only. Garments companies located in other parts of the country have not been considered for brevity sake. Here, People working in Supply Chain Department and Merchandisers have only been interviewed for collecting necessary information required for this study. Moreover, the study basically emphasized on measuring the efficiency of the Supply Chain Management of the sample companies and would infer for the entire industry. Secondary data were not available in all the cases for all the sample companies as they keep different records in many different formats.

1.9 Definitions of Terms Used

- **Supply Chain Management:** The management and integration of the entire set of business processes that provides products, services and information that add value for customers (**Cooper et. al., 1997)**.
- **SCM Efficiency:** Two terms Efficiency and effectiveness are usually used to describe performance. Efficiency can be defined as an internal

standard of performance from resource dependence perspective whereas effectiveness as an external standard (**Pfeffer and Salancik, 1978)**. Just-in-time production is an example of efficiency improvements in supply chains whereas effectiveness is attained through customer orientation and innovation.

- **SCM Effectiveness:** SCM effectiveness can be described as two interrelated constructs. Actually, efficiency and effectiveness are not independent in a supply chain context with focusing on processes.
- **SCOR Model:** SCOR model was designed by the Supply Chain Council, with the first version being developed in 1996. It is a framework for examining the supply chain in detail through defining and categorizing the processes that make up the chain, assigning metrics to such processes and reviewing comparable benchmarks (**Stephens, 2001; Huang et. al., 2004; Lockamy and McCormack, 2004)**.
- **Alliance:** The Alliance for Bangladesh Worker Safety (Alliance) is a legally binding, five-year commitment to improve safety in Bangladeshi ready-made garment (RMG) factories. The collaborative process involved apparel industry companies and stakeholders including the U.S. and Bangladeshi governments, policymakers, NGOs, members of civil society, and organized labor. Collectively, the Alliance's members represent the majority of North American imports of RMG from Bangladesh. The Alliance holds each member and their factories accountable to operate workplaces that are safe and effective in ensuring building and fire safety.
- **Accord:** The Accord on Fire and Building Safety in Bangladesh (the Accord) was signed on May 15th 2013. It is a five year independent, legally binding agreement between global brands and retailers and trade unions designed to build a safe and healthy Bangladeshi Ready Made Garment (RMG) Industry.
- **Process Integration:** SCM process integration involves collaborative work between buyers and suppliers, joint product development, common systems, and shared information.

- **Collaborative Planning:** SCM collaboration is defined as two or more autonomous firms working jointly to plan and execute supply chain operations. It has been known as a cooperative strategy when one or more companies or business units work together to create mutual benefits.
- **Lead Time:** Asgari and Hoque (**2013)**, defined order lead time as "The time span between the immediate beginning of the order issue date and the last shipment date from the Chittagong sea port." According to Rahman and Anwar (**2006)** in Bangladesh the lead time for apparel export varies between 90-120 days, whereas the time for Sri-Lanka is about 19-45 days, China 40-50 days and for India 50-70 days for similar products.

1.10 Outline of the Thesis

This research has been divided into eight chapters for easy assimilation and chronological development. Chapter 1 covered the introduction of the thesis, Chapter 2 covered RMG industry of Bangladesh**,** Chapter 3 discussed about Literature Review, Chapter 4 covered the Conceptual and Theoretical Framework of the research, Chapter 5 covered the Methodology whereas Chapter 6 covered Data Analysis, Chapter 7 covered Discussions and Findings, and Finally Chapter 8 discussed the Conclusions and Recommendations.

1.11 Conclusions

Being the largest export earning sector of Bangladesh, it is important to talk about the current problem of this sector to ensure sustainability in future. The objective this research is trying to achieve would be helpful in maintaining the competitive advantage of RMG of Bangladesh in global market. The author has provided much effort in minimizing the limitations of this study.

Chapter-2

Readymade Garments Industry of Bangladesh

2.1 Introduction

This chapter starts with a brief discussion on this history of Bangladesh RMG industry starting from 1980s. The discussion then moved to present scenario of RMG Sector and the contribution of this sector to the economy. It also talks about the opportunities of this sector and the competitive pressure RMG sector is facing in global market. This chapter also incorporates the discussion on the supply process, production process, and backward linkage of RMG industry. Besides, state of SCM, lead time, and challenges of RMG sector have also come in focus.

2.2 Historical Background

From 1980s, the apparel industry started its journey in Bangladesh. And now a significant growth of this industry is noticeable. The pioneer, of the readymade garment industry in Bangladesh is late Nurool Quader Khan. He started this journey with a vision to transform the country's economy. He sent 130 trainees to South Korea in 1978 where they learned many things basically the production procedure of readymade garments. "Desh Garments" the first factory started its journey with those trainees to produce garments for export. Meanwhile, the late Akhter Mohammad Musa of Bond Garments, the late Mohammad Reazuddin of Reaz Garments, Md. Humayun of Paris Garments, Engineer Mohammad Fazlul Azim of Azim Group, Major (Retd) Abdul Mannan of Sunman Group, M Shamsur Rahman of Style craft Limited, the first President of BGMEA, AM Subid Ali of Aristocrat Limited also took initiative to set up some garment factories in Bangladesh. Some important issues related to the RMG industry of Bangladesh are noted in table 2.1.

Table 2.1 Important Timelines of Bangladesh Readymade Garment Industry(**Databases of BGMEA and BEPB, 2016)**

Year	Issue
1970-1980	Early period of growth
1982-1985	Boom days
1985	Imposition of quota restriction
1990	Knitwear sector developed significantly
1993	Child labor issue and its solution
2003	Withdrawal of Canadian quota restriction
2005	Phase out of quota restriction
2006	Riots and strike by garments labor
2007-20012	Stable growth
2013-2017	Decline and Undergoing Different Challenges

2.3 Present Situation of RMG Sector in Bangladesh

There are more than 5000 garment factories in Bangladesh at the current time, employing more than 4 million people where 85% of the labor force is women. The salient facts of RMG industry has been put in table 2.2.

Table 2.2 RMG Industry: Lifeline to Bangladesh Economy(**Secondary)**

Bangladesh is 2nd largest apparel exporting country in the world	81% of the country's total export earnings come from RMG.	16% of GDP of Bangladesh is contributed by RMG.
	4.4 Million Workers earn their livelihood from the industry.	The Industry indirectly supports livelihood of 10 million people of the country.

Table 2.3 lists the year wise export in million USD for both woven and knit factories.

Table 2.3 Total Apparel Export in Millions of USD(**BGMEA, 2016)**

Year	Woven	Knit	Total
1994	1544.89	341.53	1886.42
1995	1976.40	512.18	2488.58
1996	1942.37	686.27	2628.64
1997	2621.33	810.49	3431.82
1998	2871.06	976.29	3847.35
1999	2987.73	1169.90	4157.63
2000	3376.49	1448.22	4824.71
2001	3162.28	1432.72	4595.00
2002	3076.28	1573.40	4649.68
2003	3398.84	1850.36	5249.20

Table 2.3 Total Apparel Export in Millions of USD(**BGMEA, 2016)**

Year	Woven	Knit	Total
2004	3686.78	2532.62	6219.40
2005	3689.60	3210.48	6900.08
2006	4544.83	4388.67	8933.50
2007	4608.40	4741.93	9350.33
2008	5655.50	6223.42	11878.92
2009	5695.88	6194.61	11890.49
2010	7067.34	7787.26	14854.60
2011	9252.80	9961.67	19214.47
2012	10117.43	9670.71	19788.14
2013	12052.30	11448.68	23500.98
2014	12421.26	12162.70	24583.96
2015	13805.44	12797.26	26602.70
2016	14931.33	13736.95	28668.29

Throughout the last two decade this industry is transforming from resource based export manufacturing to process based exports. The country is also experiencing the transition of the heavy and weakening dependence on primary commodity exports to manufactured exports. The productivity of the Bangladesh RMG sector is relatively low comparing to other nations which has been shown in Fig. 2.1.

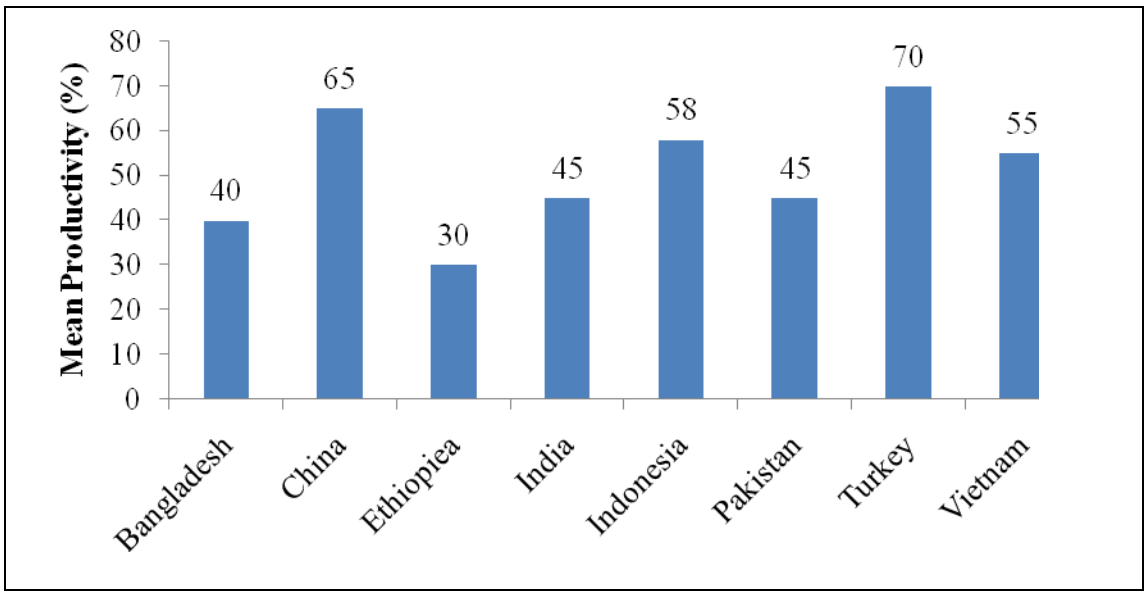


Fig. 2.1 Country wise Productivity Rate (BGMEA Data Base, 2016)

This figure above illustrates that Ethiopia has lowest productivity whereas Turkey has highest productivity which is 70%. Bangladesh RMG sector has a productivity of 40% which is 5% below than neighboring India and Pakistan. Fig 2.2 describes year wise productivity for Bangladesh RMG industry.

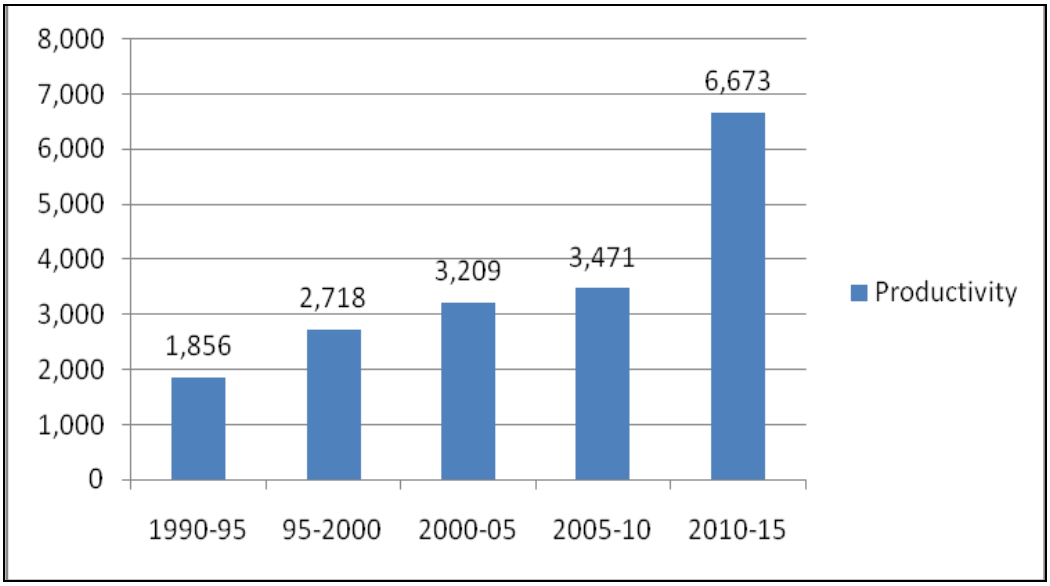


Fig 2.2 Productivity of RMG Sector of Bangladesh (BGMEA, 2016)

Recently, Bangladesh has set a target to achieve USD 50 billion in RMG exports by 2021 (Fig. 2.3) and this planning was jointly prepared by BGMEA and RMIT University, Melbourne, Australia to outline avenues and plans to achieve the RMG Vision 2021.

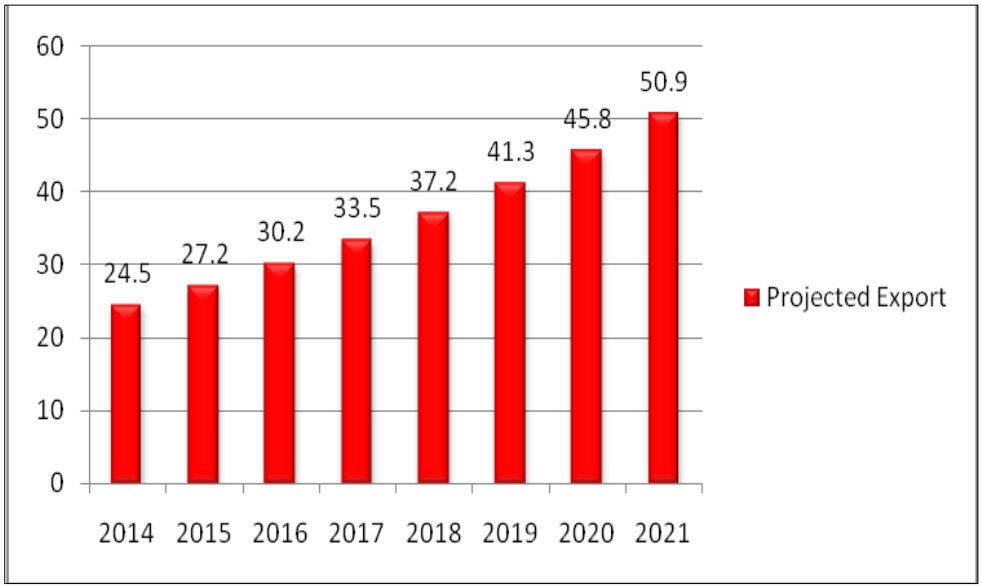


Fig.2.3 Projected Export Projection (BGMEA, 2016)

Table 2.4 shows comparison of production cost in Bangladesh RMG.

Table 2.4 Comparison of Production Cost (**Presentation made by BGMEA to Honorable Prime Minister)**

Description (List of Cost of a Garment: Knit and Woven)	2014 US Dollar	2016 US Dollar	Growth Rate %
FOB	3.23	3.15	-2.48%
Fabric	1.90	1.79	-5.79%
Accessories, Packaging and Washing	0.41	0.43	4.88%
Labor Cost	0.34	0.45	32.35%
Electricity	0.02	0.023	15.00%
Gas	0.014	0.015	7.14%
Water	0.01	0.01	0.00%
C&F/Freight/Transportation	0.05	0.07	40.00%
Bank Charge	0.01	0.01	0.00%
Bank Interest and Commission	0.16	0.15	-6.25%
Insurance	0.01	0.01	0.00%
Rental	0.03	0.04	33.33%
Business Promotion	0.02	0.03	50.00%
Lab Test	0.05	0.03	-40.00%
Others	0.03	0.04	33.33%
Tax	0.03	0.02	-33.33%
Production Cost (Excluding Fabrics, Accessories and Tax)	**0.74**	**0.88**	**18.01%**

2.4 Contribution of RMG Sector to the National Economy

The contribution of this sector in Bangladesh economy is significantly noticeable. About 76% of total export earnings in Bangladesh come from RMG sector. From statistics, it's known that, in FY 2003-04 RMG sector of Bangladesh earned US$ 5,686.06 million, in FY 2004-05 the value was US$ 6,417.67.67 million, in FY 2005-06 the value was US$ 7900.80 million, in FY 2006-07 the value was US$ 9,211.23 million, in FY 2007-08 the value was US$ 10,699.80 million, in FY 2008-09 the value was US$ 12.35 billion and finally in FY 2013-14 the value stands at $24.49 billion. The garment industry is the important manufacturer, earning around $5 billion annually. Bangladesh has about 4,000 garment factories with up to 10 million livelihoods dependent on it directly or indirectly. In 2006, it provided jobs for 2.2 million people, accounted for 10.5% of the country's GDP, and contributed 40% of its manufacturing output. Exports have been growing at an impressive rate in recent years. In 2006-07 alone, they increased by 18.2% to reach US$9.6 billion, a record

level for the fifth consecutive year. The contribution to GDP increases at 13.25% in 2007. About 80 percent of garment workers are women. Employment growth and Export growth of RMG sector of Bangladesh are shown in Fig.2.4.

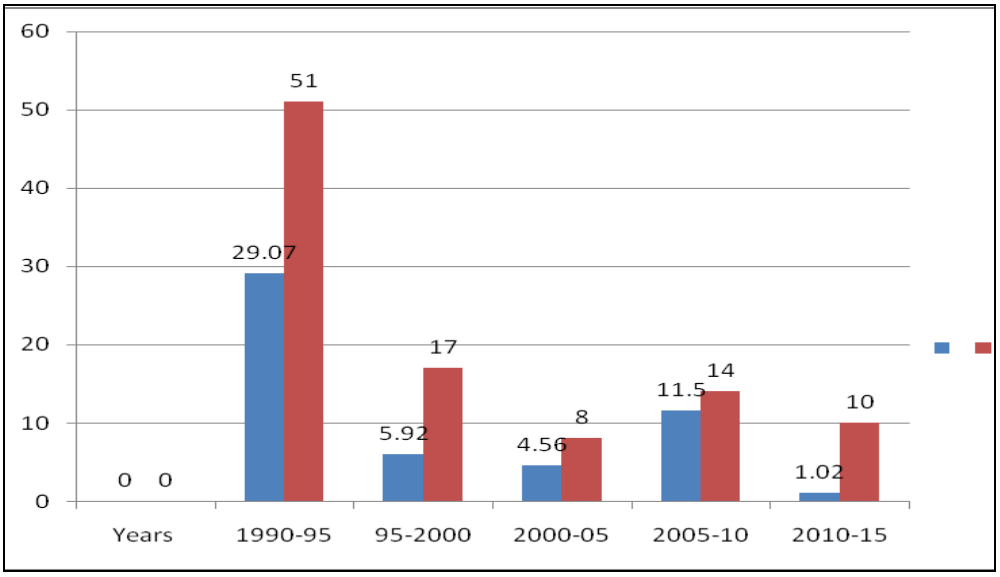


Fig.2.4 Employment growth and Export growth of RMG sector of Bangladesh (BGMEA, 2016)

The employment and export during the period of 1990 to 2015 have been provided in the above graph. The growth in employment during 1990-95 was 29.07% which has been reduced subsequently in next 10 years by 5.92% and 4.56% respectively. But again, the employment growth has increased in 2005-10 period which is 11.5 and became lowest in 2010-15. The export growth was 51% in the period 1990-95 and continued to reduce subsequent 10 years which are 17% and 8%. During the period between 2005-10 and 2010-15 the export growth was 14% and 10% respectively.

2.5 Opportunity of RMG Sector in Bangladesh

Some key factors are playing significantly for the noticeable growth of this industry in our country. Some significant key factors have been identified as listed below:

a. Vast labor force,

b. Skilled human resources,

c. Technological upgrades,

d. Government supports for textile and clothing,

e. Special economic/export processing zones,
f. Creation of textile and clothing villages,
g. Incentive for the use of local inputs,
h. Duty reduction for the import of inputs/machines, and
i. Income tax reduction.

By using the key factors more efficiently Bangladesh RMG can easily hold better position in the world market for this industry. But there are some additional factors that work for the efficiency of this industry and if it became possible to use these factors then it will not be impossible to hold the place for this industry and we will be able to attract more foreign buyers with high price.

a. Cost Effective Strategy,
b. New Product Development strategy,
c. Product Diversification Strategy,
d. Market Diversification Strategy,
e. Cost Effective Strategy includes the following two key points,
f. Cost Reduction Strategy, and
g. Labor Productivity Improvement.

Cost reduction strategy will be applicable and workable when we will have the most efficient backward linkage. These linkages will give the opportunity to avoid the dependency on foreign sources and ultimately, it will help to reduce the total and average production cost and will increase price efficiency. Price efficiency is very important to be more competitive.

2.6 Competitiveness in the RMG Industry

In Bangladesh there are more than 4,000 RMG firms and 95 percent of those firms are owned by local entrepreneurs with some firms located in export processing zones owned by foreigners (**Gonzales, 2002)**. The sector accounts for 81% of total export earnings of the country (**BGMEA, 2016)**. During FY 2016-17, the RMG sector grew by 2.16% to contribute $25.62 billion, or 80.59% in total export of Bangladesh as shown in table 2.5. A fall in global demand for Bangladesh's lucrative ready-made garments (RMG) sector caused a slowing in the rate of export earnings growth in the last fiscal year as data from the Export Promotion Bureau (EPB) has revealed. The

export growth of the RMG sector is too slow to achieve the target of $50 billion. To achieve the target by 2021, the sector will have to attain over 12% growth while the average growth of nine month is only 2.39%.

Table 2.5 RMG Exports and its Share in Total Export of Bangladesh (**BGMEA,2016)**

Year	**Export of RMG (In Million Us$)**	**Total Export of Bangladesh (In Million Us$)**	**% of RMG's to Total Export**
1987-88	31.57	811.00	3.89
1988-89	116.2	934.43	12.44
1989-90	131.48	819.21	16.05
1990-91	298.67	1076.61	27.74
1991-92	433.92	1231.2	35.24
1992-93	471.09	1291.56	36.47
1993-94	624.16	1923.70	32.45
1994-95	866.82	1717.55	50.47
1995-96	1182.57	1993.90	59.31
1996-97	1445.02	2382.89	60.64
1997-98	1555.79	2533.90	61.40
1998-99	2228.35	3472.56	64.17
1999-00	2547.13	3882.42	65.61
2000-01	3001.25	4418.28	67.93
2001-02	3781.94	5161.20	73.28
2002-03	4019.98	5312.86	75.67
2003-04	4349.41	5752.20	75.61
2004-05	4859.83	6467.30	75.14
2005-06	4583.75	5986.09	76.57
2006-07	4912.09	6548.44	75.01
2007-08	5686.09	7602.99	74.79
2008-09	6417.67	8654.52	74.15
2009-10	7900.80	10526.16	75.06

Table 2.5 RMG Exports and its Share in Total Export of Bangladesh (**BGMEA,2016)**

Year	**Export of RMG (In Million Us$)**	**Total Export of Bangladesh (In Million Us$)**	**% of RMG's to Total Export**
2010-11	9211.23	12177.86	75.64
2011-12	10699.80	14110.80	75.83
2012-13	12347.77	15565.19	79.33
2013-14	12496.72	16204.65	77.12
2014-15	12496.72	16204.65	77.12
2015-16	13496.75	17205.67	78.65
2016-17	28140.00	34869.00	80.70

The growth rate of export of RMG sector of Bangladesh to total Bangladesh export has been increasing over the period. Bangladesh RMG contributes 78.65% of total Bangladesh export in the year 2015-16 which was only 3.89% during the year 1987-88.

Table 2.6 Value of Bangladeshi RMG Sector (**BGMEA, 2016 and Kiron, 2015)**

Serial	**Financial Year**	**Value (USD)**
1	2003-2004	5.6 Billion
2	2004-2005	6.4 Billion
3	2005-2006	7.9 Billion
4	2006-2007	9.2 Billion
5	2007-2008	10.7 Billion
6	2008-09	12.4 Billion
7	2013-14	24.5 Billion
8	2014-2015	25.6 Billion
9	2015-2016	26.50 Billion

Table 2.6 shows a constant growth of RMG value over last 14 years with 26.50 billion USD is the highest in the period 2015-16 whereas the lowest value was

in 2003-04 about 5.6 billion USD. During other periods the growth rate of RMG value was increasing year to year.

Table 2.7 Employment Opportunities Created by the RMG Industry (**BGMEA, 2016)**

Year	No. of garment factories	Employment (in million workers)
2000-01	3480	1.8
2001-02	3618	1.8
2002-03	3760	2
2003-04	3957	2
2004-05	4107	2
2005-06	4220	2.2
2006-07	4490	2.4
2007-08	4743	2.8
2008-09	4925	3.5
2009-10	5063	3.6
2010-11	5150	3.6
2011-12	5400	4
2012-13	5876	4
2013-14	4222	4
2014-15	4296	4
2015-16	4328	4
2016-17	4482	4

As illustrated in table 2.7, the number of factories and level of employment in the RMG sector have increased continuously from the year 2005 to 2015. But, is has reduced in the 2015 -2016 because of some challenges.

Table 2.8 Bangladesh's RMG Export to World (FY13-14, FY 14-15 & FY15-16)(**BGMEA, 2016)**

Million USD	Woven			Knit			Total		
EU Countries	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16	2013-14	2014-15	2015-16
Sub-Total (EU)	6077.75	6519.33	7731.96	8682.25	8847.28	9421.40	14759.99	15366.60	17153.36
EU % of World	48.85	49.90	52.46	72.05	71.20	70.54	60.26	60.28	61.06
Growth%	17.40	7.27	18.60	17.38	1.90	6.49	17.39	4.11	11.63
USA	3,943.52	3,970.98	4228.62	1,197.85	1,317.14	1396.30	5141.38	5288.12	5624.92
% of USA	31.70	30.39	28.69	9.94	10.60	10.45	20.99	20.74	20.02
Growth%	2.01	0.70	6.49	5.92	9.96	6.01	2.90	2.85	6.37
Canada	556.87	544.99	575.71	445.10	383.77	422.73	1001.97	928.76	998.44
% of Canada	4.48	4.17	3.91	3.69	3.09	3.17	4.09	3.64	3.55
Growth%	7.44	-2.13	5.64	-3.65	-13.78	10.15	2.22	-7.31	7.50
Sub-Total (Non-Trad.)	1863.93	2029.31	2202.46	1724.61	1878.61	2114.99	3588.54	3907.92	4317.46
% of Non-Traditional	14.98	15.53	14.94	14.31	15.12	15.84	14.65	15.33	15.37
% Growth of Non-Traditional	26.03	8.87	8.53	16.03	8.93	12.58	21.02	8.90	10.48
GRAND TOTAL	12442.07	13064.61	14738.74	12049.81	12426.79	13355.42	24491.88	25491.40	28094.16
% Growth	12.70	5.00	12.81	15.02	3.13	7.47	13.83	4.08	10.21

It can be observed from table 2.8 that export to EU market is the highest followed by USA. In nontraditional market, RMG export growth was high in the period of 2013-14 with ups and down in subsequent period. Value additions and net retention rate of Bangladesh knitwear sector can be seen in table 2.9.

Table 2.9 Value Additions and Net Retention Rate of Bangladesh Knitwear Sector(**BGMEA, 2016)**

Year	**1994**	**2000**	**2008**	**2012**	**2013**	**2014**	**2015**	**2016**
Value Addition	50%	70%	75%	72%	75%	75%	76%	78%
Net Retention	40%	55%	61%	53%	50%	48%	48%	50%

The Bangladesh's knitwear industry produces high quality value added products that are in demand in Europe and America. Table 2.10 present the state of Bangladesh knitwear products in Europe and America, when compared with other apparel producing countries.

Table 2.10 Competitiveness of Bangladeshi Apparel (Knit) Products in the EU (**Bangladesh Bureau of Statistics, 2016)**

Polo Shirt		**T-Shirt**		**Pull over**	
Bangladesh	3.63	Bangladesh	2.10	Bangladesh	5.46
China	7.36	China	2.74	China	8.00
Indonesia	7.52	Indonesia	4.15	Indonesia	7.01
India	5.33	India	3.10	India	6.93
Cambodia	5.02	Cambodia	2.99	Cambodia	6.39
Sri Lanka	7.64	Sri Lanka	2.71	Sri Lanka	6.79
Vietnam	6.06	Vietnam	2.68	Vietnam	6.53

Table 2.11 shows the competitiveness of Bangladeshi apparel (knit) products in the USA market.

Table 2.11 Competitiveness of Bangladeshi Apparel (Knit) Products in USA(**Bangladesh Bureau of Statistics, 2016)**

Polo Shirt		**T-Shirt**		**Pull over**	
Bangladesh	3.39	Bangladesh	2.94	Bangladesh	1.70
China	5.47	China	2.32	China	5.70
Indonesia	3.87	Indonesia	2.40	Indonesia	3.53
India	4.37	India	2.33	India	3.94
Cambodia	3.25	Cambodia	2.20	Cambodia	3.36
Sri Lanka	6.50	Sri Lanka	3.46	Sri Lanka	5.08
Vietnam	4.74	Vietnam	2.94	Vietnam	3.60

Table 2.12 is showing the growth of the trims and accessories industry in Bangladesh.

Table 2.12 A Glimpse of the Growth & Status of BGAPMEA(**BGAPMEA, 2016)**

Serial No.	Year	Total No. of Members
01	1991	17
02	1996	109
03	2001	508
04	2006	764
05	2011	1075
06	2015	1397

The Bangladeshi trims and accessories industry manufactures a host of products, such as buttons, zippers, main labels, price labels, care labels, size labels, hang tags, bar tags, etc., among others. Table 2.13 provides an item wise list of producers in the Bangladeshi trims and accessories industry.

Table 2.13 Items wise Members of the BGAPMEA(**BGAPMEA, 2016)**

Serial	Item Name	No. of Producers	Serial	Item Name	No. of Producers
01	Button	26	11	Padding	03
02	Chemical	01	12	Poly	140
03	Corrugated Carton	666	13	PP Band	02
04	Elastic and Drawstring	116	14	Labels	46
05	Embroidery	03	15	Quilting & Padding	01
06	Gum Tape	04	16	Resin	01
07	Hanger	10	17	Sewing Thread	74
08	Interlining	08	18	Screen Print	06
09	Multi Items	238	19	Zipper	24
10	Packaging	28			

Profit margins have increased tremendously over the years as the overseas demand for Bangladeshi apparel has increased. In the FY 2014-15, the total export earnings of trims, accessories and packaging industry was USD 5,600 million (**BGAPMEA, 2016)**. Growth Rate of total export earnings, RMG and garment accessories and packaging sector of Bangladesh are shown in table 2.14.

