

## **READY-MADE GARMENTS OF BANGLADESH: AN OVERVIEW**

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### **Abstract**

Textile industries play a vital role in the economy of Bangladesh ready-made garments contributing USD 28.67 billion in 2016 which is 7.76 % higher than the previous year. From the total observation of 2016 export, the knitwear constituted USD 13.74 billion and woven products USD 14.93 billion. The aim of the study is to depict the overall scenarios of entire RMG sector by analyzing all data related to RMG through content analysis to make future predictions based on the analysis to detect the real problems and challenges with their credible solutions. However, recently, this industry is facing great challenges in its growth rate. The prime reasons for the challenges can be the global recession, unfavorable trade policies, internal security concerns, the high cost of production due to increase in the energy costs, different safety issues specially fire, depreciation of Bangladeshi currency that significantly increased the expenditure of imported inputs, rise in inflation rate. High cost of financing has also affected seriously the growth in the textile industry. For that reason, neither the buyers are able to visit frequently Bangladesh nor are the exporters able to travel abroad for effective marketing of their products. It is found that the Bangladesh textile industry can be brought on top winning track if government and others individuals take effective actions in removing or normalizing the mentioned hurdles. Additionally, the government should provide subsidy to the textile industry, minimize the internal dispute among the exporters, and withdraw the withholding and sales taxes. Conversely, adopting new machinery or enhancing the quality of the existing machinery, providing effective training to the workers and introducing new technology, opening up an innovative research can also be very constructive to countenance the challenges of textile garments.

**Keywords:** Challenges of textile garments, past, present and future of ready-made garments.

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## **1. INTRODUCTION**

Textiles have been an extremely important part of Bangladesh's economy for a very long time. Bangladesh is the world's second biggest exporter of clothing (ready-made garments) after China. Ready-made garments (RMG) make up 80 percent of the country's earned USD 24 billion in annual exports sharing 15 percent Gross Domestic Products (GDP) (Mazedul et al., 2013) in Bangladesh. The ready-made garments industry acts as a catalyst for the development of Bangladesh. The "Made in Bangladesh" tag has brought glory for the country, making it a prestigious brand across the globe. Bangladesh, which was once termed by cynics a "bottomless" has now become a "basket full of wonders." The industry that has been making crucial contribution to rebuilding the country and its economy is none other than the ready-made garment (RMG) industry which is now the single biggest export earner for Bangladesh which accounts for 81% of total export earnings of the country (EPB, 2017).

Due to increasing demand of sustainable apparel design, environmental changes, market competition, unpredictable consumer demand, market trends of variety, short product life cycles and low barriers of entry the textile and apparel industry is one of the most highly competitive manufacturing sectors in the world (Haider, 2007). As obstacles to trade among nations have declined due to improved transportation systems, technology transfer and government cooperation, the industry has seen a rapid increase in globalization and competition. The all Bangladesh textile mills association and individuals needs to enhance the quality of its products. However, the potentials in the RMG can be realized only if the challenges in some areas like-infrastructures, compliances, workforces supply, suppliers' performances, raw materials, political stability are tackled. Objectives of this review is to discuss the entire situation of RMG sector by analyzing the present condition using data of the past as well as making future predictions based on the information available and to detect the problems and challenges with their credible resolutions.

## **2. HISTORY OF RMG IN BANGLADESH**

The number of factories in RMG industry has gone manifold increase over the last 3 decades. The late Akhter Mohammad Musa of Bond Garments, the late Mohammad Reaz Uddin 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, AM Subid Ali of Aristocrat Limited came forward and established some of the first garment factories in Bangladesh. Following their footsteps, other prudent and hardworking entrepreneurs started RMG factories in the country. Since then, Bangladeshi garment industry did not need to look behind. Despite many

difficulties faced by the sector over the past years, it has carved a niche in world market and kept continuing to show robust performance. On that time period Reaz Garments, Jewel Garments and Paris Garments were the biggest ones amongst the nine RMG industries in Bangladesh (Hossain & Moon, 2014). Reaz Garments, the pioneer, was established in 1960 as a small tailoring outfit, named Reaz Store in Dhaka. It served only domestic markets for about 15 years. In 1973 it changed its name to M/S Reaz Garments Ltd. and expanded its operations into export market by selling 10,000 pieces of men's shirts worth French Franc 13 million to a Paris-based firm in 1978. It was the first direct exporter of garments from Bangladesh. The successful journey was first started in 1978 when Reaz garments exported its first consignment in USA and earned 69 thousand USD. But the actual milestone was led by the Dosh Garments Ltd. established in 1979, the first 100% export-oriented company. It was set up as a joint venture with Daewoo of South Korea and became the single largest and most modern garment-manufacturing unit in the sub-continent (Yunus & Yamagata, 2012). It had about 120 operators including 3 women trained in South Korea, and with these trained workers it started its production in early 1980. In 1980, a company called "Youngone Bangladesh" was established as the first equity joint-venture garment factory with a Bangladeshi firm, Trexim Ltd. It exported its first consignment of padded and non-padded jackets to Sweden in December 1980. Since that time, Bangladesh has seen a tremendous growth in the number of factories consistent with the volume of export (Rashid, 2006).