Table 2.14 Growth Rate of Total Export Earnings, RMG and Garment Accessories & Packaging Sector of Bangladesh (in millions of USD) (**BGAPMEA, 2016)**

Year	Total Export Earning	RMG Export Earning	Percentage & growth rate of RMG, Packaging & Accessories sector	Backward/deemed export of packaging & accessories
2005-07	22704.02	17112.03	75.37	2566.80
2007-09	29675.99	23047.57	77.67	3457.14
2009-11	36833.38	31110.61	84.46	3670.64
2011-13	50731.55	41875.78	82.25	7175
2013-15	61395.56	49983.28	81.41	10350

2.7 SCM in the Bangladesh RMG Sector

Few of the key characteristics of the RMG industry are short life cycle, highly fluctuating end demand, variety of designs and styles evolving everyday worldwide, and yarn and cotton supplies from many countries is very dynamic and difficult to manage (**Sen, 2008)**. So, RMG manufacturing companies should manage the supply chain in a way that satisfies the needs of the end consumers (**Gunasekaran et. al., 2008)**. This has resulted the RMG industry to become more and more complex and dynamic. The sector has attracted many new market participants and thus created intense competitions (**Gunasekaran et. al., 2008)**. The business is so volatile and competitive that the driver for thriving entrepreneurship is taking advantage of opportunities and scopes by orchestrated efforts among supply chain partners (**Sen, 2008)**. Apparel manufacturers and traders are utilizing integrated SCM as a source for improving their business

performance (**Gunasekaran et. al., 2008)**. Lam and Postle (**2006)** identified that SCM awareness was comparatively low among the RMG manufacturers and traders in Hong Kong.

On the other hand, Lee and Kincade (**2003)** found key dimensions in the US apparel supply chain including "partnership, operational flexibility, performance measurement, information technology, demand characterization commitment of top management". Bangladesh RMG manufacturers are importing most of the raw materials including woven fabrics from China, Pakistan, India, and Indonesia. So, the lead time is becoming longer which is putting a negative impact on competitiveness. Lead time reduction is possible through integrating supply chain among upstream and downstream partners for making RMG manufacturers competitive (**Nuruzzaman and Haque, 2009)**. Through using collaborative planning between fabric suppliers and garment manufacturers in Bangladesh it is possible to produce fabrics before taking orders. Nuruzzaman (**2013)** pointed out that along team is a barrier to become competitive in the world market. He concluded that Bangladesh have a possibility of creating notable position in the world's market by reducing lead time through efficiently managing the parties involved in supply chain activities.

2.8 Garments Supply Process

In case of garment industry, tremendous variety of players is playing together into the supply chain arrangement in Bangladesh. Those are distinct from each other in case of size and operational activities. The differences exist not only due to the operational and structural variability at different stages, but it also arises among the various parties who are counterparts competing with each other at the same stage (**Giri and Rai, 2013)**. Verma (**2000)** talked about the stage-wise differences amongst the parties and their respective operations. He also emphasized on the requirement of thorough deliberation of the supply chain practitioners, as from the stage of raw material to finished garment the chain is responsible for 300% – 400% value addition.

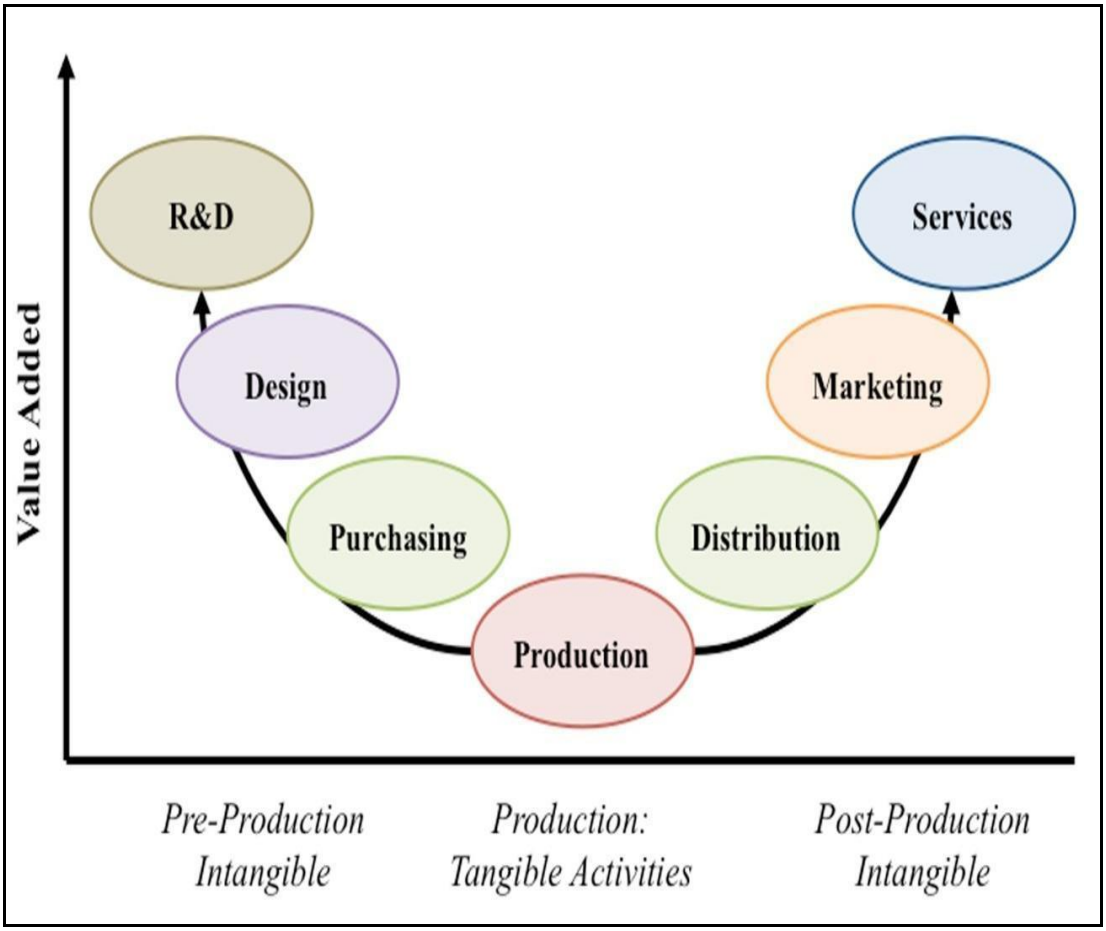


Fig.2.5 Readymade Garments Value Chain (Nuruzzaman, 2013)

On the other hand, every small and big player involved at various stages of the supply chain activities claim either an organized or the unorganized relationship with the other RMG sector parties. These parties are involved in multiple supply chain at once which again introduces high variability among the members. Because of these entangled relationship, studying supply chain as a stand-alone component become difficult. Thus, to comprehend the structure and dynamics of the entire supply chain activities, it is needed to study each stage separately. Shahriar et. al., (**2014)** stated some 'pre-production' processes that happen before 'production' processes can take place. Those are as follows:

- **Order Receive**

At first, the RMG manufacturers receive formal and detailed Purchase orders (PO) from their buyers. All necessary information like sizes, barcodes, and department names, etc. will be present in the PO (**Shahriar et. al., 2014)**.

- **Strategic Planning**

Shahriar et. al., **(2014)** state that the second stage involves management working out of all necessary parameters such as management of human labor, building, machineries and material through extensive planning, to ensure uninterrupted production procedures. At this stage, management teams have to make decision about the amount, time, number of labors, and the machinery also.

- **Sample Development**

At this level, the merchandising department prepare sample as per the buyer's order and then send it to the buyer for approval. Sample development process is related with different steps i.e. sample development, pre-production sample etc. (**Shahriar et. al., 2014)**.

- **Material Sourcing**

Material sourcing is next to the sample development. Materials are sourced as per the strategic plans either from domestic or international market, or from in-house warehouses. Bangladeshi RMG sector prefers procurement of materials mostly from the international market. Thus, the procurement process is considered as one of the most important parts for a garment factory (**Shahriar et. al., 2014)**.

2.9 Production Processes

Sen (**2008)**, Varukolu and Poaps (**2009)**, Chaudhry and Hodge (**2012)**, and Wilson (**2001)** told about some key production stages or processes that the RMG supply chain involves are fiber and yarn production, fabrication, garmenting, distribution, and retailing.

- Stage I: Production of Fiber- RMG supply chain started with the production of fibers that is the main element of making any RMG product.

- Stage II: Spinning or Yarning of fiber-Second stage involves the spinning of fibers in the spinning mills through a mechanical process.

Here, for yarning the single or folded fibers, first it kept in the "lengthwise direction and twisted together **(Wilson, 2001)**.

- Stage III: Production of Fabric-Major stage of the RMG supply chain is the fabric production. According to Giri and Rai (**2013)**, Production of fabric includes both the weaving & knitting processes and non-woven processes also. Woven fabrics are produced by interlacing two threads in lengthways and widthwise directions.

- Stage IV: Garment Production-After producing the fabric, it is further processed by dyeing, printing and finishing.

A generic garment production flow chart is shown in Fig. 2.6.

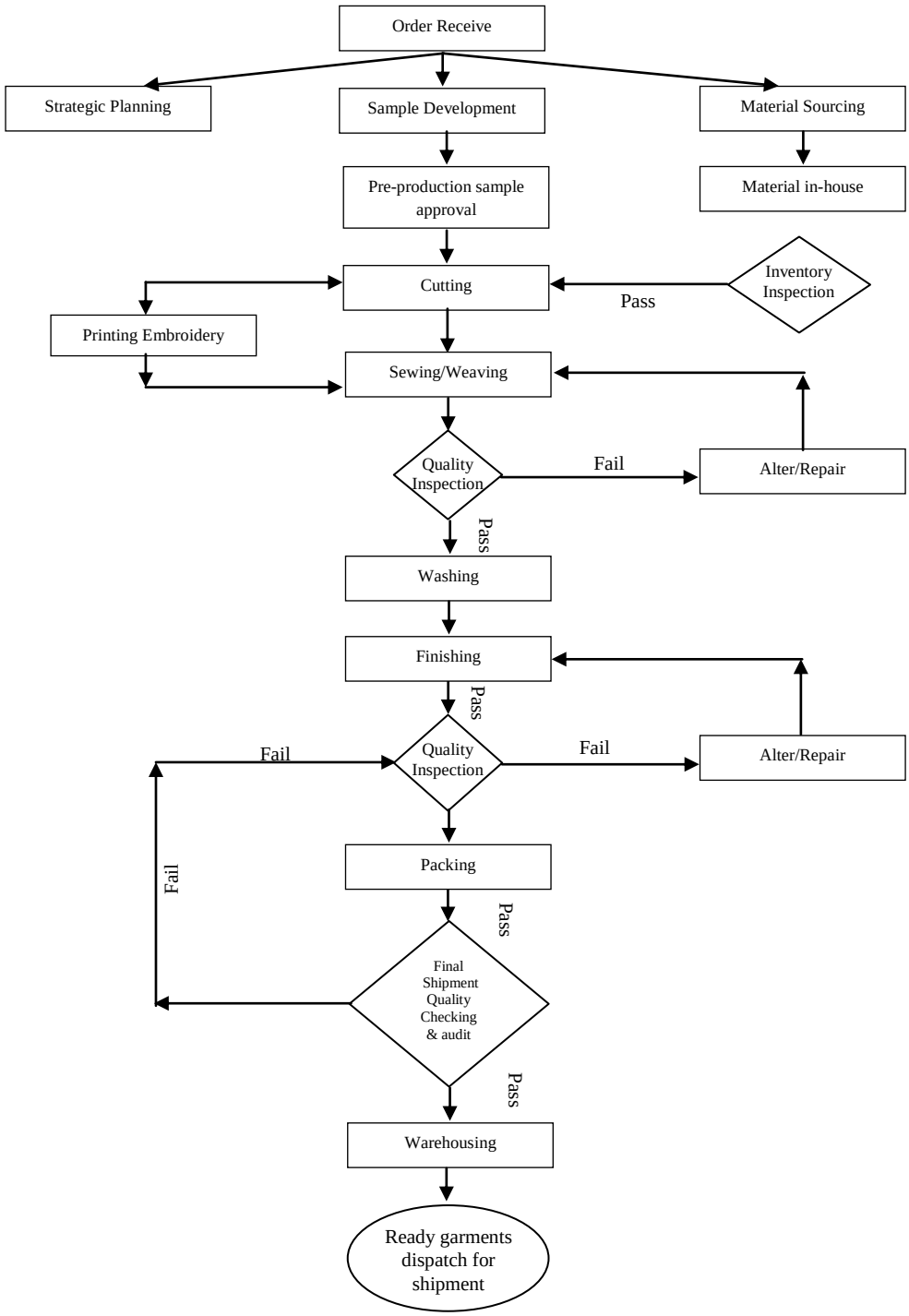


Fig. 2.6A Generic Garment Production Flowchart (Shahriar et. al., 2014)

Supply Chain Management performance acts as a powerful driver and a significant strategic tool for achieving competitive success to the firms striving to

attain so. The common elements of supply chain process in Bangladesh Garment Industry are supplier, garment industries, individuals, raw materials, finished goods, and payment.

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturers and suppliers, but also transporters, warehouses, retailers, and even customer themselves. Each stage in a supply chain is connected through the flow of products, information and fund. These flows often occur in both directions and may be managed by one of the stages or an intermediary.

Usually, the supply chain comprises of suppliers, manufacturers, distributors, retailers and customers. However, there are different support organizations, services including port facilities, customs houses, communication infrastructures, information technology, 3 PL, and 4 PL etc. involved in the chain. The customers are the center point of entire SC as the main focus of SCM is to satisfy customers. At the outset, SCM was related with inventory management within a supply chain. Later on, business organizations recoup the benefit with advance supply chain management capabilities that ensured improved customer responsiveness, increased flexibility for changing market conditions, developed, and improved customer retention customer service and satisfaction, and more effective marketing. A supply chain is the chain of the process which includes facilities, functions and activities that are involved in producing and delivering a product from supplier(s) to customer(s). In addition to that following activities are conducted as part of company's SCM:

- Inventory management
- Transportation service procurement
- Materials handling
- Inbound transportation
- Transportation operations management

Supply Chain of RMG Business suggested by Nuruzzaman (**2013)** is shown in Fig. 2.7.

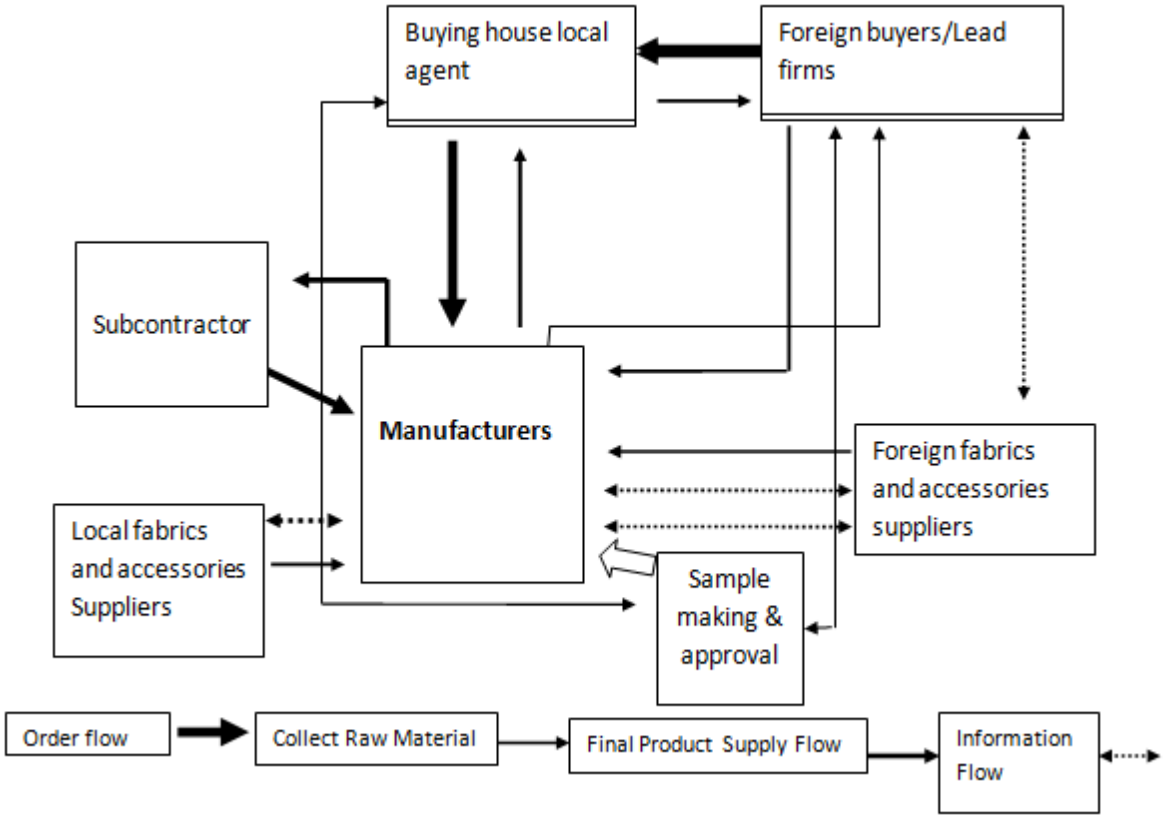


Fig.2.7 Supply Chain of RMG Business (Nuruzzaman, 2013)

2.10 State of Backward Linkage of RMG Sector

Backward linkage can be defined as the use by one firm or industry of produced inputs from another firm or industry. There are three steps involved in the production of finished garment products. These are: conversion of fibers/cotton to yarns, the conversion of yarns to grey fabrics, finally conversion of gray fabrics into dyed, or printed finished fabrics (**Habib**, **2016)**. The success of RMG sector depends on the effective backward and forward linkages. Uninterrupted supply of raw materials, components and ancillary services needed to produce the final product are very crucial. Backward and forward linkages must be well orchestrated for minimizing the cost of production and maximize sales revenue.

It is to be noted that after the lifting of quota system in 2005, the Bangladesh RMG sector is facing stiff competition in global apparel export markets. Moreover, Bangladesh is facing competition from neighboring countries like India, Pakistan, China and Thailand. These countries enjoy better backward linkage support, because they can use own produced yarns and fabric, which allows them to have competitive

advantage over Bangladeshi RMG sector. In order to compete in the global export markets, The Bangladeshi RMG sector must develop backward linkage. Bangladesh should pursue competitive product prices and shorter lead times for being competitive in the quota free business environment.

The Bangladesh RMG industry will encounter challenge if it fails to fulfill the internal demand for raw materials including fiber, yarn, fabric, trims and accessories. The backward linkages of the "RMG sector are weaving mill, spinning mill, fabric dyeing mill, knitting mill, printing mill, poly bag manufacturer, interlining and lining manufacturer, zipper manufacturer, sewing thread manufacturer, embroidery factory, button manufacture, label manufacturer, washing factory, hanger manufacturer, elastic manufacturer, carton manufacturer, etc.,"

- **Cotton**

Cotton is the basic input for yarn production. 95% of apparel products depend on stable supply of cotton. Farming of cotton requires huge agricultural land, immediately posing a challenge for Bangladesh as it is small country. Farmers of Bangladesh took initiative for farming cotton, due to set backs they shifted to different fiber materials. Bangladesh soil actually is not suitable for cotton production. Bangladesh Cotton Development Board has been conducting research for finding out a solution to this but requires time. Bangladesh need to depend on countries including Egypt, Turkey, China, Pakistan, America, and India for their cotton supplies **(Habib, 2016)**. The challenge is becoming more acute as most buyers prefer organic cotton for yarn and fabric over chemically treated cotton.

- **Spinning Mills**

Yarn is produced from fiber in the Spinning mills. This is a very vital operation of the RMG industry, as yarn is required for sewing, weaving and knitting. The major products of spinning mills are synthetic yarn, polyester yarn, cotton yarn, and mix yarn of cotton and polyester of different types. Currently there 350 spinning mills, 400 weaving firms, 310 dyeing and finishing units available in Bangladesh (**BGMEA, 2016)**. Bangladesh could fulfill the demand for sewing threads moreover, demand for weaving and knitting has also been met with a stable local supply. Hence,

Bangladesh needs to develop more mills to cope with the current and future demand of the RMG sector.

- **Weaving**

The state of woven fabric manufacturing is not very satisfactory in Bangladesh, as it is very costly operation. In general, the establishment requirement for a basic woven composite factory is USD 35 million dollars. To meet buyer requirements, a large amount of fabric is imported from countries including China and Vietnam. After confirmation of an order from a buyer, the company needs a reliable source for importing fabric and yarn. This process requires long time causing delay in the factory production. 75% of the total order value amounts the fabric cost. Presently buyers give a lead time of 40 days. In order to meet the lead time the country needs own backward linkage.

- **Knitting**

The Bangladeshi knitting industry is currently the leading contributor in the RMG sector. This knitting industry has emerged into a giant player. In the last decade, many composite knit garments industries have come up in Bangladesh. Square, Beximco, Viyellatex, Pallmall, amongst others, have emerged as true market leaders. The contribution of the industry to the national export was 39.81%, in the FY 2013-2014. The contribution of the knitwear sector in the GDP of Bangladesh is almost 7% (**BGMEA, 2016)**.

- **Trims and Accessories**

As the size of the RMG industry is increasing so as the demand of raw materials. Today the Bangladeshi trims and accessories industry is capable of fulfilling the local demand. Bangladesh has 1,327 trims and accessories producing facilities as of 2016(**BGMEA, 2016)**. The industry is growing gradually and improving it capability of serving the local requirement.

2.11 Concept of Lead-Time in Bangladesh Garment Industry

Lead time is the duration of time between the start and conclusion of a value adding process in business **(Elsmar, 2013)**. Lead time includes the time elapsed

between the point that an order is placed and the point that the goods are delivered to the final destination **(Chopra et. al., 2010; Nuruzzaman and Haque, 2009; and Christopher, 1998)**.

Asgari and Hoque (**2013)** mentioned that lead-time is not mentioned anywhere in the order confirmation in Bangladeshi RMG sector. It is implied by two dates: 1) order issue/confirmation date and 2) the shipment date. Bangladeshi RMG sector considers lead-time as the time gap between these two dates. Bangladesh RMG sector's definition of lead time is different from lead time usually assumed by industry, which is described by Chopra et. al., (**2010)** and Christopher (**1998)**. The Bangladeshi RMG sector does not account for shipping time in their lead time calculations. According to Asgari and Hoque (**2013)**, issue shipping time is dealt with by buyers.

Nuruzzaman and Haque (**2009)** mentioned that, today the global customers demand products as per their exact specifications, on time, and at the best possible price. Greater value on quality and delivery time is ensured by competitive environment in the global marketplace. The companies are constantly trying to secure a competitive edge, and thereby increase profits by reducing cost, updating product quality, and enhancing delivery schedules. Heightened competitive atmosphere among industries prompt the battle of internationally competitive lead times that allows RMG manufacturers to distinguish themselves from the other player and ultimately leading to increased international sales. Study by Nuruzzaman and Haque (**2009)** has treated the calculation of lead time as two distinct parts, namely "information lead time" and "manufacturing lead time".

Time used up for correspondence and negotiations between the prospective buyer and the respective RMG factory sales teams are encompasses into the information lead time. This correspondence and negotiation may take place on the quality, breakdown of order, color, per unit cost/price, quantity and required delivery date. Asgari and Hoque (**2013**) defined order lead time as "The time span between the immediate beginning of the order issue date and the last shipment date from the Chittagong sea port."

Meanwhile, sourcing and manufacturing activities are included into the manufacturing lead time. At first the factories source fabric for manufacturing purpose, either from local markets or outsourced from international market, may be from China, Pakistan, Sri Lanka, Indonesia or other countries. This is a time-consuming process and make-ups the majority of the activities under the concept of order lead time. In addition, Asgari and Hoque (**2013)** state that 'order lead time' and 'shipment time' constitute the 'replenishment lead time' for the international buyers who import garments from Bangladesh. The shorter replenishment lead time in procuring garments from Bangladesh gives pressure to every individual supplier involve in the supply chain activities. This factor is a major point of competition among manufacturers in Bangladesh (**Nuruzzaman and Haque, 2009; Christopher, 1998)**. Chen et. al., (**2000)** emphasized that the reliance on modern and sophisticated communication systems is helpful in shortening information lead times whereas efficient supply chain management works for shortening the manufacturing lead times.

As a result of relatively short lead time, sale will increase, which improves the competitive position ultimately and give rise to positive customer feedback. Safety inventory- idle investment of capital is another factor playing behind the requirement of shortening lead time. If can be reduction of lead-time by "X" percentage will reduce the safety inventory by X **(Chopra et. al., 2010)**.

Intended for reducing investment in safety inventories, many foreign buyers of Bangladeshi RMG products, including Wal-Mart, are demanding the product delivery within shorter lead times to minimize idle capital in their businesses. Chopra et al., (**2010)** have identified the key activities that are carried out during order lead-time by garment companies in Bangladesh considering the expert opinions gathered through phone-discussions.

2.12 Challenges of Bangladesh RMG Industry

The sector is struggling in to grasp more opportunities from 2010 and it became more intense 2013. This has been revealed in a research report by Bangladesh Institute of Development Studies (BIDS). The price and demand for RMG is struggling for being increased. In these circumstances it has become a bit risky for

new comers in this industry to make considerable profit to survive and its now resulting in reduced employment opportunities.

Few statistics have been stated below:

- Export has been reduced by .97% during 2016-17 period (Export Growth in Oven is -4.6% and in Knitwear is +3.53%).
- During July-March (2016-17) export has been reduced to only +2.39% whereas it was 13% in last 10 years.
- During this period export growth has been reduced by -5.98% from expected target.
- Export has been reduced by -7.56% in the largest export market USA for Bangladesh.
- It has been reduced by -6.82% in UK, the third largest market for Bangladesh.
- In other markets the statistics are: Canada: -6.41%, Australia: -9.47% and Brazil: -26.97%.
- According to WTO, World demand for RMG has been reduced to instable world politics, BREXIT, USA Election, Instability in Middle East; the demand was 483 Billion Dollar in 2014 which has been reduced to 445 Billion Dollar in 2015
- Production cost has been increased by 18.01% over last two years.

The RMG industry in Bangladesh has been growing with few challenges or obstacles since the later stage of the 1970s. The leadership of the industry and the government's different supportive policy and initiative has enabled the industry to survive the Multi-Fiber Arrangement (MFA) phase out in 2004 and today the Bangladeshi RMG industry remains globally competitive in the fierce competition.

The challenges that are being faced by the RMG entrepreneurs can be divided into broad three groups **(Kader and Akter, 2014)** i.e.

- Development Stage
- Execution Stage
- Development of other areas Stage

❑ Development Stage

The development stage can be defined as the stage when order is received and raw materials also being received and inventoried. The main challenges that are being faced by the industry are the lack of backward linkages and the inefficiencies in the buying order processing systems.

Backward Linkage

The main task of backward linkage industry is to supply raw materials that are required by the RMG. So, the textile industries and the accessories industries are included in the backward linkage industry. A good reputation is there in the basket of Bangladesh for the production of knit fabrics. According to Kader and Akter (**2014)**, most of the local buyers have to rely on local knit fabric supplies to produce their apparel products. Currently, more than a thousand knit composite apparel manufacturers are doing their activities profitably with order delivery time of 90 days where the average lead time is almost more than 110 days. That is why this industry is not doing well against the world competition. Moreover, it is not compatible with industry standards.

Moreover, the manufacturers who do not have established backward linkages to the knit and accessories industries have to source fabrics from foreign producers in Bangladesh. The tasks to import the raw materials are more lengthy process and ultimately result in more lengthy lead time. Importing fabrics is more complicated and it requires on an average 60 days to carry out the plan only. The woven apparel sector is facing the hardest challenge in this case. Because in the woven apparel sector, more than 90% of the required fabric is outsourced outside from Bangladesh and basically from Chinese suppliers, which requires almost 120 days to import raw materials.

Table 2.15 Average Lead Time for Different Types of Industry**(Kader and Akter, 2014)**

Type of Industry	**Average Lead Time**
Knit Composite Industry	70-90
Knit Apparel Industry	90-110
Woven Apparel Industry	120

Table 2.15clearly shows that in-housing the materials takes up to 40 days of the 90 days of the lead time. Whereas the main competitor, Chinese RMG manufacturers do not experience the burden of needing to import fabrics. This is because of their "rich in-house textile solutions."

Buying Behavior

The buying behavior of the common buyers of apparel industry in our country creating more challenges for the participants in Bangladesh. Though Bangladesh is an international hub for apparel sourcing so most apparel buyers who act internationally have procurement offices in Bangladesh and they buy through 'middle retailers. The buying behavior of buyers is such that it results in the prolonged lead time for some cases. Most of the international buyers rely on the derived demand for their purchasing so when demand changes for their ultimate products they do not hesitate to change their demand in the middle of the production run. Due to the sudden changes in the buyers demand the producers in this country have to change the shade, color or style and it is not uncommon for most of the manufacturers. These changing decisions require that same procedures will be followed to buy the raw materials in the middle of production and resulted in more order processing time **(Kader and Akter, 2014)**. All these processes add to an already prolonged lead time requirement.

- **Execution Stage**

The activities that will be done to make a start and to continue the production process until or unless all required final product is received will be included in the execution stage and this stage is comparatively short that lasts only 15 to 20 days with the efficient executions all plantings and required activities. Due to the advancement of Chinese production technology and advanced machinery Bangladesh's productivity is near to only 70 percent of Chinese productivity and it resulted in more challenges

for the Bangladeshi manufacturers and giving a room for improvement. Kader and Akter (**2014)** identified some challenges related to manufacturing and execution that resulted in more lengthy lead time:

Inefficient Planning

The execution stage urges the necessity of proper planning with the identification of needed human resources and machineries that will ultimately help to execute the plan with least possible time and will give some advantage in the order processing. The activities of the planning stage are to determine the needed human resource size, their expertise, needed machinery, facility size with capacity and all these things will derived from customer demand. Kader and Akter (**2014)** have identified four key manufacturing metrics and these are Cost, Quality, Lead time, and Technical Risk

Lack of Safety Measures

The Tazreen fire and the Rana Plaza collapse, two major and severe accidents have raised workplace safety as the most challenging and quick to work issue. And now it is the reason for headache of all stakeholders related to this industry even the government also. After these miserable accidents many activists' groups are coming forward to work on these issues such as work safe environment for the garments workers giving different provision related to building and fire safety environment. Various activists' groups are the Bangladesh Accord on Fire and Building Safety, the Alliance for Bangladesh Worker Safety and National Plan. All members of the BGMEA and BKMEA as well as the government body are working all to make the industry participants bound to follow the required rules and regulations with investment of huge amount of money. And now executing the corrective action plan is creating more challenges for the participant.

Lack of Advanced Production Systems

The nature of RMG product, manpower capacity, the culture within the organization as well as the expertise and policies of the RMG manufacturer determine the optimum production system. The traditional progressive bundling system is widely used by the RMG manufacturers in Bangladesh. Under this system, parts of

various components are tied up in bundles and distributed out to the Sewing Sections of the manufacturer, after being cut in the Cutting Room. As a result, balancing a line is somewhat difficult under this system of production.

Productivity Challenges

Bangladeshi workers are not so expert in the production process and they lack the needed qualification to work with advanced technology. Still it is only the desire for the RMG manufacturer in our country to attain the peak of the productivity where all other competitors are in the peak of the productivity. Bangladesh's productivity levels are relatively close to international standards, but there is room for more improvement.

- **Other Key Areas for Consideration**

As a developing country Bangladesh is still working for the development in the infrastructure. So, the industry participants are not getting the same opportunities that their competitors are getting. Additionally, a limited supply of energy, namely gas, transport and port capacity, which are essential prerequisites for burgeoning international trade, are yet to reach their required levels in Bangladesh.

Weak Infrastructure

According to Kader and Akter (**2014)**, Bangladesh's congested roadways add inefficiencies to apparel export lead times. Moreover, the transportation options are limited of the manufacturers in our country. The participants in our country cannot easily use the intermodal transportation due the complications existing in our country. Due to the over dependency on Chittagong port for every industry always there is huge traffic in Dhaka Chittagong highway. Most of the apparel industries are located within the divisions of Dhaka and Chittagong. As a result, the Dhaka-Chittagong highway is an extremely important communication line for apparel export. Without any alternative road and communication way the participant is facing severe challenges in this case also.

Lack of Deep-Sea Harbor

Chittagong sea port over burden due to the over dependency and resulted lead time for orders to be shipped as sea freight is lengthened by 7 to 10 days. The Chittagong sea port in Bangladesh is currently not enjoying the designation of a deep-sea harbor. As a result of this, Bangladeshi RMG exporters have to first ship their RMG products to what is called in maritime terminology as a 'feeder vessel,' which transports the RMG products to the 'mother vessel' in Singapore, which has a deep-sea harbor to accommodate the size of the mother vessel. This journey by the feeder vessel to reach Singapore, unload and reload the product onto the mother vessel again requires 7 to 10 days.

Poor Port Facility

Due to the limited capacity and over demand the productivity of the Chittagong port is significantly below par when compared to international standards. About 90% of the country's export and import is done through Chittagong port, located by the estuary of the Karnaphuli River. This introduces huge inefficiencies into the supply chain. Manual movement of cargo by navy power, limited lift crane capability and capacity, and labor strikes that can sometimes span several days at a time, severely diminishes the efficiency of the sea port facilities. Additionally, Chittagong sea port's handling capacity has not been upgraded along the years as export volumes have burgeoned. BGMEA Vice President Md Ferdous told the Dhaka Tribune that the vessel congestion was having an adverse effect on the RMG sector. According to Mahfuzul Haque Shah, director of Chittagong Chamber of Commerce & Industry, the vessel congestion at country's maritime port reached its peak. It is not uncommon for cargo containers to remain stuck for weeks at a time in the Chittagong sea port, despite prior arrangements with port authorities stipulating the release of goods within 3 working days. Container vessels now have to stay 7-10 days while the cargo vessels have to stay 25-30 days at the outer anchorage of Chittagong port.

Labor Unrest and Political Tensions

Bangladeshi RMG manufacturers are able to supply RMG products at the most competitive rates globally. Bangladesh's huge population ensures a healthy supply of workers for its industries. However, a high inflation rate means that there is always pressure from trade unions to raise wages to match inflation. Sometimes strikes and picketing movements are transformed into violent protests at the slightest misunderstanding with law enforcement authorities. At any measure, these demonstrations cause factories to shut down operations. As a result, RMG manufacturers may miss delivery deadlines agreed upon with their buyers.

2.13 Conclusions

This chapter has provided a comprehensive idea about the RMG sector of Bangladesh. Different topics have given the knowledge about the apparel export position of Bangladesh, productivity in relative to other competitive nations, production cost, creation of employment by RMG, value of this sector, and scenario of this sector in terms of SCM practices.

Chapter-3

Literature Review

3.1 Introduction

Very few articles have been found regarding the evaluation of the efficiency of supply chain management practices in RMG sector. Some of them have been reviewed in this section. Firstly, SCM definitions suggested by many academicians and organizations are stated. Then, the discussion is made on the supply chain drives suggested by Chopra and Meindl (**2012)**. After that, this chapter provides the historical perspective of SCM followed by discussions on the widely recognized principles and functions of SCM. Issues like supply chain flows, supply chain performance framework, importance of SCM for RMG, SCM efficiency, SCM practices and dimensions of performance indicators, and SCM practices in RMG sector of Bangladesh have also been incorporated.

3.2 Definitions of SCM

The term "supply chain management" has become a popular buzzword, probably first used by consultants in the late 1980s & then analyzed by the academic community in the 1990s. if one wants a simple definition, supply chain management links all the supply interacting organizations in an integrated two-way communication system to manage high quality inventory in the most effective & efficient manner. The supply chain management reflects those actions and values responsible for the continuous improvement of the design, development & management processes of an organization's supply system, with the objective of improving its profitability & ensuring its survival, as well as the profitability & survival of its customers & suppliers. Supply chain management is a holistic function with major responsibility for connecting major business functions and allied processes within and across business companies into a cohesive and better-performing business model. It includes

all the logistics management activities, as well as different manufacturing operations of any company. It drives coordination of processes and other activities with and across sales, marketing, finance, product design, and information technology.

The Council of SCM Professionals (CSCMP) (**2004)**, a leading organization promoting SCM practices, defines SCM as: "SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers". More importantly, supply chain management integrates and strikes a fine balance between supply and demand within and across companies. Supply Chain managers can be considered as Chef in five-star hotels. Just like a chef who tries to satisfy all the clients coming across the world with different taste and culture, SCM manager of any company also needs to undertake and coordinate all cross functional activities in order to satisfy the customers. S/He has to be a good negotiator, solicitor, marketer, financial manager, inventory manager, Logistician etc. Moreover, the SCM manager needs to ensure Just in Time (JIT), Total Quality Management (TQM), Lean Manufacturing, and Total Productive Maintenance (TPM) etc. S/He also needs to ensure JIT layout in order to reduce any unnecessary motion of people, material along the supply chain. Using appropriate technology is the hall mark for better organizational performance using the efficient SCM. Here optimum use of Enterprise Resource Planning (ERP), Manufacturing Requirement Planning (MRP I), Manufacturing Resource Planning (MRP II), Master Production Scheduling (MPS), Level Scheduling (Heijunka, Japanese vocabulary) is of utmost importance. Procurement is a strategic variable in modern SCM concept. Through using Supply Positioning Model (SCM), Supplier Perception Model (SPM) and dynamics of understanding supplier-buyer relationship, managers can rightly prioritize the approach of dealing with supplier. It is very important to understand the kind of relationship; arm's length or collaborative those need to be achieved. These days SC managers need to take procurement decision not only based on price, Total Cost of Ownership (TCO) is more important now.

The term 'Supply Chain Management' has been defined by different authors in a different manner. Cooper et. al. (**1997)** consider SCM as "The management and

integration of the entire set of business processes that provides products, services and information that add value for customers". Christopher (**1998)**, New and Payne (**1995)** and Simchi-Levi et. al. (**2000)** defined it as "The integration of key business processes among a network of interdependent suppliers, manufacturers, distribution centers, and retailers in order to improve the flow of goods, services, and information from original suppliers to final customers, with the objectives of reducing system-wide costs while maintaining required service levels" (**Stapleton et. al., 2006)**. According to the Global Supply Chain Forum (GSCF), "SCM is the integration of key business processes from end user through original suppliers, that provides products, services, and information that adds value for customers and other stakeholders".

SCM concerns the integrated and process-oriented approach to the design, management and control of the supply chain, with the aim of producing value for the end customer, by both improving customer service and lowering cost (**Bowersox and Closs, 1996; Giannoccaro and Pontrandolfo, 2002)**. Li et. al. (**2005)** said that the dual purpose of SCM is to improve the performance of an individual organization as well as that of the entire supply chain. CLM definitions clearly establish that SCM is more broadly conceived than merely "logistics outside the firm" (**Lambert, 2004; Lambert et. al., 1998)**. Recent research supports this conception, portraying SCM as a strategic level concept (**Stank et. al., 2005)**.

With the view of Mentzer et al. (**2001)**, "SCM is a systemic, strategic coordination of business functions within an organization and between organizations within the supply chain, for improving the long-term performance of individual companies and the supply chain as a whole. The emphasis of each of these definitions is on the objective of SCM to create a distinctive advantage by maximizing the total value of products and services (**Stank et. al., 2005**).

SCM gives a concrete form to the so called "business ecosystem idea" and provides a framework of processes for firms to engage in co-existence rather than competition (**Bechtel and Jayaram, 1997)**. Besides these, Lummus and Vokurka (**1999)** added that SCM links all the departments within an organization as well as all its trading partners (viz: suppliers, customers, 3PL providers, and information systems providers). Within 1990s, the firms felt the requirement of creating superior customer value through the collaboration of suppliers and customers. Later, this movement of

supply chain or value chain management extended the company's focus that was limited previously within an enterprise towards managing across the firm's boundaries.

Boddy et. al. (**1998)** reported that more than half of the respondents they surveyed considered that their organizations have failed to implement supply chain collaborating. According to Spekman et. al. (**1998)**, 60% among the total supply chain alliances made have a tendency to fail. Deloitte Consulting survey stated that only 2% of North American manufacturers ranked their supply chains as world class whereas 91% of them ranked SCM as important to their firm's success (**Thomas, 1999)**.

As the organizations perceived the importance of SCM, thus they shift the philosophy into the implementation. Therefore, SCM integrates both information flow and the flow of goods seamlessly between trading partners as an effective competitive weapon (**Childhouse and Towill, 2003; Feldmann and Muller, 2003)**. Talked about the importance of SCM Tan et. al. (**2002)**; Croom et. al. (**2000)** and Van Hoek (**1998)** said that "since the early 1990s, SCM has been receiving increased attention from all fronts, namely academicians, consultants, and business managers" and Tan (**2001)** said "Organizations have recognized that SCM is the key to building sustainable competitive edge in the 21st century".

In prior literature, various authors have talked about the term SCM by the various aspects such as purchasing, logistics/distribution/transportation, operations and manufacturing management, organizational behavior, and management information systems. Industrial organization and transaction cost analysis (**Ellram, 1990**; **Williamson, 1975)** resource-based and resource-dependency theory (**Rungtusanatham et. al., 2003)**, competitive strategy (**Porter, 1985)** and social–political perspective (**Stern and Reve, 1980)**. Hence, there is no generally accepted definition of Supply Chain Management due to its interdisciplinary origin and evolutionary nature (**Feldmann and Muller, 2003)**.

The term "Supply Chain" received many definitions over the past years as it gained popularity. Most definitions described it as a network of different entities (and its processes) interacting together to make materials and information flow (**Lummus and Vokurka, 1999; Cooper et. al. 1997)**. This is a complicated field in all industry

today across the world. Companies in all industries are in the process of implementing SCM for increasing competitiveness, profit and customer satisfaction. SC is a term used internationally to encompass every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer (**Feller et. al., 2000)**. Four basic processes plan, source, make, deliver-broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels and delivery to the customers (**Lam and Postle, 2006)**.

Again, SCM is moving right times to right customers at right time with lowest cost by most efficient means. It encompasses planning with forecasting, procurement, manufacturing, logistics management, inventory control, distribution and retailing. SCM practices involve a set of activities undertaken in an organization to promote effective management of its SC (**Koh et. al., 2007)**. SCM always focuses on the relation and integration of the processes in order to ensure service delivery with highest customer satisfaction. This is a link between buyer and supplier ensuring the backward and forward integration effectively.

Vokurka et. al. (**2002)** opined that completion is not company versus company rater SCM of one company with same of another company.SCM lacks a universal definition, mainly due to its multidisciplinary origin and evolution (**Croom et. al., 2000; Tan, 2001)**. A literature review by Stock et. al.**(2010)** revealed as many as 166 unique definitions of SCM. According to International Chamber of Commerce, SCM is the management of the acquisition, transformation and delivery processes that enable and direct the flows of products and services – as well as the supporting reciprocal flows of information & funds – along a chain leading from the sources of the original inputs up to the end customers, all aimed at achieving the best possible customer service at the lowest possible cost. The Council of Logistics Management 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. As

such, SCM recognizes the strategic nature of coordination between trading partners in a dyadic relationship.

Stated another way in Chen and Paulraj (**2004)**, SCM is a novel management philosophy that recognizes that individual businesses no longer compete as solely autonomous units, but rather as supply chains. Therefore, it is an integrated approach to the planning and control of materials, services and information flows that adds value for customers through collaborative relationships among supply chain members. SCM always emphasizes on timely production and delivery through relation and integration of the process in order to achieve highest customer satisfaction. Kanji and Wong (**1999)** argues that SCM always links between buyer and supplier ensuring the time delivery of the product with reasonable cost and highest possible quality. Sila et. al. (**2006)** describes SCM as an important model that actually can ensure the customer satisfaction through integrating all the parties involved in the long chain. It is said that a chain is as strong as its weakest ink. In order to make the chain very robust and strong, it is necessary that all the valued agencies need to be brought under same frame work so that they can perm effectively.

SCM practices can be defined in various ways. Donlon (**1996)** defined SCM practices as practices that include supplier partnership, outsourcing, cycle-time compression, continuous process flow and information technology sharing. Li et. al. (**2005)** defined SCM practices as the set of activities that organizations undertake to promote effective management of the SC. 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 understand that it is not sufficient to improve efficiencies within an organization, but the whole SC needs to be competitive. Implementing effective SCM practices is an essential requirement to profitably competing in a global marketplace (**Power et. al., 2001; Li et. al., 2005)**. There are two objectives of SCM: 1) to improve the performance of an individual organization, and 2) to improve the performance of the SC as a whole. It does this by integrating both information and material flows seamlessly across the SC as an effective competitive weapon (**Li et. al., 2005)**.

SCM is a vast topic with many quantitative and qualitative tools that includes with multiple disciplines. Commonly considered domain of SCM are-Location,

transportation and logistics, inventory and forecasting, marketing and channel restructuring, sourcing and supplier management, information and electronic mediated environments, product design and new product introduction, service and after sales support, reverse logistics and green issues, outsourcing and strategic alliances, metrics and incentives, and global issues.

3.3 Supply Chain Drivers

Supply chain drivers are firstly divided into two main categories such as- Logistics drivers and Cross-functional drivers and then each driver is subdivided into three categories. Fig. 3.1 taken from Chopra and Meindl (**2012)** shows the drivers based on category:

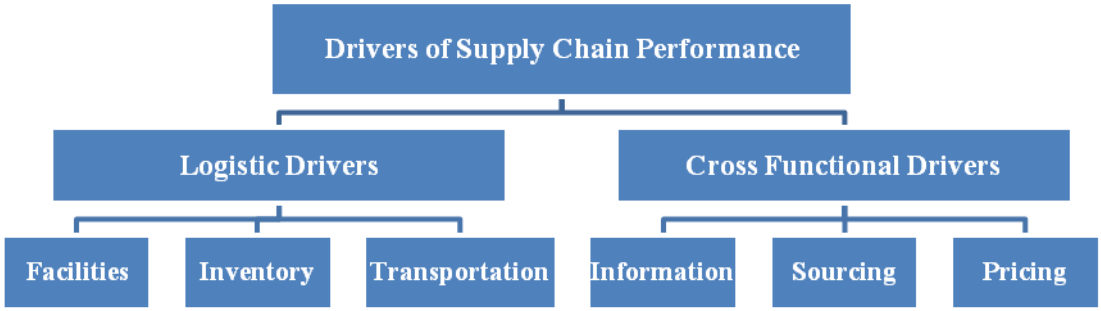


Fig. 3.1 Key Supply Chain Drivers(Chopra and Meindl, 2012)

3.3.1 Logistical Drivers

i. **Facilities:** Physical warehouses and/or storage locations, factories and processing centers- offices, retail and wholesale outlets are considered as Facilities.

ii. **Inventory:** Inventory varied with the types as- raw materials, work in process, finished goods and goods in transit, etc.

iii. **Transportation:** Transportation may happen regionally, nationally or internationally. It is nothing but physical movement/ transfer of goods from one place to another.

3.3.2 Cross Functional Drivers

i. **Pricing:** Among the entire supply chain driver, Pricing is considered as a prime.

ii. **Information:** Information regarding customer needs, wants and the actions of other members in the chain are crucial for reinforcing the coordination.

iii. **Sourcing:** Sourcing means the procurement of raw materials for the production purpose. Sometimes the procured products go directly into the company's product either as the form of finished or semi-finished products.

3.4 Historical Perspective of Supply Chain Management

This section provides a detailed view on the historical background of SCM. Table 3.1 shows the evolution of SCM and table 3.2 shows the chronological development of SCM.

Table 3.1 Evolution of Supply Chain Management

<table>
<tr><th colspan="2">Activity Fragmentation to 1960</th><th colspan="2">Activity Integration 1960 to 2000</th><th>2000+</th></tr>
<tr><td>i. Demand forecasting
ii. Purchasing
iii. Requirements planning
iv. Production planning
v. Manufacturing Inventory</td><td></td><td>Purchase/Material Management</td><td rowspan="3">Logistics</td><td rowspan="3">Supply Chain Management</td></tr>
<tr><td>vi. Warehousing
vii. Material handling
viii. Packaging</td><td></td><td>Logistics</td></tr>
<tr><td>ix. Finished Goods inventory
x. Distribution planning
xi. Order processing
xii. Transportation
xiii. Customer service</td><td></td><td>Physical Distribution</td></tr>
</table>

xiv. Strategic planning xv. Information services xvi. Marketing/Sales xvii. Finance	

Table 3.2 Chronological Development of the Supply Chain Management

The Transportation Era of the 1950s	**References**
Initially during 1950 to 1960, transportation was the prime issue of stress. Then the Book entitled 'Economics of Transportation' was written mainly on federal legislation, modes of transportation, and ratemaking.	Southern (**1997)**; Locklin (**1954)**.
Physical Distribution Era of the 1960s	
During this era (1960-1970), the study of physical distribution & logistics introduced as the separate subject instead of the academic pursuit and study of transportation. Creation of Supply Chain Management Council (SCMC) was noteworthy here in this period. In 1963, The National Council of Physical Distribution Management (NCPDM) formed. Later in 1985, Council of Logistics Management (CLM) was created which renamed again as Council of Supply Chain Management Professionals (CSCMP) in 2004.	Southern (**1997)**
The Physical Supply and Logistics Era of the 1970s	
Materials Management (previously termed as 'Physical Supply,') had drawn a huge attention during early 1970 to 1980s. During the 1970s, the Transportation Journal became one of the major journals in the disciplines of transportation and logistics management. Later on1970s, the universities included the study of transportation, physical distribution, and logistics on their curriculum.	Southern (**1997)**
The Transportation, Physical Distribution, and Business Logistics Era of the 1980s	
With the extinction of 'Physical Distribution', 'Logistics' commenced	Southern

to be emphasized more during 1980 to 1990. As for an example, James C. Johnson and Donald F. Wood renamed their textbook 'Contemporary Physical Distribution' to 'Contemporary Physical Distribution and Logistics'. Concurrently in 1985, as a reflection of increased emphasis on logistics, The National Council of Physical Distribution Management (NCPDM) officially changed its name to the Council of Logistics Management (CLM).	(**1997)**
The 1990s: Business Logistics	
From 1990s, Business logistics was given importance as a subject. Logistics was as considered as an integral part of the firm's overall strategy.'Business Logistics Management'(**Ballou 1998**), 'The Management of Business Logistics' by Coyle and Bardi (**1999**), 'Business Logistics' by Glaskowsky and Hudson (**1992**), and 'Fundamentals of Logistics Management' by Lambert. et al. (**1997**) are some of the popular textbooks published during this period.	Southern (**1997)**
The Logistics and Supply Chain Management Era of the 2000s	
Supply chain management came into the light in early 2000s with a slow transition from the concept of logistics. SCM can be defined as per the guidelines given by the Council of Supply Chain Management Professionals (CSCMP) as "Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities," CSCMP (**2010)**. At the same year in 2010, a book entitled 'Supply Chain Logistics Management' published on this emerging issue by Bowersox, Closs, and Cooper.	

Over the years, there are three major global macro developments have identified that enabled supply chain management to grab the management's attention. Those are as briefed as hereunder:

- **The Information Revolution**

When a mainframe computer was developed for the first time in early 1960s, it was needed the entire room to occupy that computer. However, with the development of the integrated circuit (IC) cost and speed of the computer has increased exponentially. Today's laptop computers with an excel in storage and computing capacity superseded it within only 15 years. Now-a-day information linkage is easier, cheaper and available. It happens so due to the emergence of new technologies such as the personal computer (PC), fiber optics networks, and the internet. These technologies have removed the information related barriers and delays in almost every supply chain network.

- **Increased Competition and Globalization**

Second major trend of SCM is the increased competition and globalization of business. Today's businesses have to face multiple realities like cultural turnover, ever-increasing products and technology, etc. Thus, because of ever changing environment the managers have to make business decisions within a short notice with a higher risks and uncertainty at a time.

Traditionally, local firms-seeing the entry of new contenders, dominate the market. However, consumers' tastes have also been changing with time. Today's consumers demand products/services that matched their personal chucks, quicker delivery and latest version with updated technology. Now a day, product life cycles have been shortened from years to 2/ 3 months even in many industries like fashion industry, products go in and out of style with the mere season.

- **Relationship Management**

According to the digital resource library of North Carolina University, "Businesses have been given a wide range of technologies for better managing their operations and supply chains as a result of the information technology revolution". Although burgeoning customer demand and global competition stimulate the businesses for increasing supply chain performance but this may not be enough. Individual effort with the coordination of other firms is a must to improve operations and performance of supply chain. Consequently, today's businesses are paying more attention in improving relationship management practices.

3.5 Principles and Functions of SCM

The idea of supply chain management is built from two core ideas. The primary consideration is that the supply chain is collectively referred to those parties and agencies whose cumulative efforts are needed to deliver a product to an end user, or consumer. The second consideration is that although the concept of supply chains subsisted for a long time, but most of the organizations have recently become attentive and develop policies for SCM. Since a few business organizations wanted to manage the entire chain of activities by their own, thus the collective effort disjointed, as a result the supply chains become ineffective.

Hence, SCM is as considered as the proactive running of all supply chain activities for accomplishing competitive advantage at a sustainable level by optimizing superior customer value. It represents a collective effort for effectively and efficiently developing and managing the entire chain. From product development, sourcing, production, and logistics, to information management systems needed to coordinate core organizational activities all are included in the scope of supply chain activities.

❑ Principles of SCM

Anderson et. al. (**2007)** identified seven principles of SCM. In order to become competitive in the industry, a company must follow these principles of SCM. Seven principles of SCM are listed as follows:

- Principle 1: Segmentation of customers based on the service needs of distinct groups and adaptation of the supply chain to serve these segments profitably.
- Principle 2: Customization of the logistics network to service requirements and profitability of customer segments.
- Principle 3: Listening to market signals and aligning demand planning accordingly across the supply chain, thereby ensuring consistent forecasts and optimal resource allocation.

- Principle 4: Segmentation of customers based on the service needs of distinct groups and adaptation of the supply chain to serve these segments profitably.

- Principles 5: Managing sources of supply strategically to reduce the total cost of owning materials and services.

- Principle 6: Developing a supply chain-wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of products, services, and information.

- Principle 7: Adopt channel-spanning performance measures to gauge collective success in reaching the end-user effectively and efficiently.

❑ Functions of SCM

Agrawal **(2010)** defines Supply Chain as "The facilities and processes used in supply of goods and services; from procurement of raw material, through manufacturing operations, up to delivery to final user" and Supply Chain Management (SCM) as "The management of all operations within a company impacting and interfacing other sections of the supply chain to improve entire supply chain performance." The main functions and components of SCM include:

- Defining Business Boundaries and Relationships
- Managing Demand and Supply
- Logistics
- Purchasing
- Selling System Interface
- Product Design Interface

3.6 Supply Chain Flows

In a supply chain, the parties and agencies are linked together through both of physical flows and information flows. Physical flow is the most visible component of SCM, which includes physical transformation, logistical movement, and storage of goods and items. However, information flow is vital to the expected performance

level because it facilitates the coordination of both long term and short-term activities and plans amongst the various supply chain associates, control the daily flow of goods and other physical items along the supply chain.

The digital resource library of North Carolina University states that, "Supply chain management is a combination of a philosophical approach and a body of tools and techniques molded into one discipline. Such a discipline usually requires a great amount of open timely interaction and inherent mutual trust between chain members to work effectively".

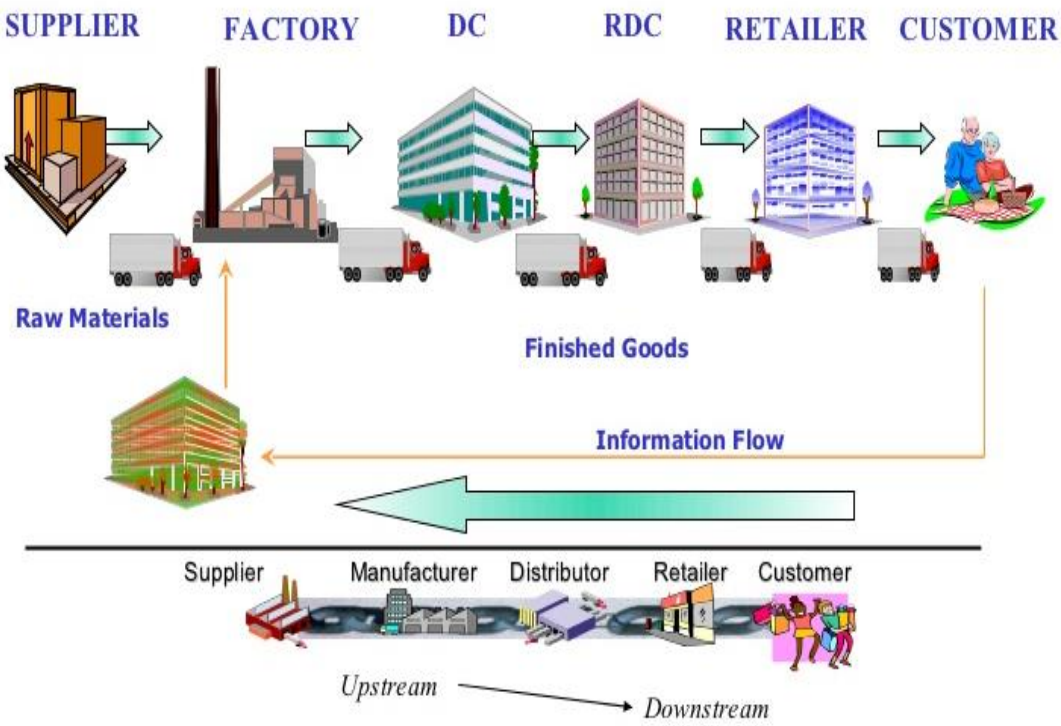


Fig.3.2 Bangladesh RMG SCM Structure (Secondary)

3.7 Widely Used Supply Chain Performance Frameworks

After starting the implementation of SCM as a management tool to increase competencies as well as to improve business performance, the methods for measuring the efficiency of SCM were identified and practiced. Those measurement methods were implemented due to checking out what the management did to control and improve upon the supply chain. Various researchers used numerous variables and metrics to measure the performance of SCM. Some researchers suggested financial

indicators while others emphasized on the non-financial indicators as the ideal performance measurement method for a supply chain.

Measuring the performance of a single supply chain partner or business is easier than measuring the performance of the entire supply chain. Because of the breadth and complex relationship among the partners in a multi-tier supply chain, it is not possible to develop any single ideal parameter among the industries (or within the industry) for measuring SCM performances. Researchers took initiatives and wrote scholarly articles on this issue, Numerous papers have presented some common measures that are used in particular sectors.

Tan (**2002)** have exhibited a cross industry performance indicators that have been collected from the field practices. Khareet et. al. (**2012)** said that, "Measuring and establishing standard practices is very complex and difficult when it includes all the partners resting in the upstream and downstream multi-tiered relation in a supply chain." Chan et. al. (**2003)** suggested a way to improve the performance of business by integrating the measurements of business activities into the supply chain.

Therefore, the researchers and academics have presented several methods of measuring the performance of supply chain activities. Some of the more popular and mainstream concepts are briefly shown in table 3.3.

Table 3.3 SCM Performance Model

Types of SCM Model	**Name of SCM Model**	**References**
Financial Performance Measurement Systems (FPMS)	Activity-Based Costing (ABC)	Ramaa et. al. (**2009**), Chan and Qi (**2003**), Chan (**2003**), Charan et. al. (**2007**), Sharma and Bhagwat (**2007**), Chen and Paulraj(**2004**)
	Economic Value Added (EVA)	Lapide(**2000**).
Non-Financial Performance Measurement	Supply Chain Balanced Scorecard (SCBS)	Kaplan and Norton (**2001**)

Systems (NFPMS)	SCOR Supply Chain Model	Huang et.al. (**2004**)
	Dimension-based Measurement Systems (DBMS)	Ramaa et al. (**2009**)
	Interface-based Measurement Systems (IBMS)	Lambert and Pohlen(**2001**)
	Perspective-based Measurement Systems (PBMS)	Otto and Kotzab(**2003**)
	Hierarchical-based Measurement Systems (HBMS)	Otto and Kotzab(**2003**)
	Function-based Measurement Systems (FBMS)	Ramaa et al. (**2009**)
	Efficiency-based Measurement Systems (EBMS)	Chan and Qi (**2003**)
Generic Performance Measurement Systems (GPMS)	Performance Prism	Neely et. al. (**2001**):
	Performance Pyramid	Kurien and Qureshi (**2011**)
	Medori and Steeple's Framework	Medori and Steeple (**2000**)
	Measurement Systems and Approaches	Gunasekaran et.al. (**2004**)
	Analytic Hierarchy Process (AHP)	Chan (**2003**)
	Output, Flexibility and Resource Measures	Beamon (**1999**)

Others	System-Thinking and a Process-Based Method	Felix et. al. (**2003**)
	Fuzzy Set Algorithm Model	Theeranuphattanaet. el. (**2012**)
	System Dynamics Approach	Forrester (**1961**)

3.8 Importance of SCM in RMG

SCM covers all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. After the 1990s companies became more interested in the efficient implementation of SCM. Firstly, companies have been moving away from vertical integration to specialization thus there was a need to deal with, and rely on, more outside sources. Most clothing firms in the world started outsourcing production of their goods to low-cost countries in order to reduce production costs. Thus, the structure of clothing SC has become even more complex. Cooperation amongst firms/agencies is required to improve operations efficiency and SCM performance. This resulted in more emphasis on relationship management. Poor relationship within agencies involved in the extended SC can have disastrous consequences. In improving the relationships, firms must maintain and develop very good relations with their upstream suppliers as well as their downstream customers (**Bozarth, 2007)**. Secondly, increased competition made it imperative for the companies to deliver high customer service at low costs. Customers are demanding quicker delivery, state-of-the-art technology, and products & services better suited to their individual needs. In the fashion industry, for example, product life cycles are shrinking from years to a matter of two or three months (**Sunhilde, 2008)**.

Customers across the world value the lead time most. Companies are also putting enough emphasis on reducing the lead time and improving the quality of the RMG product. Companies are trying to take benefit of effective implementation of SCM through reducing cost and improving customer responsiveness. If one element

in the chain is not efficient, the entire SCM becomes inefficient. Unplanned and additional import of fabrics and other input materials take the inventory higher which is considered to be evil for the company. Again, if the delivery schedule is not maintained properly, the company needs to pay higher rate of interest on the letter of credit. As a result, the company always strives to avoid delayed shipment even though using over time.

However, some time the company relies on the unauthorized sub-contractor for meeting the delivery schedule. Overuse of overtime and dependency on outsourcing results in violation of compliance for the sector. The parties of SCM in this sector including Manufacturers, Buyers and suppliers are all decentralized. Different parties have different goals and objectives. Systemic and planned use of information and through integration of SCM can reduce cost of contradictory goals and objectives. Proper implementation of SCM can ensure timely delivery of RMG products by the manufacturer to customers. Efficient SCM can help in reducing operational cost, level of inventory, improve asset productivity, reduce order cycle time, as well as improve responsiveness. Suppliers are now considered as strategic partners of the business. Collaborative plan and sharing of information amongst all the parties of extended SCM are the hall marks of efficiency of SCM in RMG sector of Bangladesh. The SCM of RMG sector is diverse one. The process of SCM is very diverse in the counts of technologies installed, raw materials used and products manufactured. Efficient SCM in RMG sector is vital as it helps generating new orders and shipping the products in due time.

3.9 SCM Practices and Dimensions of Performances Indicators

❑ SCM Practices

Table 3.4 shows the significant SCM practices generated from literatures.

Table 3.4 SCM Practices Generated from Literatures(**Secondary)**

Ser	SCM Practices	Related References
1	"Customer relationship (includes complaints handling, customer satisfaction, and long term relationship establishment,	Chandra and Kumar (**2000**); Kuei et. al. (**2001**); Millen et. al. (**1999**); Min and

Table 3.4 SCM Practices Generated from Literatures(**Secondary)**

Ser	SCM Practices	Related References
	close partnership with customer, customer service management, customer needs, increased customer responsiveness)"	Mentzer (**2004**); Ulusoy (**2003**); Tan (**2001**); Tan et. al. (**1998**); Koh et. al. (**2007**); Li et. al. (**2005**)
2	"Re-engineering material flows/Lean practices (including management of material flows, reducing inventory, elimination of waste, JIT delivery/JIT Capability, manage inventory investment in the chain)"	Chandra and Kumar (**2000**); Millen et. al. (**1999**); Tan (**2001**); Alvarado and Kotzab (**2001**); Koh et. al. (**2007**); Li et. al. (**2005**); Chin et. al. (**2004**)
3	"Strategic supplier partnership (includes many supplier relationship, supplier involvement, supplier quality management, collaboration)"	Chandra and Kumar (**2000**); Kuei et. al. (**2001**); Chen and Paulraj (**2004**); Ulusoy (**2003**); Donlon (**1996**); Koh et. al. (**2007**); Li et. al. (**2005**)
4	"Employing information and communication technologies (including information technology sharing/communication, information systems)"	Lee and Kincade (**2003**); Chandra and Kumar (**2000**); Burgess et. al. (**2006**); Chen and Paulraj (**2004**);Donlon (**1996**); Chin et al. (**2004**)
5	"Changing corporate culture (including management support and commitment, leadership, participative management, cooperation, top management leadership)"	Lee and Kincad (**2003**); Kuei et al. (**2001**); Burgess et al. (**2006**); Min and Mentzer (**2004**); Chin et al. (**2004**)
6	"Close partnership with suppliers (include long term relationship, partnership, reliable suppliers)"	Lee and Kincade (**2003**); Kuei et al. (**2001**); Millen et al. (**1999**); Chen and Paulraj (**2004**); Koh et al. (**2007**)

❑ Performance Indicators of SCM

Developing a framework for assessing the performance of the supply chain requires certain assumptions, including the ones related the areas of its measurement. Selected categories of indicators proposed in literature, which can be used to assess the performance of the supply chain is shown in table3.5.

Table 3.5 The Categories/Dimensions of the Supply Chain Performance Indicators(**Leończuk,2016)**

Sources	Categories/Dimensions	Framework
Shepherd, Günter (**2012**); Chan et. al. (**2003)**	Qualitative-quantitative	-
Gunasekaran et. al. (**2004**)	strategic, tactical, operational	decision level
De Toni, Tonchia(**2001)**	cost and non-cost: time, quality, flexibility –	-
Neely et. al. (**1995**); Elrod et. al. (**2013**); Arif-UzZaman, Ahsan (**2014**); Bozarth, Handfield (**2007**)	time, cost, flexibility, quality	-
Shepherd, Günter (**2012**)	time, cost, flexibility, quality, innovativeness –	-
Chimhamhiwa et. al. (**2009**)	cost, time, quality, technological innovation, society, customer satisfaction	-
Angerhofer, Angelides (**2006**); Beamon (1**999**)	resources, output, flexibility –	-
Cai et. al. (**2009**)	resource, output, flexibility, innovativeness, information	-
Cho et. al. (**2012**)	financial, competitiveness, quality of service, flexibility, resource utilization, innovation	service supply chain

Table 3.5 The Categories/Dimensions of the Supply Chain Performance Indicators(**Leończuk,2016)**

Sources	Categories/Dimensions	Framework
Ganga, Carpinetti(**2011**)	reliability, flexibility, responsiveness, cost, assets	SCOR metrics focus on five performance attributes
Golrizgashti(**2014**)	financial, internal processes, innovation and improvement, customers	balanced scorecard perspectives
Bullinger et. al. (**2002**)	financial, customer, organizational, innovation (for each supply chain perspective, customer perspective, function perspective)	balanced scorecard perspectives
Gunasekaran et. al. (**2004**); Chae(**2009**)	plan, source, make, deliver	SCOR model
Shepherd, Günter (**2012**); Arif-Uz-Zaman, Ahsan (**2014**)	planning and product design (plan), supplier (source), production (make), delivery (deliver), customer (return)	SCOR model
Zailani et. al. (**2012**)	operations, economic, social, environment	the extent of implementation of sustainable supply chain
RajaGopal et. al. (**2009**)	customer orientation, distribution, internal operations, supply	-
Kowalska(**2014**)	quality, delivery, total cycle time, loss	-
Witkowski (**2010**)	added value and customer satisfaction,	-

Table 3.5 The Categories/Dimensions of the Supply Chain Performance Indicators(**Leończuk,2016)**

Sources	Categories/Dimensions	Framework
	cost of operations, financial results, added value of the chain	
Kisperska-Moroń and Swierczek (**2011**)	logistics, production, purchasing, new product development, customer order management, supply chain diagnostics	-
van Hoek (**1998**)	cost effectiveness, integration, customer service	-
Otto, Kotzab (**2003**)	system dynamics, operational research, logistics, marketing, organization, strategy	-
Carvalho et al. (**2012**)	operational performance, economic performance	-
Anand, Grover (**2015**)	transport optimization, inventory optimization, information technology optimization, resource optimization	retail supply chain

3.10 Supply Chain Practices in RMG Sector of Bangladesh

Numbers of studies have been conducted on the relationship between SCM practices and organizational performances in different industries across the globe. Few of the relevant literatures have been reviewed in this section along with research gap that exists in Bangladesh RMG industry. Donlon (**1996**) describes the latest evolution of SCM practices, which include supplier partnership, outsourcing, cycle time compression, continuous process flow, and information technology sharing. On the other hand, Tan et. al. (**1998**) used purchasing, quality, and customer relations to

represent SCM practices. Alvarado and Kotzab (**2001**) included 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. Again, Tan et. al. (**2002**) identified 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 (**2004**) used supplier base reduction, long-term relationship, communication, cross-functional teams and supplier involvement to measure buyer–supplier relationships. Min and Mentzer (**2004)** identified 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 variety of different perspectives with a common goal of ultimately improving organizational performance. Li et. al. (**2005)** conducted a study taking five distinctive dimensions of SCM practices including: strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement to find out the relationship with organizational performance. The results indicate that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance. Competitive advantage can have a direct, positive impact on organizational performance.

The level of practice of SCM in Bangladesh RMG is not very satisfactory. Very few companies have spate SCM department through which they function collaborative with all the parties. The level of practice varies from country to country and from company to company within country.

The RMG business has become truly global with many countries manufacturing RMG products. China is investing huge in making their industry automated putting other nations in a very stiff competition. Many countries enjoy competitive advantage with many factors of productions including raw materials, cheap labor, cheap financing, investment friendly policies and the likes. Moreover, the time, cost and quality preferences and sensitiveness are also considerably varied among customers in different parts of the world. The RMG industry in Bangladesh could stay competitive through an efficient implementation of integrated supply chain

management. Bangladesh RMG manufacturers are importing required woven fabrics from countries including China, India, Pakistan and Indonesia. It results in relatively longer lead time comparing with other nations. The industry is yet to experience proper implementation of SCM where from it could recoup benefit. There are lot challenges for not implementing the SCM in the industry. People working in this industry are still not very aware of the SCM process and they like to carry on their business following traditional manufacturing system.

Kabir (**2007)**,Siddiqi (**2004)**,and Rashid (**2006)** mentioned that Bangladeshi garment companies are basically subcontractor and they are producing the low value product in the market. Thy further argued that Bangladesh RMG companies are performing the functions of cutting, making and trimming (CMT) activities. The industry is highly import oriented. Where 90% of woven fabrics and 60% of knit fabrics are imported (**Rashid, 2006; Rahman and Anwar, 2006**).The industry has very long and complex SC.BD has a lead time for apparel export between 90- 120 days, whereas the same for Sri Lanka is about 19-45 days, China 40-50 days and for India 50-70 days for similar products (**Rahman and Anwar, 2006; Kabir, 2007)**.

Bangladeshi RMG industry is different from structures of other industries. There is difference in SCM in Bangladesh RMG and other countries. There have been number studies conducted on challenges faced by RMH after MFA has been lifted. On the other hand, few authors conducted research on different aspects of SCM in the textile industry. Hossain (**2005)** suggested few value generating activities in the SC to create value. Bangladesh RMG industry lacks in integration between forward and backward agencies involved in the chain. Because of global SC characteristics, SCM is more complex for Bangladesh RMG industry. In the global SC, there are number of challenges including tariffs, non-tariffs barriers, exchange rates and differences in product requirements, consumer tastes and business practices. Cross-borders also act as obstacles in transportation services, by which RMG sector of Bangladesh is affected. All stages and parties including Manufacturers, suppliers, and buyers of RMG SC are decentralized. Different stages have conflicting goals and objectives. However, use of collaborative SC companies can expect to mitigate this conflicting interest. Using appropriate information technology, information helps companies in

integrating various stages of SC in the RMG sector. Therefore, Bangladeshi RMG sector needs to implement global SC to reduce lead time.

Today, it has become imperative for Bangladesh RMG companies to gain a competitive edge through increasing quality, cutting cost, and improving delivery for increasing profitability. Shortened lead times increases export and reduce costs. Order leadtime is the main factor behind the lead timeproblem in the RMG sector (**BGMEA, 2016)**. Proper implementations of SC can reduce30 days in lead time. Buyers should contract with the raw material suppliers before giving final order to the manufacturers and if the government bodies take proper measures to increase efficiency at sea port. One respondent said, 'We generally place order to the fabric suppliers after final contract with the buyers and count 15-20 days to make fabrics. This manufacturing lead time can be reduced by the help of buyers or buying house'. Poor infrastructures in railway and road transport to carry their materials causes higher lead time. They all believed that order lead-time can be reduced if government authorities take port and develop the rail and road transport. A manufacturer, K.M. Fashions Ltd., expressed his opinion in a more logical way and stated, "To reduce lead-time effectively we have to reduce import dependency as soon as possible. Immediately we can reduce 30-40% lead time only by proper and efficient management in the supply chain." In this connection, the SCM model suggested by Nuruzzaman (**2013)** has been appended in Fig. 3.3.

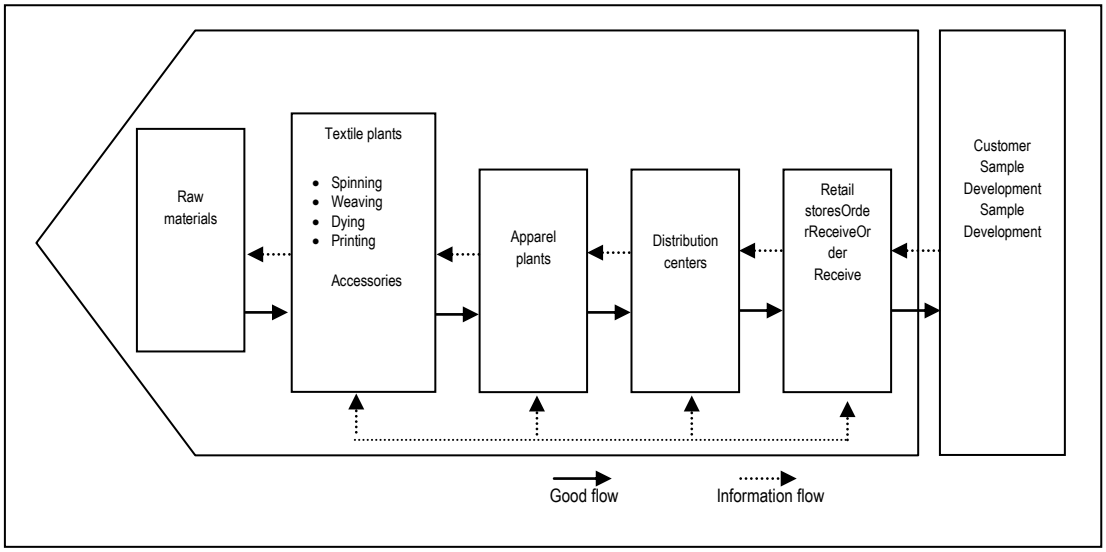


Fig. 3.3 SCM Model (**Nuruzzaman, 2013)**

There are different companies/agencies involved in the extended supply chain of RMG industry. Sodhi (**2001)** suggested an extended SC for RMG which has been illustrated in Fig. 3.4.

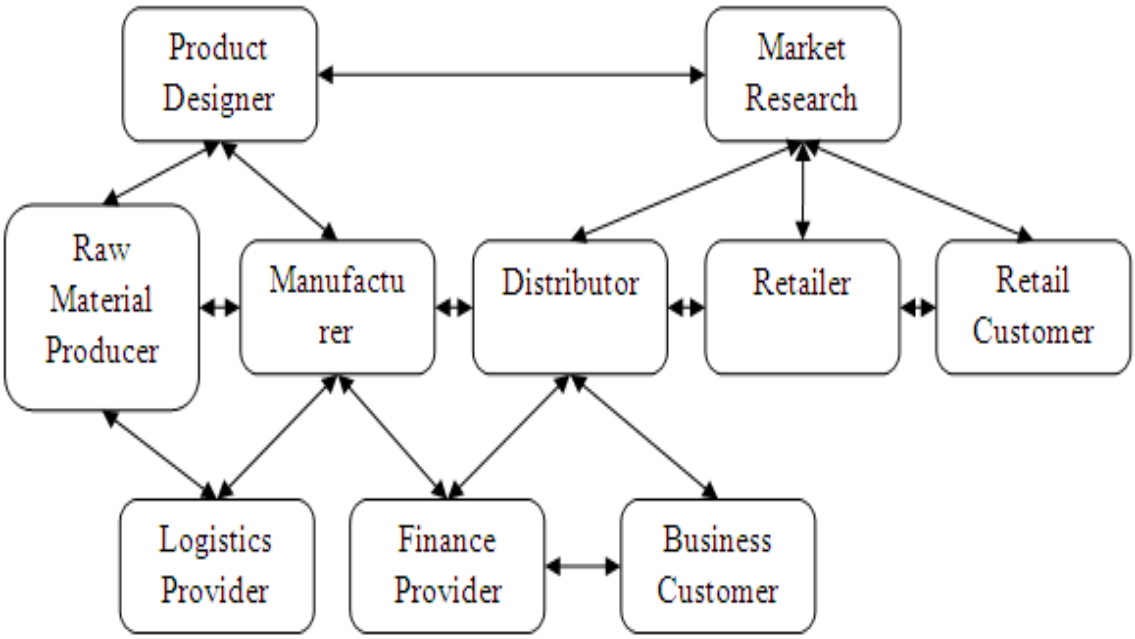


Fig. 3.4 Extended Supply Chain(**Sodhi,2001)**

SCM is Bangladesh RMG sector is not very praise worthy. Only 5 to 7%of the companies have a separate department of SCM that is indicative of level of practice of SCM in the industry. But good news is that companies started understanding the importance of efficient implementation of SCM in order to remain competitive in this global competitive market. Bangladesh RMG industry has little choice other than implementation of SCM for becoming order winning companies. The industry seriously lacks in backward linkage as it depends on import for the fabrics. RMG industry is likely to face a serious challenge in the future if the domestic demand for raw materials such as fiber, yarn, fabric, trims and accessories cannot be supplied by the domestic market **(Mohibullah et. al.,2016)**. The backward linkages of the RMG sector arespinning mill, weaving mill, knitting mill, fabric dyeing mill, printing mill, interlining and lining manufacturer, poly bag manufacturer, sewing thread manufacturer, zipper manufacturer, button manufacture, label manufacturer,

embroidery factory, washing factory, elastic manufacturer, carton manufacturer, hanger manufacturer etc.

Habib (**2016)** studied the state of backward linkages in the Bangladeshi readymade garments sector and their appraisal and policy implications. The study discussed the scope and context of the backward linkage in terms of cotton, spinning, weaving and knitting, dying, printing and finishing, and accessories industries. Giri and Rai (**2013)** studied the dynamics of the garment SC in India. They studied the structure of the garments SC, from fiber production to retailing. They identified inventory management, visibility, lead time, collaboration, technology and logistics as major challenges for the Indian garments industry. The study used secondary data and recommended a strategic fit between customization and lean agility.

Haque et. al. (**2011)** presented a case study on the performance of the Bangladeshi apparel and textile supply chain network. The study presented SCM as a common tool for ensuring success of business organizations. They also stated that measurement of SC performance was required to understand just how successfully SCM had been implemented in a firm. The study used the SCOR model using five KPIs from each operational domain including plan, source, make and deliver. Chowdhury et. al. (**2014)** highlighted on the prospects and problems of the Bangladesh RMG industry and they that in order to remain successful, Bangladesh needed to remove or limit structural obstacles to transportation facilities, telecommunication networks, power supply, management of the seaport, utility services and the law and order situation. The study also suggested that the 'government and the RMG sector should work together to maintain competitiveness in the global RMG market.'

Asgari and Hoque (**2013)** provided a system dynamics approach of SCM performance analysis of the RMG industry of Bangladesh. They used few dominant variables of SCM including enablers, performance or results, and inhibitors for the study. They concluded that RMG industry is the largest earner of exports and foreign currency in Bangladesh, and the second largest contributor to gross domestic product for more than a decade. Moreover, they argued that the customers of the apparel fashion market are becoming more time-sensitive, demanding decrease in lead

time, besides quality and cost criteria for. These all are required to win more orders from buyers in this competitive market.

The study concluded that integrated SCM can provide a competitive advantage to the Bangladesh RMG sector. It proposed a causal loop diagram to help understand the dynamic behavior among the different variables so used for the study. In another study by Hossain and Roy (**2013)** argued that SCM as a critical and strategic function for sustainable growth in the RMG industry of Bangladesh. They identified wages, supply chain, timeframe, and compliance as among the most important features of the RMG business. They further argued that industry leaders must align their SC strategies, work together with all the SC partners, share information among the stages of SC, have a standard SCM procedure, comply the code of conduct, adapt changing technologies, minimize corruption and bureaucratic tangles in customs, and cut lead time to sustain industry growth.

Tanvir and Muqaddin (**2013)** presented SCM as the new paradigm for the Bangladesh RMG industry. The study provided a general understanding on the Bangladesh RMG industry along with successes, and also provided a global context for further discussion. On the other hand, Shahriar et. al. (**2014)** gave a conceptual framework for the SC operation of RMG industry, and concluded that the prescribed framework would induce both effectiveness and efficiency if implemented. Yet, Islam and Liang (**2012)** presented a case study on the SCM of apparel order processes. The study concluded that long lead times results from import dependency on backward linked industries. More than 80% of input materials specially woven fabrics are imported (**BGMEA, 2016)**. On an average, 55-75 days are required for the import process of fabrics due to poor backward linkage industry. The study further concluded that due to this phenomenon the sector is facing long lead times, approximately 90 to 130 days on the average. Agami et. al. (**2012)** used different methods for measuring SC performance, namely financial, non-financial, perspective and efficiency based. The study presented advantages and disadvantages of all mentioned measurement systems.

Bangladesh suffers from appropriate logistics facilities required for the industry to progress. Razzaque (**1997)** used Bangladesh as a case for determining the challenges to logistics development; He argued the required mind set is the great

challenge for poor logistics infrastructures. He also mentioned that the RMG sector could achieve more competitive advantage should the country give more attention in the development of the much needed infrastructural development including road network, railway network, port development, power development the likes.

Lead time is the single most important criteria for order winning in the sector. Counties with lower lead time have more competitive advantage as they can deliver the products within very short period of time. Kader and Akter (**2014**) conducted a study on factors affecting the long lead time for export of RMG products from Bangladesh. They suggested a three step strategy for ensuring a shorter lead time for Bangladesh RMG industry. They stated that time was a great factor garment business as orders depend on weather, seasons and occasions. Lead time is a prime concern for the buyers as the products are very much time sensitive. Delivery of the right quality products must be made within the given time frame so as to meet the customer expectation. Again, Nuruzzaman and Haque (**2009**) also conducted another study on lead time management for the RMG sector of Bangladesh with few suggestions on how Bangladesh can reduce the lead time in order to remain competitive in the global market. The opined that latest knowledge of scientific and other management tools are much needed to compete successfully in the global free trade market. Bangladesh should as far as possible for building up the backward linkage industry to reduce the dependence on imported raw materials and to minimize lead-time. It can only be possible provided the industry truly understand the importance of implementing efficient SCM. Bangladesh should be able to adopt right business strategy for making the industry more competitive through implementing SCM. Bangladesh garment industry could enjoy more competitive advantage through modifying current business processes including their SCM systems.

Najmi et. al. (**2013**) presented supply chain performance models, using a literature review on approaches, techniques, and criteria etc. They argued that supply chain evaluation was one of the critical issues in most industries. Many researchers proposed various frameworks and systems to tackle this evaluation problem. The constituents of supply chain performance measurement models were extracted and it was concluded that a supply chain model can be made of various approaches, techniques, criteria and metrics according to supply chain strategy. Ali and Habib

(**2012**) presented a case study on the SCM of the textile industry in Bangladesh. The study critically described the current scenario of Textile Industry in Bangladesh. They identified lower inventories, lower costs, higher productivity, greater productivity, greater agility, shorter lead times, higher profits and greater customer loyalty as effective SCM parameters of the textile industry. They also identified few constraints of the textile industry in Bangladesh, including ineffective communication, invisibility of SCM, long lead time, etc. which would unlock further research to develop this sector. Irfan et. al. (**2008)** used SCOR model in evaluating SCM performance taking a company as case. They concluded that the state-of-the-art SCM systems could be obtained from SCOR model for business applications, advancement and practices.

Basak et. al. (**2016)** conducted a study on SC effectiveness of clothing manufacturing companies in Bangladesh. They focused on a conceptual SCM model for RMG industry of Bangladesh. They argued that parties involved in the SCM should work hand to hand with other parties in the downstream customers and upstream suppliers to achieve supply chain goal. They concluded that supply chains were efficient when the exchange value of the system fulfilled the desire of the supply chain members. Basing on their study they found some practices of SCM were effective and some were not. The study found price forecasting system, inventory were ineffective or marginally effective. On the other hand, in terms of order placement, communication, production management, SCM was highly effective. They defined modern business by shorter product life cycles, rapid new product introductions, and increasingly knowledgeable, well informed, and sophisticated customers and that this forced supply chains to be more effective. Modern supply chains were thus must be agile and proactive in order to respond to the changed satiation more rapidly, effectively, and efficiently. Haque et. al. (**2011)** evaluated the performance of SCM of RMG sector of Bangladesh. They found that Overall efficiency of the SC is only 61.85% which is not well enough compared to the global companies. Only On-Time-Delivery has higher KPI value.

Though there were plenty of studies conducted globally on measuring SCM efficiency but such study is very scarce in Bangladesh. However, Haque et. al. (**2011)** conducted a study on ‘Performance Evaluation of Bangladeshi Apparel and Textile

Supply Chain Network, A Case Study' and found out overall efficiency as 61%. But this study sued a very small sample and with very limited key Performance Indicators (KPI). Actually they used only one indicator from each fur operational domain and the result seems over stated. Few other studies were also conducted on SCM practices in Bangladesh RMG sector where the sample used was also small.

3.11 SCM Efficiency

SC efficiency is a measure of how well the resources in the SC are utilized(**Beamon,1999**). On the other hand, Organizational efficiency is defined as an internal standard of performance (**Pfeffer and Salancik, 1978**) and is approximately a construct "for doing the things right". From resource dependence perspective efficiency is an independent measure for evaluating organizational productivity. However, making evaluations of SC is more complex as boundaries are flux (**Hoek, 1998**). Efficiency is thus a quantitative as well as a qualitative evaluation in a SC as goals have to be negotiated. Efficiency is seen as a "value free" quantifiable measure – highly valued as a rationale for activities such as improvement programs or as a base for rewards. This is problematic for social systems (**Pfeffer and Salancik, 1978**) as efficiency is two dimensional (input and output) and social systems usually have several dimensions in their output. An example of this is the interdependencies within as well as among SC that cause efficiency in one SC and inefficiency in overlapping SC (**Dubois et. al., 2004**).

On the other hand, SCM excellence can be thought of both cost leadership and service leadership. The purpose of SCM in the company is to improve the competitiveness thus profitability and owners' wealth. Company can achieve desired growth in sales and increase the market by reducing lead time and improving the quality. Efficient SCM helps companies in achieving short and long-term goal. Performance excellence in all dimensions can ensure all required attributes for improving better business and demand. Few of the measures of internal performance are production lead time, short product life cycle, labor productivity etc. External performance affects the customers. Indicators of external performance include delivery precision, customer service, lead-time, and competitive price. Christopher (**1998**) argued that external network management is the hall mark for creating demand of Bangladesh RMG product. This means that SC efficiency and effectiveness are

becoming more challenging. Effectiveness refers to the extent, to which desired goals are achieved **(Mentzer et al.**, **2001**). Efficiency also explains how well companies optimize SC performance in maximizing profitability. If proper SCM is in place, it is possible to deliver the right products to the customers at the right time (**Goonatilake,1990**). Collin (**2003**) argues that SC is composed of three different dimensions: customer service, capital employed, and total cost.

Though Customer service and cost are somewhat contradictory but a fine balance will ensure the best result for a company. Cutting cost in inventory might result little longer lead time but that must be balanced with efficient inventory management. In effect an optimum balance between SC Cost and performance towards the customers need to be achieved. As the two concepts of customer service and cost are sometime contradictory to each other, companies must address the requirement of the individual buyers' organizations. The total cost of ownership (TCO) is considered highly important fundamental in today's SCM. Companies should not only focus on price only rather they should consider TCO before taking any purchasing decision. Actually, by saving cost from purchase budget which is around 65% of the total companies' budget for manufacturing companies, SC managers can contribute with multiplier effect in the bottom line.

There are a number of different measurements available for evaluating the efficiency of a Supply chain of any company. Collin (**2003**) describes inventory turnover rotation is one of the major indicators performance for such analysis regarding SCM. Customer service is another indicator for evaluating the efficiency of SCM and it depends on factors including low price, short lead-time and accurate delivery dates. Supply chain becomes efficient once internal states and processes of organizations are contingent upon environmental characteristics. Hoover et. al.(**2001)** argues that the SC has to be right for the individual customer as well to reduce cost and improve service levels. Simchi–Levi et. al. (**2000**) suggest that Efficient SC strategies must take interactions at the various tires in to consideration.

Hoque (**2013**) analyzed and modeled supply chain performance in the Bangladeshi readymade garments industry.Hoque (**2013**) analyzed the interrelationships of variables that affect performance in the industry using systems dynamics. The study also analyzed the next big factor that was going to shape the

Bangladeshi garments industry and how it could be managed by Bangladeshi industry and government. The study identified cost, quality and lead time as three important factors that affected the sale of garments to foreign brands. The study concluded that a reduction to lead time would result in a decrease in cost, and an increase in sales and supply chain performance.

3.12 Research Gap

No study was conducted in evaluating the efficiency of SCM in the Bangladesh RMG sector and that is the reason the literature on the topic is very scanty. Moreover, over the periods, buyers' preferences are also being changed. These days' buyers prefer shorter lead time followed by quality and cost. Under this changed preference by buyers what Bangladesh RMG should do, there is no such studies. But, Bangladesh needs to implement efficient SCM in order to remain competitive in the global apparel market as it is facing stiff competition from other RMG producing countries in the world. Collaborative SCM is another issue that Bangladesh RMG sector should focus on. Not so much research also has been carried out in Bangladesh. This study aims to evaluate the efficiency of SCM in Bangladesh RMG sector using a large and representative sample with SCOR model taking twenty dimensions in to considerations.

3.13 Conclusions

From this chapter, it can be understood that the definitions of SCM varies over person to person. But, the underlying principles and functions seem to be in accord. It can be inferred that SCM can play a significant role in performance enhancement of RMG sector by making the overall process more efficient. A proper SCM practices can be a true advantage for a RMG company. This chapter also arises the concern over poor SCM practices in RMG sector of Bangladesh.

Chapter-4

Conceptual and Theoretical Framework

4.1 Introduction

At first, this chapter brings the discussions on the conceptual framework of this study which is based on Supply Chain Operations Reference (SCOR) Model. SCOR model has five processes i.e.plan, source, make, deliver and return. These processes are discussed along with their KPIs. After that, theoretical framework of this research is given. Discussions are also made on the scopes and benefits of SCOR model along with the strengths and weaknesses of this model.

4.2 Conceptual Framework

There are different performance evaluation models available in the literatures including Performance Prism Model, Balanced Score Card Model, Supply Chain Operations Reference (SCOR) Model etc. But in this study SCOR Model will be used in order to evaluate the supply chain management effectiveness for the RMG sector of Bangladesh. Five Key Performance Indicators (KPIs) under each functional domain have been identified for such evaluation. The conceptual framework used for this is based on Supply Chain Operations Reference (SCOR) Model. SCOR model was designed by the Supply Chain Council, with the first version being developed in 1996. It is a framework for examining the supply chain in detail through defining and categorizing the processes that make up the chain, assigning metrics to such processes and reviewing comparable benchmarks (**Stephens, 2001; Huang et. al., 2004; Lockamy and McCormack, 2004)**. It is the only integrated cross functional framework that links performance measures, best practices and software requirements to a detailed business process model.

The SCOR model defines supply chain as being composed of five main integrated processes: Plan, Source, Make, Deliver and Return. Furthermore, performance of these processes is measured using 5 criteria: Reliability, Responsiveness, Flexibility, Cost and Asset. As return function is not very prominent in RMG sector, thus this particular function has not been considered in this framework. Table 4.1 shows different KPI that can be measured to find out the overall supply chain efficiency.

Table 4.1 KPI for Overall Supply Chain Efficiency(**Primary)**

Operation Domain	**KPI's**	
Plan	1) Inward Material/ Input Quality	SCM Efficiency
	2) Quantity and Timely Delivery of Materials	
	3) Unit Cost of Material in Procurement	
	4) Inventory Level of Materials	
	5) Capability and Initiative of Vendor Development	
Source	1) Meeting Production Target as per Plan	
	2) Sample Conversion Rate/Time	
	3) Material Utilization Efficiency	
	4) Cost Adherence	
	5) Planned T&A v/s Actual T&A	
Make	1) Production Cost Efficiency	
	2) Capacity Utilization	
	3) Maintenance of Quality	
	4) Change Over Time	
	5) Operator Training Effectiveness	
Deliver	1) Order Fulfillment	
	2) On Time Shipment	
	3) Claims and Discounts	
	4) Quality at Delivery	
	5) Transit time	

Based on the above table, the conceptual frame work of this study has been graphically presented in Fig. 4.1.

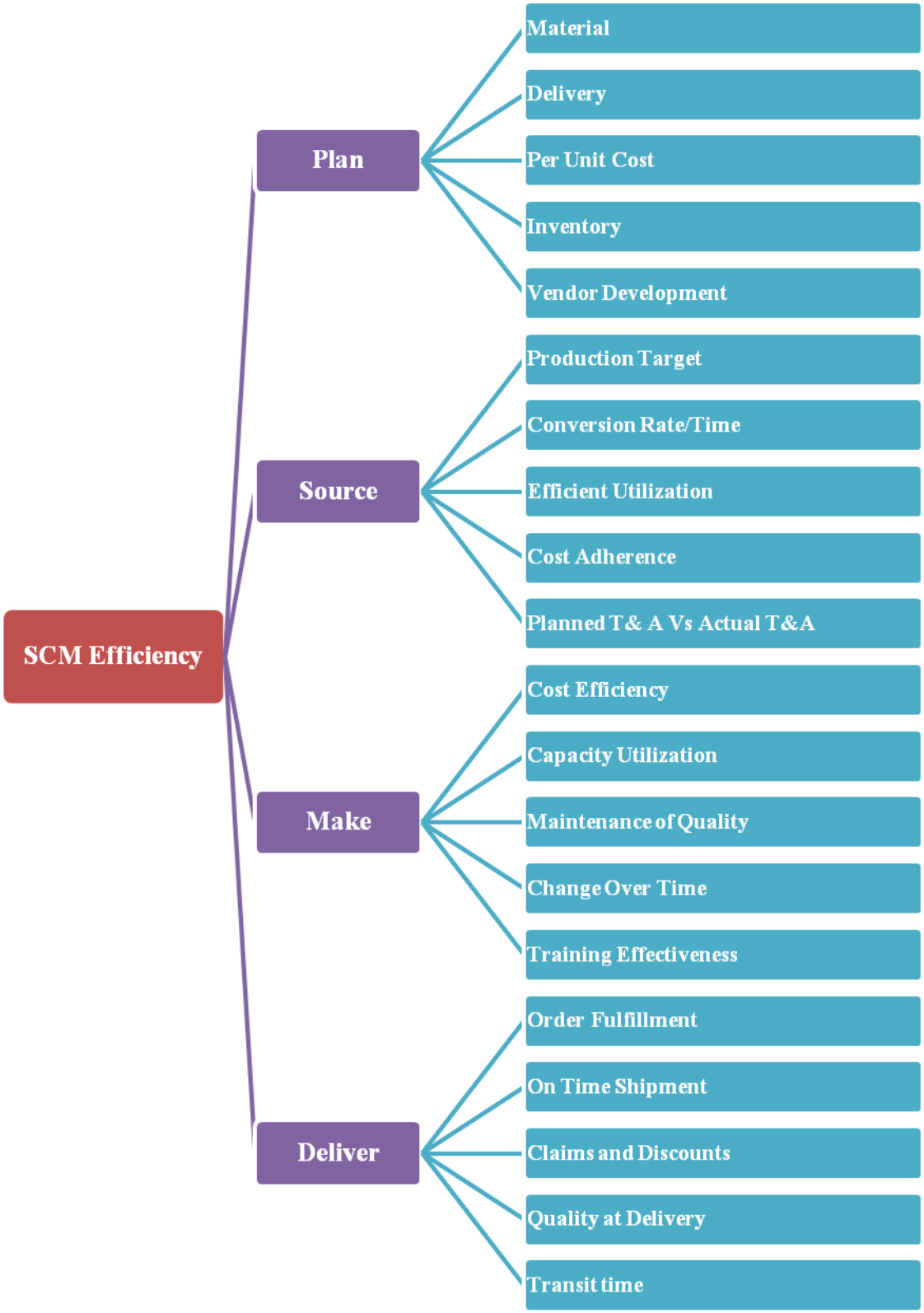


Fig. 4.1 Conceptual Framework of Measuring SCM Efficiency (Primary)

4.3 Theoretical Framework

The theoretical framework of this study is based on Supply Chain Operations Reference Model developed by Huang et.al. (**2004)**. According to Performance Drivers (**n.d.**), Process Reference Models combine the disciplines of Business Process, Re-Engineering, Benchmarking, and Process Measurement into a cross-functional structure. The objective or purpose of a 'Process Reference Model' is to aid a business in capturing the status quo process with the objective to achieve the desired future state. Additionally, the model allows a business to quantify its operational performance, establish internal targets based on benchmarking targets from a pool of similar companies. A 'Process Reference Model' also describes the scope for standard management processes, and the methods for exploring relationships among different processes. These models define standard methods to assess process performance, and also identify management practices that produce the best-in-class performance. Lastly, a 'Process Reference Model' also defines the scope for management practices and computer based software solutions that may produce the best competitive performance.

It may be concluded that 'Process Reference Models' aid in the implementation of complex management processes by enabling them to translate through a standard process reference model. This function aids businesses in communicating clearly and precisely and measure, manage, tune and re-tune specific business processes, Performance Drivers (**n.d.**).

According to Inwent (**n.d.**), the Supply Chain Operations Reference Model is a reference model, in the sense that it may be used as an initial starting point for designing or improving a supply chain across the numerous different businesses along its length and width. Reference models may serve to act as a role model for the supply chain. A reference model may be used as an analysis and optimization tool for identifying weaknesses in an existing model.

Using a reference model such as SCOR allows the following, Inwent (**n.d.**):

- Utilizing a reference model simplifies and accelerates the design of supply chain models as they improve and ease the process of

identification of essential processes and structures and enhance the transparency by this.

- Reference models offer a steady terminological standard, thereby helping communication and orientation.
- Reference models act as a standardization tool by defining a standard for a certain field.

According to Inwert (**n.d.**), SCOR model offers a standardized, comparable and assessable reference model for logistics. The supply chain is defined and best-practices are analyzed within the bounds of this model, with the aim of allowing individual businesses to draw conclusions for their own supply chain. Thus, SCOR model is an approach to standardize process chains across the numerous different businesses along its length and width. As a result, a common understanding of workflows may be achieved. Additionally, assessments of the supply chain based on key figures that are provided by SCOR are also achieved.

The SCOR model is a hierarchical model, consisting of four levels. The starting point for the model is an integrated supply chain that covers all interactions with customers from incoming order to incoming payments and all material flow. Also covered are the production processes, as well as all interactions with the market from resource delivery from our supplier to the delivery to the customer, Inwert (**n.d.**).

According to Hudson (**2004**), the Supply Chain Operations Reference model or SCOR is a management tool that may be utilized by a company to "address, improve, and communicate supply chain management decisions within a company." Suppliers and customers of a business may also be involved in this process. The SCOR model identifies the business processes necessary to satisfy customer demand. The SCOR model aids in clarifying the roles and scope of the processes along the whole supply chain. The model also provides a structured method for improving these said processes.

The SCOR model is unique in the sense that it was developed whilst in consultations with leading practitioners of supply chain management concepts.

According to Hudson (**2004**), the model was developed by the supply chain council whilst in consultations with 70 of the world's leading manufacturing companies. The SCOR model has been hailed as the most promising model for supply chain strategic decision making by experts, Hudson (**2004**).

The SCOR model expresses supply chain management process and matches these processes against best practices, Performance Drivers (**n.d.**). The SCOR model provides businesses with a powerful means for rendering their supply chain operations more effective and efficient. The SCOR model enables manufacturers, suppliers, distributors and retailers within the framework to assess the operational effectiveness of their supply chain activities, and to identify and gauge specific processes.

The concepts utilized for the SCOR model were produced to allow businesses to communicate, compare and study the strategies and actions of competitors and other businesses both within the industry and outside. The model measures the effectiveness of supply chain reengineering, on top of its ability to plan and experimentally attempt future process improvements. SCOR is one of the few approaches that deal with the designing of strategic issues in a supply chain (**Huang et.al., 2004**). The schematic diagram (Fig. 4.2) of SCOR model shows that it encompasses the five management processes plan, source, make, deliver, and return.

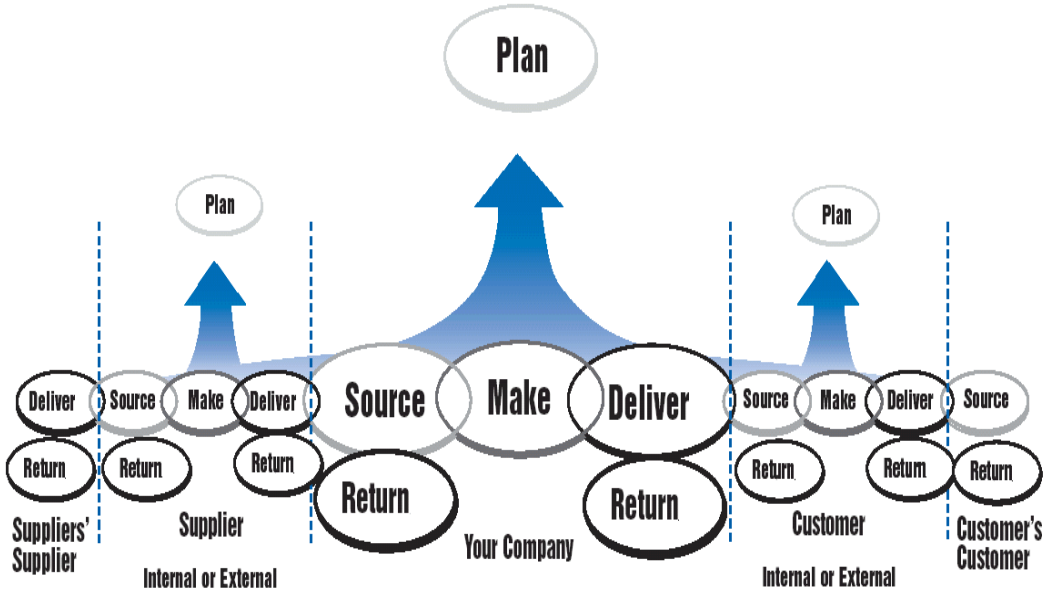


Fig. 4.2 SCOR Model of Supply Chain Management(Malapit, 2016)

4.4 Scope of the SCOR Model

According to Malapit (**2016**), the SCOR model does not endeavor to clarify every business process or activity. Like in other business models, there lies a specific scope within the SCOR model that it addresses, including the following segments:

- **Customer Interactions:** The SCOR model takes into account the entire process of customer relationship, starting from the order entry all the way through to the invoice payment.
- **Product Transactions:** The model accounts for product transactions from products provided by the supplier's supplier to those sent downstream by the customer's customer, including equipment, supplies, bulk products, etc. (**Malapit**, **2016**).
- **Market Interactions:** Apart from products, the model also deals in the interactions between the various market forces, starting from the understanding of demand, to the fulfillment of customer and supplier orders.

According to Malapit (**2016**), the focus of SCOR may also be defined and measured on 3 distinct process detail levels.

- Process detail 1: Defining Scope- geographical scope, market segments, and context
- Process detail 2: Arrangement of the supply chain
- Process detail 3: Process element details – identifies key business activities within the chain.

SCOR Model defines basic processes of the supply chain and groups them into five categories as Plan, Source, Make, Delivery and Return. SCOR exactly names the main process in each of these groups. The operations which are in the range of SCOR model are:

- All supplier / Customer interactions
- Order entry through paid invoice
- All physical material transactions from your supplier's supplier to your customer's customer, including equipment, suppliers, spare parts, bulk products, software etc.
- All market interactions from the understanding of aggregate demand to the fulfillment of each order.

The Supply Chain Operations Reference-model is a process based reference model. At the heart of the model is a hierarchy of four levels that represent the path a business may take to achieve supply chain management performance improvement, Performance Drivers (**n.d.**).

4.5 Benefits of Using the SCOR Model

The Supply Chain Operations Reference model or SCOR is one of the leading supply chain frameworks in use today. The model links business processes, performance metrics, practices, and most importantly, 'people skills' into a unified structure. SCOR framework may be utilized in businesses to achieve the following:

- Increasing the speed of system implementations
- Supporting organizational learning goals
- Improving inventory turns

The processes that are part of the SCOR model may be utilized at many levels of detail in order to assist a business analyze its supply chain. It gives businesses a general idea of how advanced its supply chain is. The SCOR model helps businesses comprehend how the 5 steps repeat over and over again between suppliers, the company, and its end customers.

Each individual SCOR step is a link in the supply chain that is critical to transitioning a product effectively along each level. The SCOR model has established itself capable of benefitting businesses that have used it to optimize and identify problems in their supply chain. The model allows complete leveraging of capital investments, creation of supply chain road maps, alignment of business functions, and an average of two to six times return on investment (**Hudson, 2004**).

According to Malapit (**2016**), the major supplier of light bulbs globally and also in Bangladesh, Philips Lighting, has been employing the SCOR model from around 1999. The company recently announced to the 'Supply Chain Council' that as a result of incorporating the SCOR model into their business framework, the business has directly benefitted in terms of improved customer service and reduced inventories over the years.

The SCOR model is a "tried and true process for manufacturing and distribution industries." The successful results emanating from the use of this model have been seen for decades. "When applied correctly, it can streamline processes and refine your organization's supply chain," Malapit (**2016**).

ILIM (**n.d.**) concludes that the SCOR model presents a powerful analysis tool that supports the definition of competitive strategies for businesses. Many opportunities for optimization can be identified due to sharing information, and handling quality policies with suppliers and planning jointly for the management of demand and supply.

ILIM (**n.d.**) states that just some of the advantages that an effective supply chain empowered by SCOR would allow a business could be:

- Better management of inventories, that effortlessly translates into the reduction of costs. It may be possible to greatly optimize stock management and fend off collapses in the production cycle if the suppliers can agree on principle to sharing the information of the stores and to the needs of production.

- The model enables the supply chain to enjoy a narrower relationship with clients that is supported by a better communications infrastructure. This ultimately lets efficient flows of information that allow a better answer to the dynamic requirements of the new market.

- A SCOR enabled supply chain allows strategic integration with the suppliers, thereby allowing multiple channels of feedback, and valuable information sharing and reduces the risks of supply breakdowns in some cases.

- Error identification is also improved, as there will be an improvement in the management of faults along the supply chain. According to ILIM (n.d.), this will "allow building a unified, efficient and solid productive block, which will be very well valued in the market and principally by the clients."

4.6 Strengths and Weaknesses of the SCOR Model

According to research conducted by the Advanced Integrated Technologies Group, Inc. and SCE Limited, (as cited by ILIM (**n.d.**)), the strengths and weaknesses of the SCOR model have been presented below:

- **Strengths**

  - Model provides an organized methodology for a coordinated orientation of Strategic and Operational metrics; additionally, the model provides goals to designate business improvement opportunities
  - The model provides a Standardized Supply Chain reference model and framework for business to improve their chains
  - The model is one that provides standardized multi-hierarchy process performance measurement indexes
  - Benchmarking is enabled through the use of industry and competitive benchmark data sources
  - The model facilitates a Macro-level approach for designation of opportunities for improvement
  - Material, work and information flow analyses are provided for Level 1 through to 3
  - Effectively gives best-in-class supply chain management practice directions
  - Priorities the introduction of effective IT capabilities to optimize the Supply Chain

- Helps to deliver comprehensive opportunities and project portfolios with detailed ROI analyses

❑ **Weaknesses**

- Insufficient organization wide training and development protocols provided by the model
- Very little analytical tools for analyzing causes and effects, and also for problem solving at the macro level
- Insufficient tools, methodologies, and techniques provided for focusing on implementing projects identified by the SCOR efforts
- Somewhat programmatic infrastructure required for organizing and managing simultaneous project activities

4.7 Conclusions

This chapter has provided detailed information about the SCOR model. It has brought the pros and cons of this model in discussions along with the scopes of using this model. These have given the idea about the appropriateness of this model in different scenarios. By considering these, it can be said that SCOR model is suitable for studying the supply chain efficiency in RMG sector of Bangladesh.

Chapter-5

Research Methods

5.1 Introduction

This chapter talks about how this entire research has been designed and conducted. It starts with the discussion over the design of this research and research methods followed. Then, it focuses on the target population and how the sample was determined from the population. Detailed sampling procedures are discussed along with the sample distribution. After that, it puts the light to questionnaire design and scaling and how the data has been collected with questionnaire. A brief overview of the case addressed in this research is also given. Finally, it provides the information about methods of analyzing the collected data.

5.2 Research Design

Creswell (**2009)** have found three types of research methods, such as: 1) qualitative, 2) quantitative and 3) combination of both. A framework of mixed method has been used in carrying out this research with the help of both close and open-ended questions. Since, the purpose of the study was to explore the process or factors behind the efficiency of SCM in RMG sector of Bangladesh using SCOR model so the qualitative method was justified in collecting the data. Again, the sample used for the study was large, data were quantitative in nature, formal and structured questionnaire were used in administering the data collection process, so the quantitative methods were also justified for this study. On the other hand, the research has been designed as an applied research; as it seeks to resolve the very practical issues of measuring supply chain management efficiency of Bangladeshi RMG sector. However, it also qualifies as causal research as cause and effect relationship has been used.

The research has attempted to measure the efficiency of the different SCM activities of the RMG sector of Bangladesh and as such, this research will qualify as a descriptive research since it incorporates activities of all parties involved directly or indirectly in SCM process. Then again, this study is incorporated with the positivist approach of research methodology. Mårtensson and Nilstun(**1988)** and Mihalache and Vukman (**2005)** said about the positivists approach that, "It considers the truth as knowledge; depend on the findings of facts and their relations. They reject human ability to know the absolute facts and reject the pressure of society, culture with human cognition on truth". Silverman (**1993)** added that, by the use of quantitative methods, it seeks to discover the laws. Positivism accentuates the measurement of relationships between events and variables, which are formed in a statistical and systematic way. Besides this, positivism considers the prediction, explanation, observation and the test of hypothesis.

5.3 Research Methods

Different organizations measure the performance of supply chain activities through various measurement approaches. Prabir (**2007)** mentioned some measurement approaches of which SCOR model, the Logistics Scoreboard, Activity-Based Costing (ABC), Economic Value Analysis (EVA), and Balanced Scorecard are widely popularized. When the supply chains are comparatively complex and occurred across multiple industries then the SCOR model is used which includes all the customer, physical, and market transactions. After thorough analysis in finding the appropriate models for measuring SCM efficiency, SCOR model had been finally adopted to develop the measurement framework for RMG sector of Bangladesh. In his study Prabir (**2007)** used one variable to measure the supply chain efficiency but in this study 20 variables have been considered which cover all the aspects of SCM in RMG sector.

Besides analyzing the data so collected from a representative sample of 399, a Case Study has been conducted in Interfab Shirt Manufacturing Company Limited (ISML)in order to better understand how efficiency of SCM is measured. This has helped in designing the questionnaire. ISML is the sister concern of VIYELLATEX group which launched its journey in 1998. ISML's highly dynamic, motivated, well-trained and skilled workforce meets the demands of its international premium

customers such as Hugo Boss, Esprit, Calvin Klein, Tommy Hilfiger, M&S, DKNY, Olymp, and Tom Tailor in an effective and efficient manner.

According to Prabir (**2007)**, "Supply chain efficiency measurement framework is developed in terms of efficiency with respect to key functional parameters spanning four different operation domains namely source, plan, make and deliver." In each operation domain, five primary key performance indicators (KPI) are identified. Once the data has been collected from each KPI then it been interpreted accordingly with the help of factor and regression analysis. Supply chain efficiency of the organization can be identified through measuring the weighted averages of all KPI. Diverse performance indicators have been identified and measured with appropriate tools and matrices from the selected company and weighted values of those indicators are given based on management's opinion. Higher score means the better efficiency, as for an example, 100% supply chain efficiency indicates to a perfect organization.

5.4 Target Population and Sampling

In early 1980's, BGMEA started their journey with only 12 members that turned into around 4300 now. Among the all member factories, around 40% are knitwear & sweater manufactures, and the rest are woven garment manufactures (**BGMEA, 2016)**. Here in this study 2580 woven garment manufacturers have been selected as target population. At the same time, all the officials of Bangladeshi RMG sector involved directly or indirectly in supply chain activities were also considered as target population. In Bangladesh there are around 200 companies have separate SCM department with on an average 5 working members. Thus, it becomes a population of around 1000 (including Managers/Executive/Office Staff). These 1000 personnel has been considered as population for respondents from whom data were collected through structured questionnaire survey. Moreover, data were also collected from factory managers, owners to make the report more plausible.

5.5 Sampling Procedure and Techniques

The entire membership list of BGMEA has been used as sampling frame of RMG organizations. The payrolls of the selected companies have been used as the sampling frame for supply chain managers and merchandisers. There were two types of sample used for this study; one sample for Garments Companies and another

sample for respondents from whom data for this study were collected. The study has used a probability sampling procedure, with cluster area sampling and stratified random Sampling being used to identify organizations for study.Individual supply chain managers and merchandisers selected from different clusters (Large, Medium and Small Garments companies located in the four areas of Savar, Gazipur, DEPZ and Naraynganj have been used as sampling units.

Probability sampling, within which both the stratified and cluster sampling technique has been used in this study. Stratified Random Sampling splits the total population into mutually exclusive groups. Afterward, the members from different groups are chosen disproportionately by using random sampling technique. Population has been clustered into three categories as large, medium and small based on the number of lines and workers. When the list is too large then the Cluster Random Sampling is use to select participants instead of simple random sampling.

In Bangladesh, the garments companies are concentrated mostly in the areas like Gazipur, Savar, Naraynganj, Tongi, Ashulia, Mirpur, Gulshan and Banani. Garments companies located in Savar, Gazipur, Narayanganj and Banani, these four geographical locations have been used for selecting respondents with a view to collect data. The sample for respondents has been determined adopting following formula:

The sample size for industries: $n = \frac{NZ^2pq}{Nd^2+Z^2pq}$

Where,

n= Sample size

N = Population Size =2580

Z = the confidence level in standard error units, at 95% confidence level it is 1.96

p = estimated proportion of success, here population proportion is taken as 50%

q = estimated proportion of failure (1-p), here it is 50%.

d= Precision level, maximum allowance for error. Here it is 5% or 0.05

$$n = \frac{2580 \text{ X } 1.96^2 \text{ X } 0.5 \text{ X } 0.5}{2580 \text{ X } 0.10^2 + 1.96^2 \text{ X } 0.5 \text{ X } 0.5} = 99.99$$

= 100 (Rounding the value to the next higher number)

The distribution of this sample RMG companies is shown in table 5.1.

Table 5.1 Sample Distribution(**Primary)**

Ser	**Type of RMG**	**Weights**	**Number of Companies**	**Area/Location**	**Remarks**
1.	Large	100 × .20	20	1. Savar 2. Gazipur 3. Narayanganj 4. Banani	Type of RMG has been decided on number of Production Lines and workers.
2.	Medium	100 × .30	30		
3.	Small	100 × .50	50		

Krejcie and Morgan (**1970)** in 'Determining Sample Size for Research Activities'suggest a formula to calculate the sample size as-

$$n = \frac{X^2 NP(1-P)}{ME^2(N-1) + X^2 P(1-P)}$$

Where,

n= Sample size

X^2= Chi Square for the specified confidence interval at 1 degree of freedom

N= Population size, assumed as 1,000

P= Population proportion, assumed as 0.5

ME= Desired margin of error, assumed as 0.05

Therefore, putting all the values into the above equation a sample size of **399** has been found.

As 200 garments factories are available in Bangladesh and estimated numbers of supply chain managers are 1000. Sample determination formula developed by Taro Yamane (**1964)**for known population has been used for this study.

$$n=\frac{N}{1+N(e^2)}$$

Where,

N = Total Population size

e = Precision level

1 = Constant Value

$$n = \frac{1000}{1+1000(.04)^2}$$

n = 385

According to the above two sampling formula, the sample size of respondents is 399 and 385 respectively. For better representation, the sample size has been considered as 399 for this study. Mostly the Supply Chain Personnel, Merchandisers have been interviewed for necessary data for this report. However, handful numbers of owners, Vice presidents of BGMEA, research director of BGMEA research cell have also been interviewed in depth for having depth knowledge and insight.

Total 500 questionnaires were sent to 100 RMG companies of Bangladesh as each company has at least 5 employees involved with supply chain related activities. Of these 500 questionnaires, 415 were returned during the study period. After checking the filled-up questionnaires, 399 were found complete. Different analysis was done based on these 399 questionnaires. The distributions of respondents are given in table 5.2.

Table 5.2 Distribution of Respondents(**Primary)**

Ser	**Type of RMG**	**Number of Respondents**	**Total Respondents**
1.	Large	80	399
2.	Medium	119	
3.	Small	200	

5.6 Questionnaire and Scaling

Both of the primary and secondary data have been used for this study. In case of primary data, a questionnaire has been developed with both open and closed ended questions for collecting required information. Only one set of questionnaire has been administered for the officials of SCM department of different selected companies. Relevant literatures, Articles, BGMEA reports were also consulted for collecting necessary data. A five point rating Likert scale was mostly used to rate the statement regarding the SCM practices in RMG sector of Bangladesh. Ordinal or Rank order scale was used onward to rank different challenges of RMG sector.

5.7 Data Collection Methods

A research team was employed for collecting the data from the respondents amongst different selected companies through a formal survey. Additionally, an in-depth interview was also conducted with high management officials including directors, owners and BGMEA officials for having insight on the subject. A focus group discussion was organized in BGMEA office to explore insights behind the lack of efficiency of SCM in RMG sector where few owners who are also director of BGMEA, Research director and Research Assistant and Company secretary took part. Some data have been collected by personal observation of SCM in different companies. The study has surveyed individuals who are knowledgeable in the SCM operations of the Bangladeshi RMG sector and have relevant experiences to contribute to this study. This study considered the highest ethical standard in terms collecting data from all primary and secondary sources, analyzing and reporting those data. Adequate measures have also been taken in order to reduce the biasness from all concerned. Data were collected in the period of February 2016 to March 2017. Secondary data have been collected for the last ten years.

5.8 Case Study

A case study was conducted at Interfab Shirt Manufacturing Limited located in Gazipur, Dhaka. Different selected performance matrices under five major functional areas including Product Flow, Labor Utilization, Cycle Time, Space Utilization and Labor Issues were measured and Value Stream Mapping (VSM) was prepared. Score Model has been used for calculating overall efficiency of supply

chain. Having calculated the different performance matrices, subjective weights have been assigned against each matrices basing on relative importance and finally the overall efficiency of Supply Chain Management has been calculated.

5.9 Data Analysis Methods

For analyzing the primary and secondary data, a number of appropriate statistical tools have been used. Statistical tools include both descriptive and inferential statistics. Inferential Statistics tools i.e. Factor Analysis to classify different variables under diverse factors, Trend Analysis to understand the trend of particular phenomenon over the periods, Correlation Analysis to identify the inter-relationship between different variables, Regression Analysis to recognize the impact of different factors on SCM efficiency, Chi Square test to identify the independence of variables, ANOVA test to explore the presence of significant difference among different variables means have been used with the help of SPSS and Excel. In addition to that, Kendall Coefficient of Concordance has also been used for measuring the association amongst responses through significance test for the rank data, Different charts, and graphs have also been used for presenting and analyzing the data in more meaningful way. Necessary figure, pie charts, graph and bar have been used to show the frequency of the data or information.

Data were tested for validity, robustness and reliability with appropriate statistical test. Reliability test like Cronbach Alpha model was used to test the reliability of the collected data. Nunnaly (**1978)** argues that the acceptable internal consistency should be 0.50 to 0.60. The value of Cronbach was 0.687 which is higher than the acceptable limit. All the contents or sources of data were verified to identify the validity.

5.10 Conclusions

From above discussion, it can be said that the sample selected for this study are adequate representation of target population. The design of research and questionnaire are appropriate for capturing the true picture of SCM in RMG of Bangladesh. The methods followed for data analysis are also well-popular and expected to help in achieving the objectives of this research.

Chapter-6

Data Analysis

6.1 Introduction

The data collected from the respondents through administering a structured questioner has been presented in this chapter with required analysis. This chapter has provided analysis for the questions added in the questionnaire and provided associated findings. It also shows the measurement of SCM efficiency, overall distribution of efficiency along with the procedure of getting the results. It also includes the case study on Interfab Shirt Manufacturing Ltd (ISML).

6.2 Survey Data Analysis

The data collected from the respondents through administering a structured questioner has been presented in this chapter with required analysis. From initial selection of 500 employees, 415 has filled and returned the questioners in due time of which 399 was found usable. Further analyses were done based on the usable questionnaires. Table 6.1 shows the survey output for the existence of supply chain departments in the selected organizations.

Table 6.1 Result of the Existence of Supply Chain Department in Organization(**Primary)**

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	30	7.5	7.5	7.5
	No	369	92.5	92.5	100.0
	Total	399	100.0	100.0	

A total 399 respondents were selected from 100 different sizes of RMG companies located in different parts of the Dhaka City. Out of 399 respondents, 30 respondents (7.5%) relied that they have a separate Supply Chain Department in their company which is very insignificant.369 respondents (92.5%) replied negatively

specifying that they don't have a separate department with the name Supply Chain Department. Actually, these figures suggest that the level of practice of Supply Chain Management in Bangladesh RMG sector is not praise worthy and very encouraging. In this era of global competition where Bangladesh is competing with many different countries for its share of pie, the level of practice of Supply Chain Management is very frustrating. It is evident that without proper implementation of Supply Chain Management, the RMG companies will not be able to compete to grasp the market share.

Table 6.2 Result of the Age of SC Department in Organization(**Primary)**

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0 - 1 Year	13	3.3	43.3	43.3
	1 - 2 years	9	2.3	30.0	73.3
	3 - 5 years	8	2.0	26.7	100.0
	Total	30	7.5	100.0	
Missing	System	369	92.5		
Total		399	100.0		

Table 6.2 shows the survey output for the age of supply chain departments in the selected organizations. 7.5% of the sample companies out of 95 RMG companies those have a different department of Supply Chain Management, but the ages of those departments are also very less. 43% of the companies those have separate Supply Chain Department, the age of the department is only 0 – 1 year; that means they just started functioning very newly. 30% and 27% of the companies' age of their Supply Chain Department is in between 1-2 years and 3-5 years respectively. These suggest that the age of these Supply Chain Departments is not very old. Companies have very limited practices of Supply Chain Management and still to recoup the benefit of proper supply chain output.

Table 6.3 Descriptive Analysis(**Primary)**

		Mean	**Std. Deviation**	**Mean**	**Grand Mean**
Source	High Quality Inward Material	2.84	1.16	3.17	2.96***
	On Time and Timely Delivery	3.19	1.31		
	Optimum Unit Cost	3.27	1.21		
	Optimum Material Inventory Level	4.17	0.98		
	Improved Vendor Development Capability	2.38	1.10		

Table 6.3 Descriptive Analysis(**Primary)**

		Mean	**Std. Deviation**	**Mean**	**Grand Mean**
Plan	Adherence to Production	2.35	1.10	2.78	
	Short Sample Conversion Rate	2.47	1.35		
	Efficient Material Utilization	3.28	1.04		
	Coat Adherence	3.36	1.23		
	Match Between Planned T&A and Actual T&A	2.47	1.11		
Make	High Capacity Utilization	2.46	1.10	2.82	
	Production Cost Efficiency	3.39	1.02		
	High Quality Capability	2.52	1.15		
	Short Change Over Time	3.32	1.08		
	High Operator Training Effectiveness	2.40	1.11		
Deliver	On Time Shipment	3.19	1.12	3.08	
	High Order Fulfillment	3.21	1.15		
	Reduced Claim and Discounts	3.27	1.16		
	On Time (High Quality) at Delivery	3.36	1.16		
	Low Transit Time	2.38	1.38		

*** Significant at 1% level

Basing on the SCOR model and the conceptual framework of this research four different distinct dimensions of Supply Chain Management Practices namely Source, Plan, Make and deliver have been identified by the researcher. Under these four dimensions a total of 20 different practices, 5 each under each dimension have been pin pointed for Bangladesh RMG sector. Respondents were asked to put their opinion on these practices at their respective companies in a 5 points rating scale. The descriptive statistics (mean, standard deviation, mean and grand mean) under each practice and dimension have been stated in table 6.3. The mean of responses ranges from very low 2.38 to very high 4.17. However, the mean of responses under each dimension ranges between 2.78 in plan to 3.17 in source with grand mean of 2.96. One of the null hypotheses was that the efficiency level of practice of Supply Chain Management was satisfactory with mean response value of minimum 3.5. But the test result (table 6.4) suggests that the grand mean is 2.96 which is statistically significantly below than 3.5 that rejects the null hypothesis.

Table 6.4 Result of t-statistic(**Primary)**

Mean	**Standard error**	**t-statistic**	**P-value**
2.96	0.057	-9.37	0.000

Comment: the mean level of efficiency is significantly less than the hypothesized level of efficiency (3.50)

Table 6.5 Correlation Analysis(**Primary)**

	Make	Source	Plan	Deliver
Make	1			
Source	.337**	1		
Plan	.383**	.232**	1	
Deliver	.425**	.298**	.415**	1
**. Correlation is significant at the 0.01 level (2-tailed).				

A correlation analysis has been conducted among responses of different dimensions so selected in order to determine whether the responses are correlated with each other or they are independent to each other. The findings in table 6.5 suggest that the practice of supply chain is not an independent matter; they are positively correlated to each other. It is the holistic approach of all the dimensions involved that is required for improving overall efficiency of organization wide supply chain management practices. However, the correlation value is varied from each other with the highest correlation between Make and Deliver (0.4265) with least correlation value of .232 between Source and Plan. So, to ensure the efficiency of supply chain practice, the organization needs to address a collective exercise of improving all the dimensions of supply chain management practice.

A reliability test of the data set so collected from the respondents through a rigorous questionnaire survey has been conducted where the Cronbach's Alpha value has been found as 0.687 which is very acceptable.

Table 6.6 Result of Reliability Test(**Primary)**

Cronbach's Alpha	**N of Items**
0.687	20

As discussed above that there have been total 20 different dimensions/practices under four broad dimensions have been identified in order to measure the efficiency of Supply Chain Management, it needs reduction of those dimensions/factors through Factor Analysis. Before actually conducting the Factor Analysis a sufficiency test has been conducted just to make sure whether the Factor

Analysis is justified or not. The test result suggests that with KMO measure of Sampling Adequacy of 0.807, it is really justified to conduct the Factor Analysis. The result of Sufficiency Test for Factor Analysis has been presented in table 6.7, 6.8, and 6.9.

Table 6.7 Test for Sufficiency of Factor Analysis(**Primary)**

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	877.935
	Df	190
	Sig.	.000

Table 6.8 Total Variance of Components(**Primary)**

Compone	**Initial Eigen values**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.603	18.017	18.017	3.603	18.017	18.017	2.663	13.315	13.315
2	1.281	6.406	24.423	1.281	6.406	24.423	1.761	8.804	22.119
3	1.187	5.933	30.355	1.187	5.933	30.355	1.218	6.088	28.207
4	1.156	5.782	36.137	1.156	5.782	36.137	1.198	5.990	34.198
5	1.110	5.548	41.686	1.110	5.548	41.686	1.188	5.938	40.136
6	1.044	5.220	46.905	1.044	5.220	46.905	1.169	5.843	45.979
7	1.026	5.130	52.035	1.026	5.130	52.035	1.128	5.639	51.618
8	1.008	5.039	57.075	1.008	5.039	57.075	1.091	5.457	57.075
9	.969	4.845	61.920						
10	.921	4.607	66.527						
11	.860	4.302	70.828						
12	.819	4.095	74.924						
13	.763	3.815	78.738						
14	.726	3.630	82.368						
15	.671	3.354	85.722						
16	.641	3.203	88.925						
17	.604	3.021	91.946						
18	.586	2.929	94.875						
19	.522	2.612	97.487						
20	.503	2.513	100.000						
Extraction Method: Principal Component Analysis.									

From the above analysis it can observed that if all 20 KPIs are considered, 100% of the variations in dependent variable 'SCM_ Efficiency' can be explained.

57% of the changes in dependent variable can be explained with 8 latent variables which is supported by theory.

Table 6.9 Rotated Component Matrix of Factor Analysis(**Primary)**

	Components							
	Production Cost Adherence	**High Quality Delivery**	**Training Effectiveness**	**Adherence to Production Plan**	**Match Between Planned T&A and Actual T&A**	**High Quality Capability**	**On Time and Timely Delivery**	**High Quality Inward Material**
Cost Adherence	0.67							
Efficient Material Utilization	0.66							
High Order Fulfillment	0.65							
Optimum Material Inventory Level	0.59							
Production Cost Efficiency	0.51							
Optimum Unit Cost	0.48							
Reduced Claim and Discounts		0.69						
On Time (High Quality) at Delivery		0.61						
On Time Shipment		0.57						
Short Change Over Time		0.47	-0.33					
High Capacity Utilization			0.76					
High Operator Training Effectiveness			0.46	-0.33				
Improved Vendor Development Capability				0.80				
Adherence to Production				-0.49	0.44			
Match Between Planned T&A and Actual T&A					0.79			
High Quality Capability						0.86		

On Time and Timely Delivery							0.80	
Short Sample Conversion Rate							-0.40	
High Quality Inward Material								0.85
Low Transit Time								-0.43
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.								
a. Rotation converged in 19 iterations.								

The factor analysis has grouped/reduced 20 different practices under 4 broad dimensions in to 8 components/sub group with different priority those influence the efficiency of Supply Chain Management. Each component/sub group has grouping/collection 1 to 6 practices under them.

In order to reduce the number of indicators (dimension) to understand the efficiency of SCM practice in the organizations more specific way we have imparted the exploratory factor analysis. We started with 20 observed indicators and reduced these into 8 latent factors based on the internal homogeneity of the responses of the respondents. Based on the magnitude of the correlation coefficient and the pull of observed variables that come under the same factor we have given a name of each of the factors. These newly identified factors are well expressive and concise to get idea about the efficiency of the SC practice in the studied organizations.

First factor comprises of six observed variables namely, Cost Adherence, Efficient Material Utilization, High Order Fulfillment, Optimum Material Inventory Level, Production Cost Efficiency and Optimum Unit Cost. After studying the nature of these variables it reflects that it relates with the production cost and adherence and accordingly we put 'Production Cost Adherence' as the name of the factor. The test result suggests that this is the priority 1 factor that influences or affects the efficiency of Supply Chain Management performance. If this factor is taken good care of, then the efficiency of SCM of any garment company would definitely improve. Again within the six observable variables, Cost Adherence has the highest coefficient value which is 0.67 implies that this is the most important contributing variable for improving SCM efficiency. Second factor 'High Quality Delivery' is comprised of Reduced Claim and Discounts, On Time (High Quality) at Delivery, On Time

Shipment and Short Change over Time. However, within these practices Reduced Claim and Discount is most important than others which affects the Efficiency of Supply Chain Management.

The third most important factor is 'Training Effectiveness' which comprised of the practices Short Change over Time, High Capacity Utilization, High Operator Training Effectiveness. Each of the practices has different degree of importance in influencing the efficiency of SCM. Here in this factor the most important influence in practice is High Capacity Utilization with highest coefficient value of 0.76. The fourth factor is 'Adherence to Production Plan' which has three practices including High Operator Training, Effectiveness Improved Vendor Development Capability and Adherence to Production. This factor has been ranked as fourth priority in terms of contributing to improving the efficiency of Supply Chain Management. Improved vendor development practice has the highest coefficient factor of 0.80 implying that this practice is the most important practice that influences the efficiency of Supply Chain Management of RMG sector.

In the same way, the fifth most important factor that influences the efficiency of Supply Chain Management is Match between Planned T&A and Actual T&A which s consisted of only two practices including Adherence to Production and Match between Planned T&A and Actual T&A. However the most important practice in this factor is 'Match between Planned T&A and Actual T&A' with largest coefficient value of 0.79. The sixth important factor that influences the efficiency is High Quality Capability. This factor is comprised of only one practice basing on which the factor has been named. The next factor which influences the efficiency is On Time and Timely Delivery and comprised of two practices namely On Time and Timely Delivery and Short Sample Conversion Rate. Points to note that in this factor On Time and Timely Delivery is the most important contributing factor with the relatively highest coefficient factor of 0.80. The last but not the east factor is High Quality Inward Material which is also comprised of two practices including High Quality Inward Material and Low Transit Time. Here in this factor High Quality Inward Material practice is the most contributing factor to efficiency of Supply Chain Management. Result of ANOVA test is shown in table 6.10.

Table 6.10 Analysis of Variance (ANOVA)(**Primary)**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	29163.721	8	3645.465	1040.003	.000[b]
	Residual	1367.046	390	3.505		
	Total	30530.767	398			

a. Dependent Variable: SCM_Efficiency

b. Predictors: (Constant), REGR factor score 8 for analysis 1, REGR factor score 7 for analysis 1, REGR factor score 6 for analysis 1, REGR factor score 5 for analysis 1, REGR factor score 4 for analysis 1, REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1

6.3 Efficiency Measurement of SCM

As it is very difficult to measure the exact level of efficiency of SC practice in the organizations by means of observe variables because there are numerous factors visibly and invisibly associate with this level efficiency. But to see the effect of the indicators on the overall practice of SC we needed a measure of the efficiency of SC. As we have the responses on the different practices of SC, so, we constructed an index of efficiency based on the weighted sum of the responses of all the indicators. This variable we have taken as proxy of supply chain efficiency and the dependent variable of the study. After conducting the factor analysis where we found eight contributing latent factor comprising of different numbers of practices it will be interesting to know the degree and direction of relationship of each contributing factor with dependent variable SCM_Efficiency.

It is to be noted that as the responses are qualitative in nature it will be rarely possible to interpret with exact cause and effect relationship between dependent and independent variables. The regression analysis shown in table 6.11 confirms the findings of the factor analysis. In this regression analysis we also find that factor 1 ‘Production Cost Adherence’ has the highest coefficient value of 6.455 whereas the eighth factor ‘High Quality Inward Material’ has the lowest coefficient value. The results also suggest that other than the last factor, the relationship of all other factors

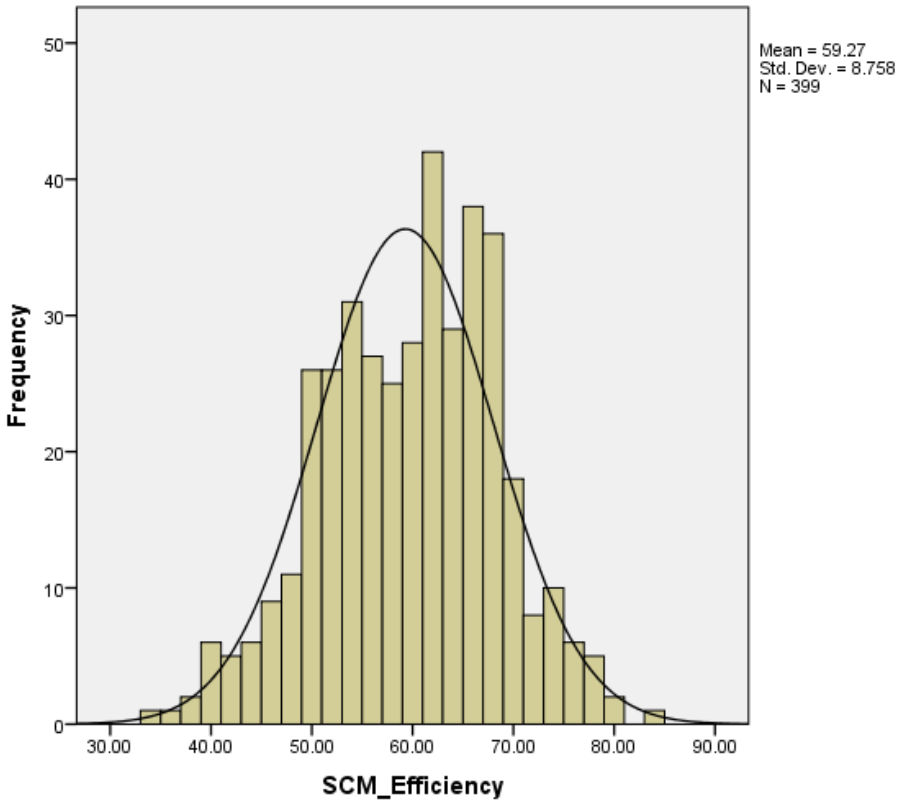
to the dependent variable is statistically significant. The reason for this insignificance of high quality inward material can be that the quality of inward material is determined according to the choice of the buyers. RMG companies have no much control over this variable. They are always required to provide the quality they have been asked for otherwise entire order can be cancelled. On the other hand, RMG companies have mentionable control over other variables which lead those variables to be significant in ensuring SCM efficiency.

SCE= f(Latent Factors)

SCE=59.27 +6.46 Production Cost Adherece+4.60 High Quality Delivery
+1.44 Training Effectiveness+0.65 Adherence to Production Plan
+2.43 Match between Planned T & A and Actual T & A
+1.16 High Quality Capability+0.58 on time and Timely Delivery
+0.02High Quality Inward Material

Table 6.11 Result of Regression Analysis(**Primary)**

Supply Chain Latent Indicators	**Unstandardized Coefficients**		**t-statistic**	**p-value**
	B	**Std. Error**		
(Constant)	59.271	.094	632.364	0.000
Production Cost Adherence	6.455	.094	68.785	.000
High Quality Delivery	4.640	.094	49.447	.000
Training Effectiveness	1.437	.094	15.315	.000
Adherence to Production Plan	.649	.094	6.920	.000
Match Between Planned T&A and Actual T&A	2.430	.094	25.894	.000
High Quality Capability	1.158	.094	12.342	.000
On Time and Timely Delivery	.581	.094	6.191	.000
High Quality Inward Material	.016	.094	.168	.867



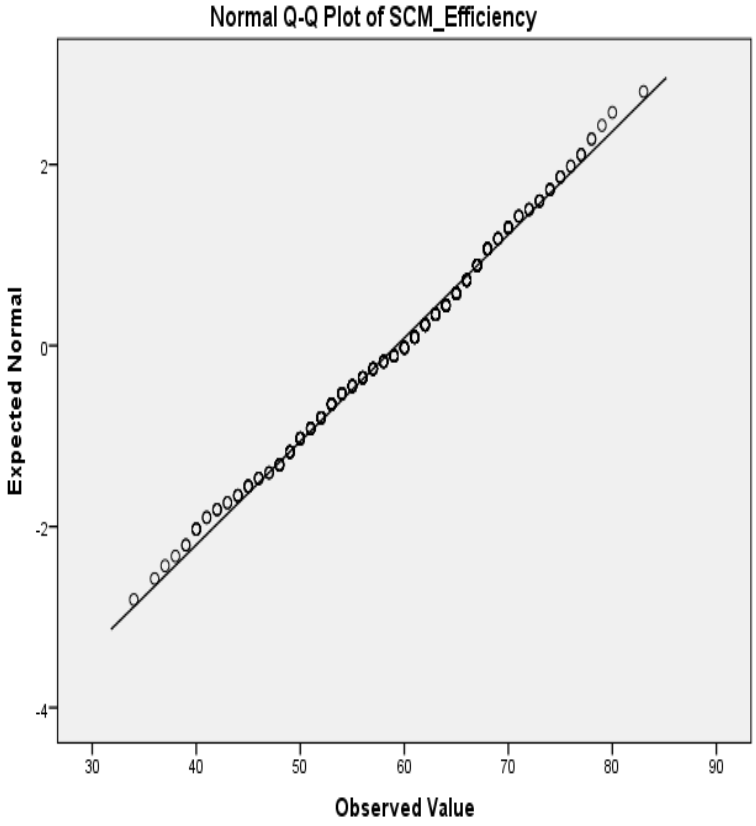


Fig. 6.1 Test for Normality (Primary)

6.4 Overall Efficiency Distribution

Considering all operational Domains, my company has efficient SCM Practice

Table 6.12 Result Efficient SCM Practice in Organization(**Primary)**

Categories of responses	Frequency	Percent
Strongly Disagree	24	6.0
Disagree	150	37.6
Neutral	90	22.6
Agree	110	27.6
Strongly Agree	25	6.3
Total	399	100.0

We train our managers, technicians, workers to manufacture new & upcoming fashionable and sophisticated items to increase manufacturability (production efficiency & quality)

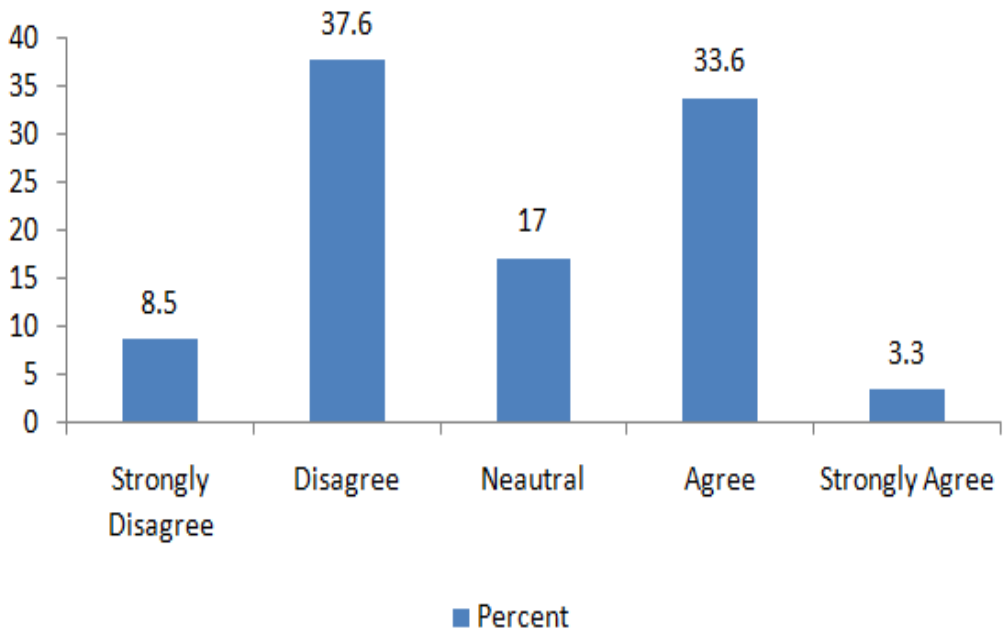


Fig. 6.2Training of Employees to increase manufacturability (Primary)

Respondents were asked whether they train their managers, technicians, workers to manufacture new and fashionable and sophisticated products to increase

manufacturability. As shown in Fig. 6.2, Majority of the respondents replied that the state of providing training is not very up to the mark. The factories still have workers with low productivity and continuing the production with unskilled workers. In general companies are reluctant in training their work force for improving the productivity. Here, manufacturer's most focuses on repeat business with same buyers with same kind of products. They are not very interested in trying with newer designs of product with the anticipation that they might lose the business. However, if companies need to remain competitive there is short cut to trained personnel.

We procure and use new & sophisticated machineries to improve the chance to win orders from buyers.

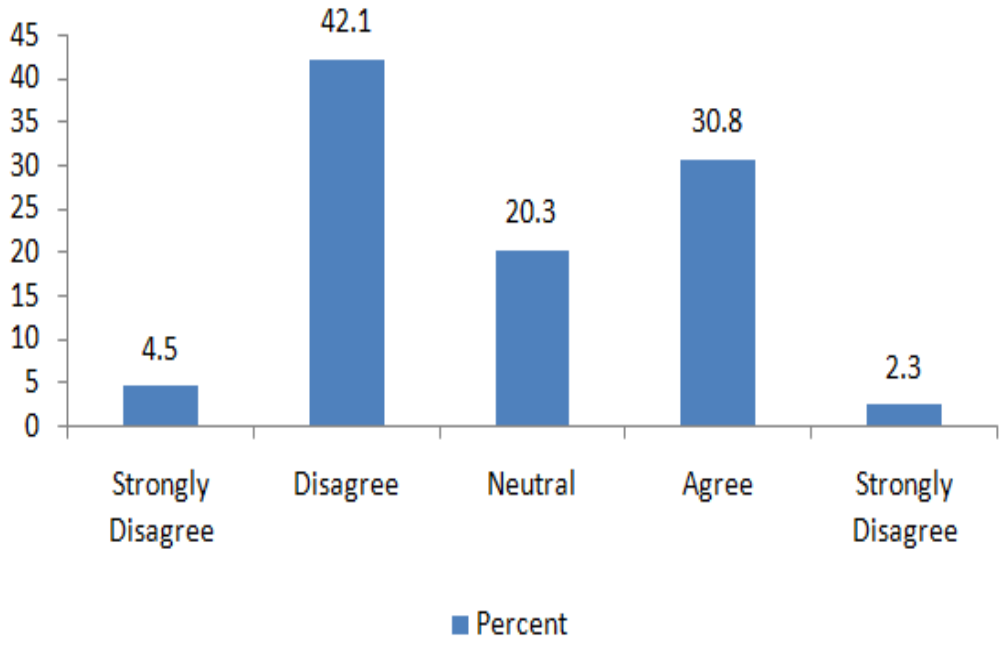


Fig. 6.3Procurement of Machineries to Win Orders (Primary)

In the present era of competiveness, companies must win orders from buyers. They Buyers preference are changing with the passage of time. In order to increase productivity, apart from having trained personnel in the company, the company must purchase new machines and technology so that they can keep pace with the change. Bangladesh is now facing intense competitions from many RMG products producing countries. Companies must win orders from buyers to sustain the business. The survey result (Fig. 6.3) shows that the state of procuring new technology and machines is not very satisfactory. Essentially companies are not very eager in buying

new technologies and machines instead they want to maximize their profit with existing or less investment in capital machineries.

Table 6.13 Result of Requirements of Buyers(**Primary)**

Descriptive Statistics		
	N	**Mean**
Importance of Lead time	399	4.8647
Importance of Quality Improvement	399	4.2080
Importance of Cost Minimization	399	4.2757
Importance of Timely Shipment	399	4.3133
Importance of Sophisticated Item	399	3.1278
Valid N (list wise)	399	

This question looks for the answer on how buyers' preferences are changing over the period. The RMG products are very much time sensitive. Low cost will not ensure business for the companies these days. Buyers' preferences are changing over the period. The result in table 6.13 shows that buyers are giving more importance on lead time reduction. They prefer manufacturers those can deliver products in shorter lead time. Lead time has become most important factor in selecting the supplier of their demanded products. Timely shipment by the suppliers has been placed in second position while selecting the suppliers followed by cost minimization. Actually RMG business is becoming more challenging because buyers look for shorter lead time, time shipment by the suppliers, cost reduction, innovative products, ability of ensuring all these is not a very easy task. Bangladesh RMG sector needs to increase the overall capability of the entire industry so that they can meet up the changed preference of the buyers. Here actually comes the importance of developing backward linkage.

Table 6.14 Result of Practices for Changing Requirement in Future(**Primary)**

	N	**Mean**
Training of human resource	399	3.2281
Using IT	399	3.1378
Working together with buyers	399	2.6967
Working together with suppliers	399	2.7970
Installing new machineries	399	2.6591
Improving production process and efficiency	399	2.9123
Valid N (listwise)	399	

The next question was asked is what measures the RMG companies are taking in meeting very demanding requirement of the buyers. Six different measures were identified and responses were taken against those measures. The analysis suggests that the initiatives taken by the companies are not very praiseworthy. However, within the few measures so identified, from table 6.14 it can been that the companies are focusing on providing training to the people working for the companies. It is said that technology makes things possible but the human being makes it happen. So companies must not undermine the requirement of trained personnel in order to improve the overall productivity of the company. The sector rightly pin pointed their priority of training its personnel for remaining competitive in the global market. They are also putting right emphasis on using IT in improving their competitiveness. From the analysis it can be argued that, the sector is in right track in order to meet the future challenge thrown by the buyers.

Table 6.15 Result of Practices for Process Integration(**Primary)**

	N	Mean
Provide related information to your suppliers on time	399	2.8647
Provide feedback information to buyers	399	3.0877
Work together with buyers to improve quality, efficiency	399	3.9073
Work together with suppliers to improve quality, efficiency	399	3.3033
Valid N (list wise)	399	

Process integration refers to seamless coordination amongst all the value adding parties so that there is no unnecessary motion of people, materials etc. Process integration reduces waste of all kinds and reduce the cycle time required for manufacture the finished products. There were four measures identified for better process integrations and respondents were asked to put their response against each practice. It has been seen in table 6.15 that the practice of working together with buyers in an attempt of improving quality and efficiency is very satisfactory followed by the practice of working with suppliers for all the inputs for meeting the delivery time schedule and quality.

Table 6.16 Result of Coordination as Part of Collaborative Planning(**Primary)**

Collaborative Planning of SCM (Coordination)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	9	2.3	2.3	2.3
	Disagree	162	40.6	40.6	42.9
	Neutral	133	33.3	33.3	76.2
	Agree	75	18.8	18.8	95.0
	Strongly Agree	20	5.0	5.0	100.0
	Total	399	100.0	100.0	

Collaborative planning within all the parties involved in the production and distribution process enhances the SCM performance of any company. Having a coordination team in the factory increases the performance level of SCM. Respondents were asked to what extent they have a centralized coordination team which is responsible for coordinating necessary activities with all SCM parties. Table 6.16 shows that almost 77% of the respondents responded that they don't have a team of this nature or the level of practice of coordination amongst all concerned is not very satisfactory. It clearly indicates that this dimension of collaborative planning is not well practiced sample companies.

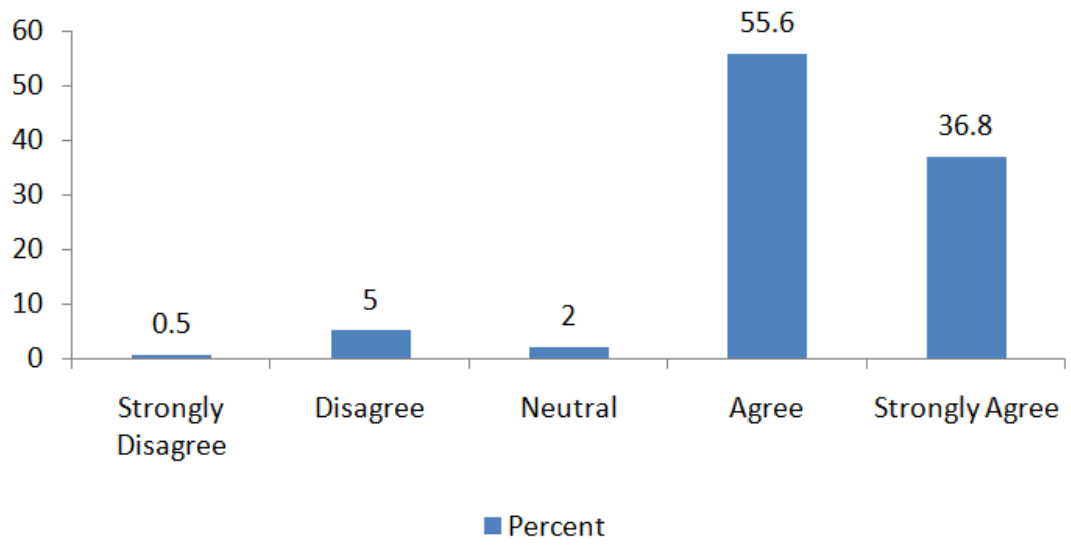


Fig. 6.4 Product Design as Part of Collaborative Planning (Primary)

The second measures of collaborative plan was whether buyers share required information timely while there is a change on product design. 93% respondents told that the information sharing takes place between buyers and manufacturers in the

event of change in product design (Fig. 6.4). This measure of collaborative is well practices in Bangladesh RMG industries.

Table 6.17 Result of Seasonal Demand as Part of Collaborative Planning(**Primary)**

Collaborative Planning of SCM (Seasonal Demand)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	4	1.0	1.0	1.0
	Disagree	16	4.0	4.0	5.0
	Neutral	47	11.8	11.8	16.8
	Agree	144	36.1	36.1	52.9
	Strongly Agree	188	47.1	47.1	100.0
	Total	399	100.0	100.0	

Table 6.17 shows that in case of seasonal products and their associated demand buyers usually communicate with manufacturers. This is very good that there is an efficient flow of information regarding the seasonal demand of the RMG products which facilitates manufacturers in planning well in advance.

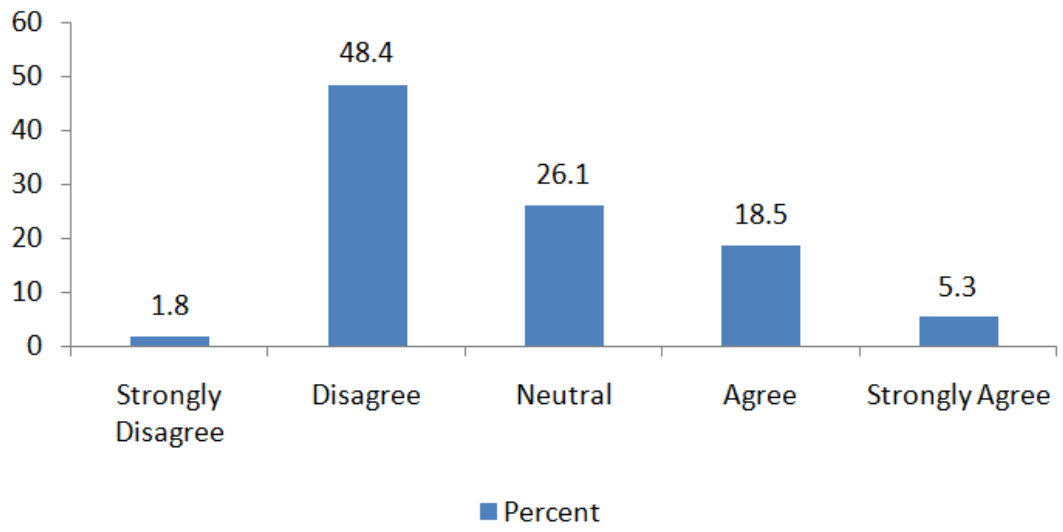


Fig. 6.5Productions Status from Buyers to Suppliers as Part of Collaborative Planning (Primary)

But the situation from manufacturer's side regarding efficient flow of information on progress of production is not very satisfactory. 76% of the respondents opined that the flow of information requires much improvement (Fig. 6.5).

Table 6.18 Result of Productions Status from Suppliers to Buyers as Part of Collaborative Planning**(Primary)**

Collaborative Planning of SCM (Productions Status from Suppliers to Buyers)					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strongly Disagree	4	1.0	1.0	1.0
	Disagree	122	30.6	30.6	31.6
	Neutral	228	57.1	57.1	88.7
	Agree	37	9.3	9.3	98.0
	Strongly Agree	8	2.0	2.0	100.0
	Total	399	100.0	100.0	

Table 6.18 signifies thatssuppliers also do not practice the efficient flow of information regarding their progress of production to the buyers. This is not very expected practice because it hampers the practice of collaborative planning by the companies.

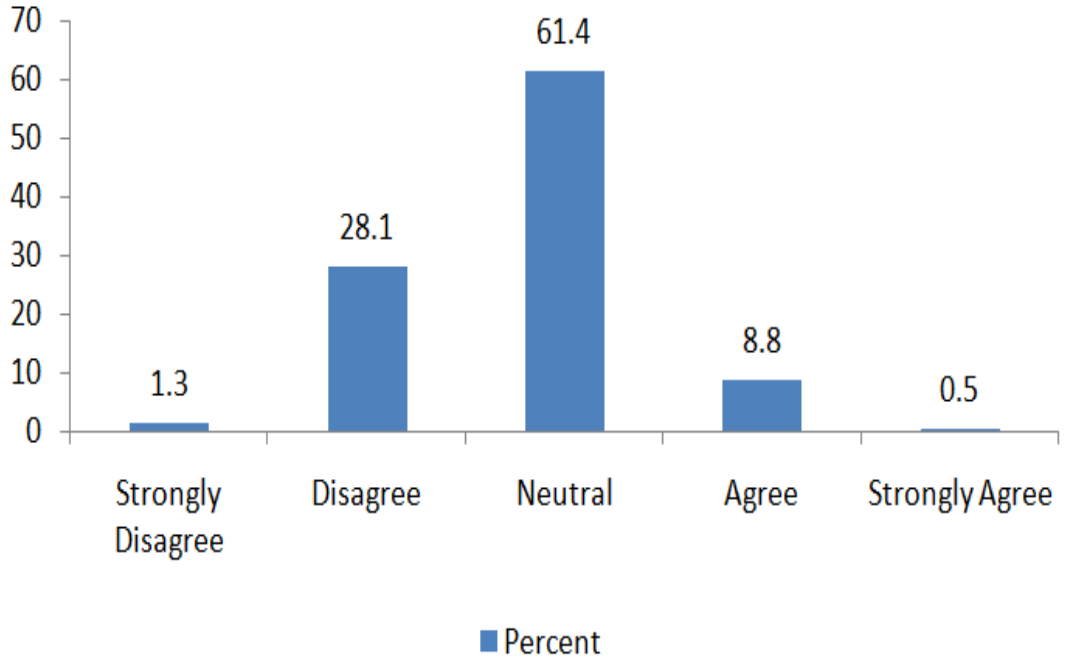


Fig. 6.6Product Design Change as Part of Collaborative Planning (Primary)

From Fig 6.6 it can be interpreted that the practice of sharing efficient information flow between buyers and suppliers are also not very promising. Here there is serious lacking in sharing required information any change in product design or product specification.

Table 6.19 Descriptive Statistics of Practices for Collaborative Planning**(Primary)**

	N	**Mean**	**Grand Mean**	**Std. Deviation**	**Grand SD**
Coordination in Collaborative Planning	399	2.84		0.93	
Product Design in Collaborative Planning	399	4.23		0.76	
Seasonal Demand in Collaborative Planning	399	4.24	3.28***	0.88	0.81
Buyers productions status in Collaborative Planning	399	2.77		0.95	
Suppliers productions status in Collaborative Planning	399	2.81		0.69	
Product Design Changed in Collaborative Planning	399	2.79		0.63	
Valid N (list wise)	399				

*** significant at 1% level

The descriptive statistics on the responses against all six dimensions of collaborative plan has been given in table6.19. The grand mean is found 3.28. The test result shows that the level of practice of collaborative plan by the Bangladesh RMG companies is not satisfactory. The observed value (3.28) is significantly different from hypothesized value of 3.5.Bangladeshi RMG companies to become competitive; use of collaborative plan should be improved.

Table 6.20 Result t-statistic of Collaborative Planning**(Primary)**

Mean	**Standard error**	**t-statistic**	**P-value**
3.38	0.041	-2.95	0.000

Comment: Table 6.20shows that collaborative practice level is significantly below than the considered hypothesized mean level of practice (3.50).

Table 6.21 Correlation Analysis of Collaborative Planning**(Primary)**

	Coordination	**Design**	**Seasonal demand**	**Productions status**	**Productions status**	**Product design changed**
Coordination	1					
Design	.128*	1				
Seasonal demand	.211**	.255**	1			
Productions status (suppliers to Buyers)	.820**	.122*	.240**	1		
Productions status (buyers to Suppliers)	.559**	.142**	.207**	.543**	1	
Product design changed	.368**	0.08	.253**	.337**	.287**	1
*. Correlation is significant at the 0.05 level (2-tailed).; **. Correlation is significant at the 0.01 level (2-tailed).						

The bivariate correlation analysis between the measures of collaborative planning in table 6.21 indicates that the practice of one measure positively triggers another practice.

Table 6.22 Result of the Causes of Shipment Uncertainty**(Primary)**

	Mean	**Rank**
Production Efficiency	3.57	1
Sophisticated Items	3.18	3
Suppliers Distance	2.89	6
Sewing Quality	2.99	5
Poor Fabric	3.09	4
Collaborative Buyers Suppliers	3.36	2
Valid N (list wise)		

This study attempted to find out the causes with priority for shipment uncertainty regarding quantity, quality and shipment date. The findings in table 6.22 suggest that lack of production efficiency and productivity as the number one cause

with mean value of response of 3.57. Distance between suppliers and factory has been rated as the last rank with mean value of response of 2.89.

Table 6.23 Result of the Challenges of SCM in RMG**(Primary)**

Challenges	Mean	Std. Deviation	Freq with Highest Priority	Ranks
Lack of Workplace Safety	1.39	0.55	254	1
Unavailability of Raw Materials	2.33	0.93	63	2
Inefficiency of the Workers	3.75	0.92	11	3
Political Instability in the Country	3.82	2.11	45	4
Labor Unrest in the Sector	4.67	1.2	12	5
Lack of Training of Personnel	6.64	1.05		6
Incompetent Ports Entry in the Country	7.93	0.96		7
Unacceptable Load-Unload Time	8.15	2.62	6	8
Inefficient Custom Clearance Process	8.35	2.47	13	9
Poor Govt Policy on Sector	8.54	0.89		10
Diesel and Power Crisis	12.09	1.88	1	11
Insufficiency of Loan	12.9	1.29	2	12
Lack of Marketing Tactics	13.09	1.02		13
Autocratic Managers Approach	13.22	2.01		14
Inadequate Blending Procedure	13.23	1.92		15

A total 15 different challenges of implementation of SCM in RMG sector have been pin pointed after carrying out in depth interview with Garments owners, BGMEA officials, and SCM professionals. Ranked data were collected from the respondents and statistical analysis was made.In table 6.23 and table 6.24,itcan be observed that Safety issue for the RMG sector has been identified as the number 1 challenge for the efficient implementation of SCM with 254 respondents identified this to be highest priority. Inadequacy or dependency on imported raw materials have

been identified as 2nd challenge and political crisis and custom clearance processes have identified as 3rd and 4th challenge for efficient implementation of SCM in this sector. Labor unrest and inefficiency of labor forces in the RMG sector has been identified as 5th and 6th challenge for implementation of SCM. Loading and unloading in the port, insufficiency of loan and power crisis have been identified as 7th, 8th and 9th challenges. Rests of the ranks with frequency against each reason have been provided in the table.

Table 6.24 Score Obtained by SCM Challenges**(Primary)**

SCM Challenges	Mean	Std. Deviation	Score Obtained	Freq with Highest Priority	Rank
1. Lack of Workplace Safety	1.39	0.55	554	254	1
2. Unavailability of Raw Materials	2.33	0.93	928	63	2
3. Inefficiency of the Workers	3.75	0.92	1496	11	3
4. Political Instability in the Country	3.82	2.11	1524	45	4
5. Labor Unrest in the Sector	4.67	1.2	1865	12	5
6. Lack of Training of Personnel	6.64	1.05	2651	-	6
7. Incompetent Ports Entry in the Country	7.93	0.96	3165	-	7
8. Unacceptable Load-Unload Time	8.15	2.62	3251	6	8
9. Inefficient Custom Clearance Process	8.35	2.47	3331	13	9
10. Poor Govt Policy on Sector	8.54	0.89	3409	-	10
11. Diesel and Power Crisis	12.09	1.88	4523	1	11
12. Insufficiency of Loan	12.9	1.29	5146	2	12
13. Lack of Marketing Tactics	13.09	1.02	5223	-	13
14. Managers Autocratic Approach	13.22	2.01	5274	-	14
15. Inadequate Blending Procedures	13.23	1.92	5279	-	15

Fig. 6.7 shows the number of respondents put particular barriers of efficient implementation of SCM in the industry:

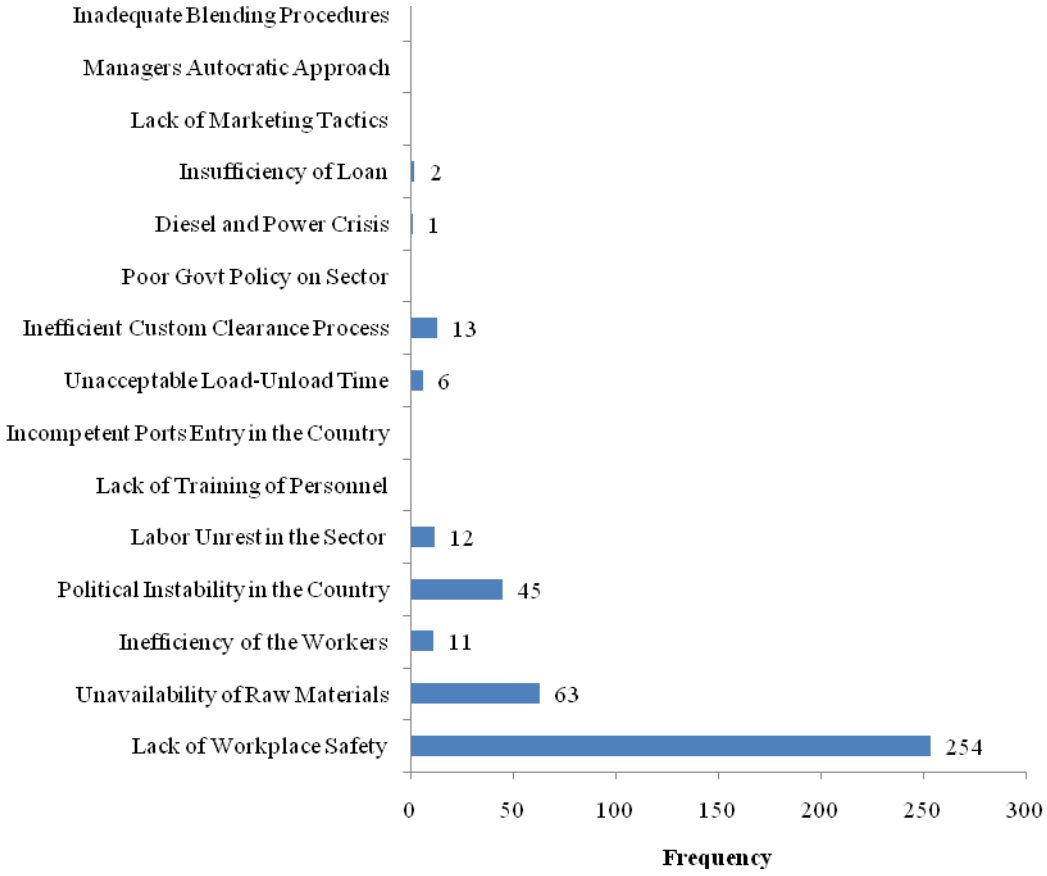


Fig. 6.7 Frequency of Challenges with Highest Priority **(Primary)**

Table 6.25 containts total score obtaied by the challenges. This is calculated by summing up individual score given by the resepondants.

Table 6.25 Ranking of SCM Challenges by Score**(Primary)**

Ranks	Challenges of Implementation of SCM	Score Obtained
i.	Safety and Compliance Issue	554
ii.	Unavailability of Raw Materials	928
iii.	Inefficiency of Workers	1496
iv.	Political Crisis	1524
v.	Labor Unrest	1865
vi.	Lack of Training Organizations	2651
vii.	Incompetent Ports, Entry/Exit Complicated	3165
viii.	Loading/Unloading Takes Much Time	3251

Table 6.25 Ranking of SCM Challenges by Score**(Primary)**

Ranks	Challenges of Implementation of SCM	Score Obtained
ix.	Time-Consuming Custom Clearance	3331
x.	Poor Government Policy	3409
xi.	Diesel & Power Crisis	4523
xii.	Insufficiency of Loan by Financial Institutions	5146
xiii.	Lack of Marketing Tactics	5223
xiv.	Autocratic Approach of Managers	5274
xv.	Sluggish Backward or Forward Blending Procedure	5279

6.5 Procedure for Obtaining Result

In order to find out whether there is any association in the rankings or not Kendall Coefficient of Concordance (W) has been applied. A toal 15 challenges for efficient implementation of SCM in the RMG sector have been identified after the in depth interview with RG professionals. The ranks put by the respondents under each challenge/factor have been added. The column with lowest value would be ranked first and column that gets the highest value will be ranked last. According to the analysis, the first rank is the most important whereas last rank is least important. Next the average ranks of each column were computed. The following formula has been used for finding out the value of Kendall coefficient of concordance:

$$W = \frac{\sum_{i=1}^{n}(\acute{R} - R)^2}{N(N^2-1)/12} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where:

W = the degree of association among the 50 respondents in ranking 16 factors

$\acute{R}_i$= the average of the ranks assigned to the ith Cause.

R =the average (or grand mean) of the ranks assigned across all causes.

N = Number of causes being ranked.

K = number of respondents.

$N(N^2-1)/12$ = maximum possible sum of the squared deviations, i.e. the numerator which would occur if there were perfect agreement among the K respondents.

χ^2 (chi-square)= K (N – 1) W, at (N-1) degree of freedom

Results:

W = 0.0.8744

$\chi^2 = 399(15-1)\ 0..8744 = 4884.39$

Although equation (1) shows the intuitive rational for the statistics of W, a somewhat simpler formula may be used. This formula is,

$$W = \frac{12^2 - 3K^2N(N+1)^2}{K^2N(N^2-1)} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

$$W = \frac{12(192243077) - 3(399)^2 15(15+1)^2}{(399)^2(15)(15^2-1)}$$

W =0 .8744 (observed value).

The critical value of χ^2 at 14 degree of freedom and at 0.001 level of significance is 37.70 indicating that the H_o is rejected. It means that the alternative hypothesis (H_1) is accepted meaning that there is good association among the ranks of causes of poor implementation of SCM in RMG sectors of Bangladesh and the association is significant at 0.001 level of significance.

Table 6.26 shows that fifteen causes were ranked by the respondents, those are affecting efficient implementation of SCM in Bangladesh RMG sector. Safety and Compliance issue was the most important factor with a score of 554 and it became the first rank. Sluggish Backward or Forward Blending Procedure was the least important cause and it became last rank with the score of 5279.

Table 6.26 Process of Obtaining Result**(Primary)**

Respondents	**I**	**ii**	**iii**	**iv**	**V**	**vi**	**vii**	**viii**	**ix**	**x**	**xi**	**xii**	**xiii**	**xiv**	**xv**	**Total**
1	1	3	2	12	4	5	3	13	6	11	15	8	10	9	7	120
2	1	12	5	12	4	2	3	13	6	11	15	8	9	10	7	120
3	1	15	4	13	3	2	5	14	6	12	6	7	10	9	8	120
4	2	14	1	13	3	5	4	12	7	15	11	8	6	10	9	120
5	1	14	2	12	4	5	3	13	7	11	15	8	6	10	9	120
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
395	1	13	2	14	5	6	3	12	7	15	11	9	4	8	10	120
396	2	10	3	12	4	5	11	14	7	15	12	12	1	8	9	120
397	2	14	1	13	5	4	3	12	6	3	15	7	11	8	9	120
398	1	10	2	14	3	4	8	13	5	15	12	11	7	6	9	120
399	2	12	3	13	5	6	1	14	9	11	15	7	4	10	8	120
Ri	554	4823	928	5146	1496	1865	1524	5223	2651	5274	5279	3165	3251	3331	3409	47919
Average Ri (ARi)	1.39	12.05	2.32	12.86	3.74	4.66	3.81	13.05	6.62	13.18	13.19	7.91	8.12	8.32	8.52	119.80
Grand Average **(R)**	**7.98**															
(ARi-R)*(ARi-R)	43.76	16.46	32.26	23.67	18.15	11.14	17.64	25.58	1.88	26.88	27.01	0.01	0.02	0.11	0.27	244.84
Ranks	1	11	2	12	3	5	4	13	6	14	15	7	8	9	10	
W	**0.8744**															
Ri*Ri (0000)	3	2326	86	2648	224	348	232	2728	703	2782	2787	1002	1057	1102	1162	19224
W	**0.8744**															

An effort has been taken to analyze the SCM efficiency of the sector taking all the independent variables including plan, source, make, deliver, collaborative plan, measures for process integration, training of workers etc. The descriptive statistics and regression output of the model have been summarized in table 6.27.

Table 6.27 Overall Measurement of SCM Efficiency**(Primary)**

Descriptive Statistics			
	Mean	Std. Deviation	N
SCM_Efficiency	59.2707	8.75845	399
SCM_Make_Total	14.0852	2.76605	399
SCM_Plan_Total	13.9248	3.22745	399
SCM_Deliver_Total	15.4110	3.42419	399
Total_Collaborative	19.6842	3.19084	399
Total_Measures	30.5940	3.99693	399
Managers_Tachnicians_workers	2.8546	1.07923	399

Regression output of the model is shown in table 6.28.In regression shown in table 6.11, the relationship of SCM efficiency with different key performance indicators (KPI) has been studied. In this regression, the impact of various significant operational domains on SCM efficiency is explored. The regression model suggests that SCM efficiency is significantly influenced by Plan, Source, Make and Deliver. Collaborative planning, measures for Process integration and training for workers also influence the efficiency but not statistically significant.

Table 6.28 Regression Results of SCM Efficiency (Primary)

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.96[a]	.92	.91	2.58	2.35
a. Predictors: (Constant), Managers_Tachnicians_workers, SCM_Deliver_Total, Total_Collaborative, Total_Measures, SCM_Plan_Total, SCM_Make_Total					
b. Dependent Variable: SCM_Efficiency					

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B*	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.49	1.55		4.846	.00		
	SCM_Make_Total	1.25	0.05	.395	23.34	.00	.76	1.32
	SCM_Plan_Total	1.06	0.05	.392	23.26	.00	.77	1.33
	SCM_Deliver_Total	1.14	0.04	.444	25.94	.00	.74	1.35
	Total_Collaborative	0.04	0.04	.015	.10	.32	.99	1.01
	Total_Measures	0.05	0.03	.023	1.57	.12	.98	1.02
	Managers_Tachnicians_workers	-0.18	0.12	-.022	-1.48	.14	.98	1.02
a. Dependent Variable: SCM_Efficiency								

* The regression coefficient can be between -∞ and ∞ as mentioned by M. Nurul Islam in An Introduction to Statistics and Probability, 4th edition, Dhaka: Mullick & Brothers.

However, among the independent variables, Make has the highest impact (1.25) on supply chain efficiency followed by Deliver (1.14) and Plan (1.06). The lowest impact

can be observed for Collaboration which is 0.04. Fig 6.8 shows the test of normaly of this model.

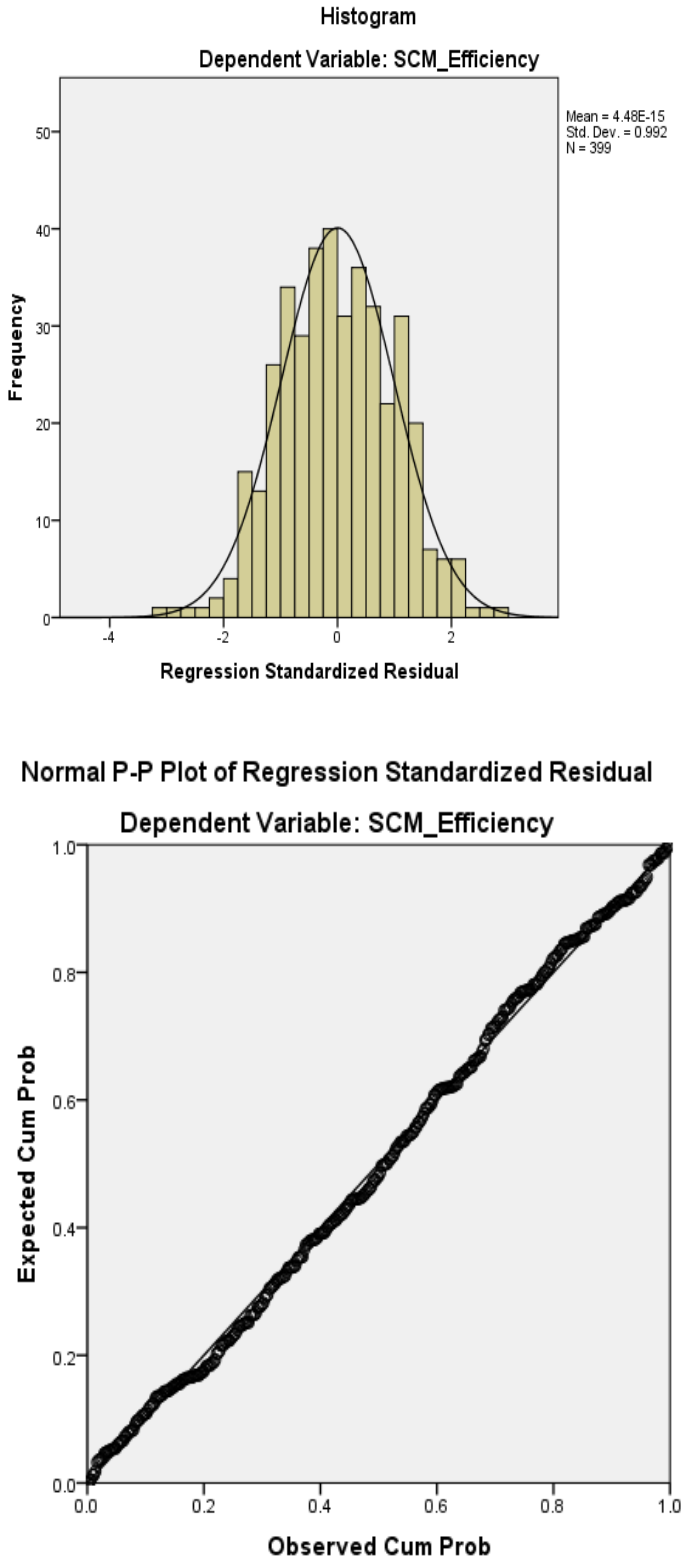


Fig. 6.8Test for Normality (Primary)

6.6 Case Study on Interfab Shirt Manufacturing Ltd (ISML)

Interfab Shirt Manufacturing Ltd (ISML) is the woven apparel business unit of VIYELLATEX group. The researcher has studied number of companies in depth to understand the practice of SCM in RMG industry of Bangladesh practically. From that study, it is found that ISML maintains a comprehensive process of supply chain management and has well-established performance indicators to measure their SCM efficiency. So, a case study of ISML would provide a complete picture of SCM practices in reputed RMG companies of Bangladesh.

ISML started its journey back in 1998. ISML has a highly dynamic, well trained, motivated and skilled workforce that meets the demands of its international premium customers such as Hugo Boss, Esprit, Calvin Klein, Tommy Hilfiger, M&S, DKNY, Olymp, and Tom Tailor. ISML has associations with prominent suppliers such as A & E, Wendler, etc. To ensure the highest level of quality, all products are manufactured using technologically advanced machinery imported from Europe and Asia.

ISML established the Ethical Model Factory project by Marks and Spencer, which led to over 10% increase in efficiency and significant reductions in the rate of grievance among other benefits. Furthermore, ISMl runs educational, social and free health care programs. It has also attained TUV Certification, FLO Trade certificate and Tyser Risk Management for Excellence in Safety over the years. It is also compliant as per GSP, ETI, BSCI and local law. Interfab Shirt Manufacturing received the BATEXPO 2013 award by BGMEA in the year 2013.The company also received "Supplier Excellence Award 2013" on 22nd February 2013 from buyer "WOOLWORTHS" South Africa. The award recognizes the strong performance of Interfab amongst other suppliers involved in the company's supply chain.

Maximizing resource utilization and minimizing costs are the driving forces towards ensuring that initiatives are economically viable. We are constantly driven to do more with less. Long term gains will always have preference over long term yields. So we always calculate how much return we are getting from the investment. Truly speaking we are ensuring sustainability through a profitable business. We can say that

the Servo Motor which we replaced with the conventional motors its payback was calculated within the two years and continuously it is ensuring the savings of energy.

VIYELLATEX Limited (VTL) is the composite knit apparel and textile manufacturing business unit of VIYELLATEX group. It started its journey in 1996. VTL is comprised of Design and Product Development, Sample, Knitting, Dyeing, Washing, Cutting, Sewing and Finishing sections. The Textile Testing Corporation (Testing Lab) is also a part of VTL. It caters to major buyers like Puma, S.Oliver, Espirit, Marks and Spencer, Sainsbury's, etc.

The products of VTL range from men's wear, ladies' wear and kids' wear. These are manufactured using technologically efficient machinery imported from Europe and Asian countries. VTL is FLO-Cert, ISO 14001: 2004, GOTS and Oeko-Tex certified among others. The state-of-the-art Textile Testing Corporation is accredited by Marks & Spencer and Puma. Furthermore, in collaboration with Marks & Spencer, VTL recruits and trains physically handicapped individuals to enable them to enter into the mainstream job. These employees have shown remarkable performances over time. All sustainable initiatives undertaken by VTL have been aimed towards ensuring social and environmental prosperity. Mutual agreement on deliverables performance measures of Interfab Shirt Manufacturing Ltd. is presented in table 6.29.

Table 6.29 Mutual Agreement on Deliverables Performance Measures**(Primary)**

Mutual Agreement on Deliverables Performance Measures – Interfab Shirt Manufacturing Ltd.						
A. Performance Measures "Metrics" *(Deliverables Drivers)*						
Impact	**Performance Measures "Metrics"**	**Area**	**U/M**	**Current**	**Future**	**Remarks**
Product Flow	Lead Time (15%)	Sewing	Minutes of any given style	634	120	30%
		Cutting		1342	700	
		Finishing		1783	300	
	Inventories & WIP (5%)	Stores	Pieces – Overall Factory	5247	N/A	48%
		Cutting		3560	3000	
		Sewing		1020	1020	
		Finishing		14475	3500	
		Finished Goods		22500	15000	
	Stock Turnover Ratio (5%)	Factory	Days	31.2	15	47%

	Cut to Ship Ratio (10%)	Factory	Percentage of quantity shipped vs. Cut	88%	95%	92%
Labor Utilization	Machine Breakdowns 10	Sewing	Plant Overall in Monthly Minutes	3625.14 Minutes	1600	44%
	Changeover (10%)	Sewing	Daily average Minutes per Worker per changeover	20.41 Minutes	8	40%
	Lack of Balancing Only the time related to idle workers "Waiting" (10%)	Cutting Room Processes	Daily average Minutes per Worker	91.91 Labor Minutes	20	21%
		Sewing Process		162 Labor Minutes	40	24%
		Finishing Process		208.13 Labor Minutes	60	28%
	Unnecessary Activities (3%)	Cutting Area	Minute/ pcs	.369	.10	17%
		Sewing Area	Minute/ pcs	3	.5	
		Finishing Area	Minute/ pcs	.758	.1	
	Right First Time (5%)	Sewing		86%	96%	89%
Cycle Time	Wasteful motions (2%)	Finishing	Minutes of studied style vs. Cycle Time	2.813	.5	18%
	Over processing (2%)	Handling in Sewing		1.098	0.25	23%
Space Utilization	Space per sewing machine (5%)	Factory Overall (650 Sew M/C)	SQFT	478	350	73%
Labor Issues	Absenteeism (3%)	Factory	Percentage	11.03%	3%	27%
	Labor Turnover (2%)	Factory	Percentage	5%	1%	20%

Table 6.30 highlights the key performance indicators (KPI) of Interfab Shirt Manufacturing Ltd.

Table 6.30 Key Performance Indicator**(Primary)**

Impact	KPI Value (%)	Weight
Lead Time	30	0.15
Inventories & WIP	48	0.15

Table 6.30 Key Performance Indicator**(Primary)**

Impact	KPI Value (%)	Weight
Stock Turnover Ratio	47	0.05
Cut to Ship Ratio	92	0.1
Machine Breakdowns	44	0.1
Changeover	40	0.1
Lack of Balancing Only the time related to idle workers 'Waiting'	24	0.1
Unnecessary Activities	17	0.03
Right First Time	89	0.05
Wasteful Activities	18	0.02
Over processing	23	0.04
Space per sewing machine	73	0.05
Absenteeism	27	0.04
Labor Turnover	20	0.02
Total Weight Assigned Based on Relative Importance		1
Overall Supply Chain Management Efficiency		**44.55**

6.7 Results of Hypothesis Testing

Results of hypothesis testing are presented in table 6.30.

Table 6.31 Result of Hypothesis Testing **(Primary)**

Hypothesis	Decision
H_{01} : The SCM practice of Bangladesh RMG sector is not efficient.	Accepted
H_{A1} : The SCM practice of Bangladesh RMG sector is efficient.	Rejected
H_{02} : The dimensions identified in SCOR Model of SCM are not independent.	Accepted
H_{A2} : The dimensions identified in SCOR Model of SCM are independent.	Rejected
H_{03} : RMG sector of Bangladesh doesn't use effective supply chain efficiency measurement model.	Accepted

H_{A3} :	RMG sector of Bangladesh uses effective supply chain efficiency measurement model.	Rejected
H_{04} :	Bangladesh RMG industry does not use collaborative SCM practices satisfactorily.	Accepted
H_{A4} :	Bangladesh RMG industry uses collaborative SCM practices satisfactorily.	Rejected
H_{05} :	All components of SCOR model used in measuring the supply chain efficiency in RMG sector of Bangladesh are not sufficient.	Accepted
H_{A5} :	All components of SCOR model used in measuring the supply chain efficiency in RMG sector of Bangladesh are sufficient.	Rejected

6.8 Conclusions

This chapter has provided a comprehensive data analysis based on the responses of the respondents collected through the formal questioner. Data on the existence of supply chain department, age of department, processes of SCOR model and related KPIs, process integration, collaborative planning, challenges of SCM implementation and others have been analyzed and presented using descriptive and inferential statistics.

Chapter-7

Discussions and Findings

7.1 Introduction

This chapter provides some discussions over the previous chapter and lists related findings. In discussion part mainly talks about the present condition of the RMG industry of Bangladesh and the level of SCM practices in this sector. The findings mostly focus on the results from data analysis. It incorporates discussion over SCOR model, collaborative planning for RMG, and challenges of SCM implementation.

7.2 Discussions

The Readymade Garment (RMG) Industry of Bangladesh has turned into the largest foreign exchange earning sector which is exporting all kinds of apparel to the USA, Europe and other developed countries of the world. The country started exporting apparel products in 1978, but the growth since the early 1980s has been simply extraordinary. The industry made a very unprecedented growth over the years even after going through different turmoil situation. There were conspiracies by different vested interested parties located both home and outside the country. Overcoming all the challenges faced from different corners, Bangladesh is world's second biggest apparel exporter country after China. The export of ready-made garments (RMG) from Bangladesh has been increasing rapidly for the last two decades.

Bangladesh started exporting RMG at an annual value of about US$32 million in 1983-84 but experienced a continuous massive growth in subsequent years. Bangladesh Government now has set $37 billion export target for 2016-17 fiscal year mainly depending on appeal sector (**BEPB, 2016)**. The export value of RMG was 76% of total export in 2008 and 80% in 2016 (**BEPB, 2016)**. The Readymade

Garments (RMG) Industry has become a mammoth industry for Bangladesh (**Shahriar et. al., 2014)**. It serves as the catalyst for the growth and development of the economy. The growth and ability to create employment opportunity especially for women is phenomenon. After the independence of the country in 1971, the country was one of the poorest in the world. The industry is the single biggest export earner for Bangladesh (**BGMEA, 2016)** which is contributing significantly in economic growth.

Bangladesh has a strong position in the global RMG market primarily because of its cheap labor cost. The MFA is quota system by the US federal government to support business from countries including Cambodia, Sri-Lanka, China, Kenya etc. with the aim of fostering their manufacturing capability and competitiveness. Bangladesh started facing more anticipated and unanticipated competition from many RMG producing nations after the MFA became obsolete in 2005 (**Asgari and Hoque, 2013)**. The market has become a truly open market for all participants. Presently, the Bangladesh RMG industry is struggling with cost, quality, customer service, and lead time.

Many recognized buyers of different countries in the world are conducting trading activities simultaneously with different countries of the world. This globalization has become order of the day as cheap labor is available in some part of the world whereas raw material is readily available in others. Moreover, many time demanding factor like the time, cost and quality sensitiveness are also highly varied among customers in different continents of the world. It can be argued that Bangladesh could be competitive through efficient implementation of integrated SCM. This competitiveness should be achieved by ensuring the required efficiency and responsiveness. Traditionally, all the companies used to strive for improving the efficiency of their own company leaving aside the different partners of the Supply Chain (**Poweret et. al., 2001)**. It means companies used to practice only quarter supply chain instead of extended supply chain. The extended supply chain concept considers an end to end process where it recognizes the Suppliers; supplier in the upstream and Customers' customers in the downstream. The country needs to improve productivity and implement efficient SCM in order to become competitive in the global apparel market.

The concept of SCM is not very old. The term was first articulated in a white paper back in only 1982. There are innumerous definitions for SCM. The term SCM has been defined from the respective perspective considering the requirement of the particular business organization in question. The primary focus of SCM is on cooperation, trust and confidence that ensures whole is greater than the sum of parts. SC is a term used internationally to encompass every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer (**Feller et. al., 2006)**. Four basic processes plan, source, make, deliver- broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels and delivery to the customers (**Lam and Postle, 2006)**.

On the other hand, SCM practices also widely vary from authors to authors; industry to industry. SCM ensures responsive customer service with reasonable cost removing all unnecessary business process from the system. Many argue that, the term Demand Chain Management is more appropriate as the entire concepts customer driven not the supplier driven. Moreover, many researchers have their observation on the word 'Chain'; they are more comfortable using the work network. In order to promote the supply chain excellence the company needs to improve both on Product excellence and Process excellence. Traditionally, product excellence used to be given more rarity over process excellence. In effect, the SC excellence can be considered as product both product and process excellence. The focus of SCM should be upon the relationship management in order to achieve more profitable out come for the parties involved in the chain. The SCM is required to improve the competitiveness of the organizations in the era of ever competitive world.

The company should strive for both cost and value advantage. Achieving any one of these two does not necessarily ensure the competitiveness. Company should achieve both simultaneously to remain in the high ground meaning to say that ensuring superior customer value with lesser cost. The company should analyze the value chain proposed by Michael Porter which will also assist implementing the efficient SCM for the organization. SC managers need to consider few principles including responsiveness, reliability, resilience and relationships for survival in this

competitive environment. Moreover, the SCM manager needs to ensure Just in Time (JIT), Total Quality Management (TQM), Lean Manufacturing, and Total Productive Maintenance (TPM) etc. He also needs to ensure JIT layout in order to reduce any unnecessary motion of people, material along the supply chain. Using appropriate technology is the hall mark for better organizational performance using the efficient SCM. Here optimum use of Enterprise Resource Planning (ERP), Manufacturing Requirement Planning (MRP I), Manufacturing Resource Planning (MRP II), Master Production Scheduling (MPS), Level Scheduling (Heijunka, Japanese vocabulary) is of utmost importance.

Procurement is a strategic variable in modern SCM concept. Through using Supply Positioning Model (SCM), Supplier Perception Model (SPM) and dynamics of understanding supplier-buyer relationship, managers can rightly prioritize the approach of dealing with supplier. It is very important to understand the kind of relationship; arms-length or collaborative those need to be achieved. These days SC managers need to take procurement decision not only based on price, Total Cost of Ownership (TCO) is more important now. SCM is an enormous topic covering multiple disciplines and employing many quantitative and qualitative tools. The twelve categories are commonly considered as domain of SCM; these are: location, transportation and logistics, inventory and forecasting, marketing and channel restructuring, sourcing and supplier management, information and electronic mediated environments, product design and new product introduction, service and after sales support, reverse logistics and green issues, outsourcing and strategic alliances, metrics and incentives, Global issues.

Many researchers have identified diverse practices of SCM ranging from Supplier Relationship Management, Customer relationship Management, Inventory Management, Quality Management, Lean Manufacturing, Reduction of Cycle Time etc. Donlon (**1996**) describes the latest evolution of SCM practices, which include supplier partnership, outsourcing, cycle time compression, continuous process flow, and information technology sharing. On the other hand, Tan et. al. (**1998)**used purchasing, quality, and customer relations to represent SCM practices. Alvarado and Kotzab(**2001)**included 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. Again, Tan et. al. (**2002)** identified 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 (**2004)**used supplier base reduction, long-term relationship, communication, cross-functional teams and supplier involvement to measure buyer–supplier relationships. Min and Mentzer (**2004)** identified 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 variety of different perspectives with a common goal of ultimately improving organizational performance. Li et. al. (**2005)** conducted a study taking five distinctive dimensions of SCM practices including: strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement to find out the relationship with organizational performance. The results indicate that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance. Competitive advantage can have a direct, positive impact on organizational performance.

The Council of SCM Professionals (CSCMP) (**2004)**, a leading organization promoting SCM practices, defines SCM as: "SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers". More importantly, supply chain management integrates and strikes a fine balance between supply and demand within and across companies. There are only few ACM practices have been studies in the context of RMG sector of Bangladesh. Majority of studies found that lead time for Bangladesh RMG is relatively longer comparing to other RMG manufacturing nations.

In Bangladesh RMG sector, few studies have been conducted where Lead Time Management, Productivity Management, Procurement management have been used as SCM practices. Kabir **(2007)**, Siddiqi **(2004)**, and Rashid **(2006)**mentioned that Bangladeshi garment companies are basically subcontractor and they are

producing the low value product in the market. They further argued that Bangladesh RMG companies are performing the functions of cutting, making and trimming (CMT) activities. The industry is highly import oriented. Where 90% of woven fabrics and 60% of knit fabrics are imported (**Rashid, 2006; Rahman and Anwar, 2006)**.The industry has very long and complex SC.BD has a lead time for apparel export between 90- 120 days, whereas the same for Sri Lanka is about 19-45 days, China 40-50 days and for India 50-70 days for similar products (**Rahman and Anwar, 2006; Kabir, 2007**).

Practice of SCM in the RMG sector of Bangladesh is not very satisfactory. Only 5 to 7% of the companies have a separate department of SCM. This is consistent with prior research findings. Actually, Bangladesh is involved only in the manufacturing part of the extended SCM process which has the least value addition. Bangladesh RMG does not involve in the forward linkage including retailing, distribution, research and development. Moreover, the industry lacks in vertical integration also. RMG industry is likely to face a serious challenge in the future if the domestic demand for raw materials such as fiber, yarn, fabric, trims and accessories cannot be supplied by the domestic market, Mohibullah et. al. (**2016**). Present study also has found similar state of backward linkage of the SCM for the industry. The backward linkages of the RMG sector are; spinning mill, weaving mill, knitting mill, fabric dyeing mill, printing mill, interlining and lining manufacturer, poly bag manufacturer, sewing thread manufacturer, zipper manufacturer, button manufacture, label manufacturer, embroidery factory, washing factory, elastic manufacturer, carton manufacturer, hanger manufacturer etc. Habib (**2016)** studied the state of backward linkages in the Bangladeshi readymade garments sector, and their appraisal and policy implications. The study discussed the scope and context of the backward linkage in terms of cotton, spinning, weaving and knitting, dying, printing and finishing, and accessories industries. Giri and Rai (**2013)** studied the dynamics of the garment SC in India. They studied the structure of the garments SC, from fiber production to retailing. They identified inventory management, visibility, lead time, collaboration, technology and logistics as major challenges for the Indian garments industry. The study used secondary data and recommended a strategic fit between customization and lean agility.

Haque et, al. (**2011)** presented a case study on the performance of the Bangladeshi apparel and textile supply chain network. The study presented SCM as a common tool for ensuring success of business organizations. They also stated that measurement of SC performance was required to understand just how successfully SCM had been implemented in a firm. The study used the SCOR model using five KPIs from each operational domain including plan, source, make and deliver. Chowdhury et. al. (**2014)**highlighted on the prospects and problems of the Bangladesh RMG industry and they that in order to remain successful, Bangladesh needed to remove or limit structural obstacles to transportation facilities, telecommunication networks, power supply, management of the seaport, utility services and the law and order situation. The study also suggested that the 'government and the RMG sector should work together to maintain competitiveness in the global RMG market.'

Asgari and Hoque (**2013)** provided a system dynamics approach of SCM performance analysis of the RMG industry of Bangladesh. They used few dominant variables of SCM including enablers, performance or results, and inhibitors for the study. They concluded that RMG industry is the largest earner of exports and foreign currency in Bangladesh, and the second largest contributor to gross domestic product for more than a decade. Moreover, they argued that the customers of the apparel fashion market are becoming more time-sensitive, demanding decrease in lead time, besides quality and cost criteria for. These all are required to win more orders from buyers in this competitive market.

Basing on the SCOR model four different distinct dimensions of SCM Practices namely Source, Plan, Make and deliver have been used for determining the level of efficiency of SCM in the industry. The mean of responses ranges from very low 2.38 to very high 4.17. However, the mean of responses under each dimension ranges between 2.78 in plan to 3.17 in source with grand mean of 2.96. One of the null hypotheses was that the efficiency level of practice of SCM was satisfactory with mean response value of minimum 3.5. But the test result suggests that the grand mean is 2.96 which is statistically significantly below than 3.5 that rejects the null hypothesis. Unfortunately there is no such study available where efficiency of SCM has been measured. Moreover this study also suggests that there are correlations exit

among these four dimensions meaning to say that should company wants to improve the efficiency of SCM, it needs to pay due attention in all these dimensions.

Twenty relevant factors have also been used for this study under four major dimensions. A factor analysis has been conducted in order to reduce the dimensions. We started with 20 observed indicators and reduced these into 8 latent factors based on the internal homogeneity of the responses of the respondents. Based on the magnitude of the correlation coefficient and the pull of observed variables that come under the same factor we have given a name of each of the factors. These newly identified factors are well expressive and concise to get idea about the efficiency of the SC practice in the studied organizations.

First factor 'Production Cost Adherence' comprises of six observed variables namely, Cost Adherence, Efficient Material Utilization, High Order Fulfillment, Optimum Material Inventory Level, Production Cost Efficiency and Optimum Unit Cost. The test result suggests that this is the priority 1 factor that influences or affects the efficiency of SCM performance. If this factor is taken good care of, then the efficiency of SCM of any garment company would definitely improve. Again within the six observable variables, Cost Adherence has the highest coefficient value which is 0.67 implies that this is the most important contributing variable for improving SCM efficiency. Second factor 'High Quality Delivery' is comprised of Reduced Claim and Discounts, On Time (High Quality) at Delivery, On Time Shipment and Short Change over Time. However, within these practices Reduced Claim and Discount is most important than others which affects the Efficiency of Supply Chain Management.

The third most important factor is 'Training Effectiveness' which comprised of the practices Short Change over Time, High Capacity Utilization, and High Operator Training Effectiveness. Each of the practices has different degree of importance in influencing the efficiency of SCM. Here in this factor the most important influence in practice is High Capacity Utilization with highest coefficient value of 0.76. The fourth factor is 'Adherence to Production Plan' followed by 'Match between Planned T&A and Actual T&A', 'On Time and Timely Delivery' and 'High Quality Inward Material'. As the measurement of SCM efficiency is very complex this study used a proxy of SCM efficiency as the dependent variable of the

study. The regression analysis confirms the findings of the Factor Analysis. In this regression analysis we also find that factor 1 'Production Cost Adherence' has the highest coefficient value of 6.455 whereas the eighth factor 'High Quality Inward Material' has the lowest coefficient value. The results also suggest that other than the last factor, the relationship of all other factors to the dependent variable is statistically significant. It is to be mentioned that this model is tested and found to be fairly usablein measuring and explaining SCM efficiency. Collaborative SCM practice is of utmost importance for improving the efficiency of SCM of the industry. Numbers of relevant dimensions/ factors have been used in determining whether companies use collaborative SCM. The grand mean of responses is 3.28. The test result shows that the level of practice of collaborative plan by the Bangladesh RMG companies is not satisfactory. The observed value (3.28) is significantly different from hypothesized value of 3.5.Bangladehi RMG companies to become competitive; use f collaborative plan should be improved.

The study suggests that buyers' preferences are changing over the period. The RMG products are very much time sensitive. The result shows that buyers are giving more importance on lead time reduction. They prefer manufacturers those can deliver products in shorter lead time. Lead time has become most important factor in selecting the supplier of their demanded products. Timely shipment by the suppliers has been placed in second position while selecting the suppliers followed by cost minimization. Actually RMG business is becoming more challenging because buyers look for shorter lead time, time shipment by the suppliers, cost reduction, innovative products, ability of ensuring all these is not a very easy task. Bangladesh RMG sector needs to increase the overall capability of the entire industry so that they can meet up the changed preference of the buyers. Here actually comes the importance of developing backward linkage. The prior study reported that buyers used to give more importance on cost followed by time shipment. This study also suggests that the initiatives taken by the companies are not very praiseworthy. The companies are focusing on providing training to the people working for the companies. Companies must not undermine the requirement of trained personnel in order to improve the overall productivity of the company. The sector rightly pin pointed their priority of training its personnel for remaining competitive in the global market. They are also putting right emphasis on using IT in improving their competitiveness. From the

analysis it can be argued that, the sector is in right track in order to meet the future challenge thrown by the buyers.

This study attempted to find out the causes with priority for shipment uncertainty regarding quantity, quality and shipment date. The findings suggest that lack of production efficiency and productivity as the number one cause and distance between suppliers and factory has been rated as the last rank. This study went further in pin pointing the challenges for efficient implementation of SCM in the industry. In doing that, a total 15 different challenges of implementation of SCM in RMG sector have been pin pointed after carrying out in depth interview with Garments owners, BGMEA officials, and SCM professionals. It has been observed that Safety and compliance issue for the RMG sector has been identified as the number 1 challenge for the efficient implementation of SCM. Inadequacy or dependency on imported raw materials haven identified as 2nd challenge and political crisis and custom clearance processes have been identified as 3rd and 4th challenge for efficient implementation of SCM in this sector. Labor unrest and inefficiency of labor forces in the RMG sector have been identified as 5th and 6th challenge for implementation of SCM. Loading and unloading in the port, insufficiency of loan and power crisis have been identified as 7th, 8th and 9th challenges. Other reasons along with corresponding ranks have been given in the respective section. Finally, another regression model has been run taking all related variables which suggest that SCM efficiency is significantly influenced by Plan, Source, Make and Deliver. Collaborative planning, measures for Process integration and training for workers also influence the efficiency but not statistically significant.

7.3 Findings

This study has following major findings:

Bangladesh RMG is the single largest industry for the economy and is considered as life of the economy. Moreover, Bangladesh is the second largest exporter of apparel products after China. The industry employs more than four million people direct and indirectly. After the Rana Plaza and Tazreen Fashion incident, the buyers' organizations have put more compliance issues under two platforms Accord and Alliance. In one hand, global demand of apparel products have reduced,

production cost has increased and buyers are not ready to increase price. There is acute shortage of skilled man power at all level; mostly people lean their jobs through on the job training. Educational and industrial training facilities are also very limited in the country. All these have negative impact on the contribution margin in the industry. Moreover, the MFA and GSP quota system have also been lifted putting the industry in a truly competitive and open global market where the sector is facing stiff competition with China, India, Sri Lanka, Cambodia, Vietnam, Kenya etc. In addition, government has set a target export volume of $50 billion to be achieved by 2021. New investment from local and foreign investors is also not satisfactory. It has become real difficult for new investors to start business and become profitable and sustainable.

The level of practice of SCM is not satisfactory in the industry. 5 to 7% of the companies have a separate department of SCM with an average age of the department ranges between six months to two years.

SCOR model suggests that the level of efficiency of SCM in the industry is unsatisfactory. Survey results show that within four dimensions plan, source, make and deliver, the practice of sourcing is relatively better with the plan becomes the least efficient. The overall efficiency as measured by this model is not satisfactory in the industry. Moreover, the study also reduced the factors so identified under four broad dimensions in to eight latent factors. These factors are Production Cost Adherence, High Quality Delivery, Training Effectiveness, Adherence to Production Plan, Match between Planned T&A and Actual T&A, High Quality Capability, On Time and Timely Delivery and High Quality Inward Material. 'Production Cost Adherence' is the priority 1 factor that influences or affects the efficiency of SCM performance with 'High Quality Inward Material' as the last.

The state of providing training at level is not very up to the mark. The factories still have workers with low productivity and continuing the production with unskilled workers. In general companies are reluctant in training their work force for improving the productivity. Here, manufacturer's most focuses on repeat business with same buyers with same kind of products. They are not very interested in trying with newer designs of product with the anticipation that they might lose the business. People learn their jobs mostly through on the job training with high turnover. In the present era of competitiveness, companies must win orders from buyers. The Buyers

preference is changing with the passage of time. In order to increase productivity, apart from having trained personnel in the company, the company must purchase new machines and technology so that they can keep pace with the change. The survey result shows that the state of procuring new technology and machines is not very satisfactory. Essentially companies are not very eager in buying new technologies and machines instead they want to maximize their profit with existing or less investment in capital machineries.

Buyers preferences are changing over the period. The result shows that buyers are giving more importance on lead time reduction. They prefer manufacturers those can deliver products in shorter lead time. Lead time has become most important factor in selecting the supplier of their demanded products. Timely shipment by the suppliers has been placed in second position while selecting the suppliers followed by cost minimization. Bangladesh RMG sector needs to increase the overall capability of the entire industry so that they can meet up the changed preference of the buyers. Here actually comes the importance of developing backward linkage.

As the buyers' preferences are changing over time, so Bangladesh RMG industry needs to take appropriate measures in order to win business. The analysis suggests that the initiatives taken by the companies are not very praiseworthy. However, within the few measures so identified, the companies are focusing on providing training to the people working for the companies. Companies must not undermine the requirement of trained personnel in order to improve the overall productivity of the company. The sector rightly pin pointed their priority of training its personnel for remaining competitive in the global market. They are also putting right emphasis on using IT in improving their competitiveness. From the analysis it can be argued that, the sector is in right track in order to meet the future challenge thrown by the buyers.

Process integration is another aspect of efficient implementation of SCM in the industry. There were four measures identified for better process integrations. It has been seen that the practice of working together with buyers in an attempt of improving quality and efficiency is very satisfactory followed by the practice of working with suppliers for all the inputs for meeting the delivery time schedule and quality.

Six dimensions including Coordination, design, Seasonal demand, Productions status (Suppliers to Buyers), Productions status (Buyers to Suppliers) and Product design changed of collaborative plan have been identified for this study. The grand mean is found 3.28. The test result shows that the level of practice of collaborative plan by the Bangladesh RMG companies is not satisfactory. The observed value (3.28) is significantly different from hypothesized value of 3.5.Bangladehi RMG companies to become competitive; use of collaborative plan should be improved. The bi-variate correlation analysis between the measures of collaborative planning indicates that the practice of one measure positively triggers another practice.

This study found out ranks of causes/challenges of efficient implementation of SCM for the industry. A total 15 different challenges of implementation of SCM in RMG sector have been pin pointed. It has been observed that Safety/ Compliance issue for the RMG sector has been identified as the number 1 challenge for the efficient implementation of SCM. Inadequacy or dependency on imported raw materials have been identified as 2^{nd} challenge and political crisis and custom clearance processes have identified as 3rd and 4^{th} challenge for efficient implementation of SCM in this sector. Labor unrest and inefficiency of labor forces in the RMG sector has been identified as 5^{th} and 6^{th} challenge for implementation of SCM. Loading and unloading in the port, insufficiency of loan and power crisis have been identified as 7^{th}, 8^{th} and 9^{th} challenges. Poor Govt Policy, Insufficiency of Diesel Power, Insufficiency of Loan, Lack of Marketing Tactics, Managers Autocratic Approach and Sluggish backward and forward blending procedure have been ranked as 10^{th}, 11^{th}, 12^{th}, 13^{th}, 14^{th} and 15^{th}.

7.4 Research Outcome

The outcomes of this research can be listed as

- Practice of Supply Chain Management is not satisfactory in the RMG sector of Bangladesh.
- The level of efficiency of SCM practices is also not satisfactory.
- Buyers are preferring low lead time and trendy products instead of low cost product.

- Lack of work place safety is the single most important barrier in efficient implementation of SCM in the industry.

- The model for measuring SCM efficiency in the RMG sector of Bangladesh can be described as

SCE = 7.488 + 1.25 Make + 1.06 Plan + 1.14 Deliver + 0.65 Source + .04Collaborative Plan+ .05 Measures Taken for Meeting ChangedPreference + 0.18 Training for Manager/Technicians + e

7.5 Contributions of the Research

Bangladesh RMG sector is lagging behind from the competitors in respect to Supply Chain Management (SCM) efficiency. Though Bangladesh has the advantage of cheap labor, without SCM efficiency it will be tough for Bangladesh to sustain in global market. To facilitate this, there needs to perform comprehensive studies in different areas of SCM. Study should be conducted aimed at identifying the problem, prospects, current status, and other issues of SCM. This research also tried to incorporate some knowledge in the arena of SCM in RMG sector of Bangladesh. This study will be helpful in understanding the SCM of RMG sector deeply. Based on this conceptual framework, further research in the topic can be conducted by incorporating another set of sample companies or time periods.

7.6 Conclusions

Discussions on the chapter establish that though the RMG sector of Bangladesh is the highest export gainer and has a competitive position in global market, the future doesn't seem promising except this sector shows immediate concern over the implementation of SCM successfully. Without SCM, it would be difficult to sustain in competition in the long run.

Chapter-8

Conclusions and Recommendations

8.1 Conclusions

Basing on the discussions and findings of the study, following conclusions have been drawn:

- All the parties involved including financial institutions, logistics providers etc. in the extended SCM need to be equally efficient for recouping true benefit of SCM. As all parties are related, if one party falls behind it will impact the entire supply chain.
- The lead time, Bangladesh is offering is not very competitive comparing to other garments products manufacturing countries which is a threat for RMG sector in terms of long-term sustainability. Buyers are preferring suppliers who are providing products in low lead time. So, Bangladesh is standing in a disadvantageous position in this case.
- Without proper implementation of SCM in the sector, it will be very difficult for the sector to be become competitive in the global market.
- Required infrastructural facilities including port, road, and railway are not adequate in Bangladesh.
- Compliance/safety issue is the top most challenge for the industry working as barrier to efficient implementation of SCM.
- Bangladesh RMG sector must strive for coordinating with all buyers, middlemen, suppliers of input materials, logisticians etc. in order to implement collaborative SCM for remaining competitive in the global appeal market.

Bangladesh RMG industry has very few options other than implementing the efficient SCM in order to remain competitive. This study did not address the state of backward and forward linkage of the SCM in details. It only identified that there is serious lacking in both forward and backward linkage. Moreover this study also did not explore much the state of logistics and other infrastructural facilities including road, railway, deep sea port etc. Future researchers can focus on state of backward and forward linkage of SCM for the industry.

8.2 Recommendations

In order to improve efficiency of SCM in Bangladesh RMG industry, following recommendations have been made:

- RMG companies need to review their supply chains and identify the areas where the companies are lagging behind in attaining an appropriate lead time comparable to other competitive RMG producing countries.

- Proper initiatives should be taken by the stakeholders of RMG sector to promote collaborative planning for ensuring SCM efficiency.

- BGMEA and government should engage with foreign buyers in order to achieve trust and confidence so that buyers extend more cooperation in complying with safety requirements.

- The industry leader along with concerned government officials and buyers need to work in collaboration for ensuring the improvement of required infrastructures which will help increasing level of efficiency of SCM in the sector.

- Government and BGMEA officials should take necessary steps for increasing the training facilities/institutions so that people can be trained effectively.RMG companies should also design and offer training programs for their workers and employees to improve their productivity.

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