In year 1983-84, there were only 134 RMG units, where only 40,000 workers were working in this sector. But, in 2012- 2013, the number of RMG units increased to around 6000 with the employment of around 4.2 million workers (BGMEA, 2015). This growth is strongly facilitated by the Multifiber Agreement (MFA) under the Uruguay round of GATT (General Agreement for Tariffs and Trade) of 1994, proactive entrepreneurial approach, and supportive policies of Bangladesh government. The growth of factory has shown a negative trend in year 2013-14 due to the utility crisis and strong inspection from the regulatory body to identify the risky factories. In the history of textile industries there are 10 phases well-known since 1970 (Table 1). The booms days were recognized during 1982-1985. Then after unethical quota restriction was imposed on RMG from the buyers in 1985 as a result, export was decreased. In 1990, knitwear sector was developed drastically. In 1993, child labor became an issue and its solution also gave. In 2003 Canadian quota restriction was withdrawn, and in 2005 phase out of quota restriction occurred. In 2006 riots and strike by garments labor hampered the production. From 2007-2008 the progress in RMG sector remain stable but from 2009 its growth is on continuous condition.

### 3. CATEGORIES OF RMG

Bangladesh RMG firms vary in size. Garment companies in Bangladesh form formal or informal groups. The grouping helps to share manufacturing activities, to diversify risks; horizontal as well as vertical coordination can be easily found in such group activities.

**Table 1. Phases of textile industries in different years\*.**

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 labour
2007-2008	Stable growth
2008-2018	Continuous growth

\*Source: BGMEA, 2017; <http://www.bgmea.com.bd>

Ready-made garments manufactured in Bangladesh are divided mainly into two broad categories:

- i. Woven products: Woven fabric garments are produced by weaving. Weaving is the process most used for the manufacture of textile fabrics. In weaving two or more set of yarns are interlaced at right angles to each other. The warp yarns run in the length wise direction in a woven fabric also called as ends. The feeling yarns run in the crosswise direction are also called as picks. Extra warp yarns at each side form a selvedge which is parallel to the warp yarns. There are different types of woven fabric garments viz., Georgette Chiffon, Voile Dotted Swiss, Warp Rib, Weft Rib, Weft- way twill, Weave Denim, Gabardine Flannel, Canvas Oxford, Fil-a-Chambray, Seersucker, Terry towel, Sheeting, Crepe, Embroidery, Jacquard.

- ii. Knit products: This type of fabric is produced by knitting. Knitting is the method of creating fabric by transforming continuous stands of yarn into a series of interlocking loops, each row of such loop hanging from the one immediately preceding it. The basic structure of a knit fabric structure is the loop intermeshed with the loops adjacent to it on the both sides above and below it. There are two types of knitting: (i) Weft knitting and (ii) warp knitting. In weft knitted structure, a horizontal row of loops can be made using one thread and thread runs in horizontal direction. There are different types of knitted garments. such as- Plain single jersey, Single Lactose, Double Lactose, Polo pique, Fleece, Terry, 1x1 rib, 2x2 Rib, Feeder stride, Mesh, Interlock, etc. In warp knitted structure, each loop in horizontal direction is made from different threads used to produce such a fabric is at least equal to the no of loops in horizontal direction. In warp knitted fabric the threads run roughly in vertical direction. Some types of warp knitted garments are given viz., Tricot, Raschel, Crochet, Milanese. Day by day knitted items production is increasing in considerable rate and such products currently account for more than 40% of the country's total RMG export earnings (BGMEA, 2016).

#### **4. ORGANIZATION INVOLVED IN READY-MADE GARMENTS**

There are some government approved associations which are controlling garments sector of Bangladesh. Name of main associations are stated below:

##### **4.1. Bangladesh Textile Mills Corporation (BTMC)**

BTMC was formed in 1972. It is a government organization. It started its formal function from July, 1972 with 74 nationalized textile mills then 12 new textile mills also established. BTMC is now involved in meeting the domestic demand of yarn as much as possible. In the concept with achieving millennium development goal (MDG), implementing "Vision 2021" and developing Bangladesh as a medium income country.

##### **4.2. Bangladesh Textile Mills Association (BTMA)**

BTMA was established in 1983. It is the national trade body for textile mills, manufactures, and mills in Bangladesh. BTMA provides the following services-

- BTMA provides 3 kinds of certificates to its member, viz.,
  - i. Issue certificates of production and processing to avail Generalized Scheme of Preferences (GSP) facilities.
  - ii. Certificates of alternative cash assistance.
  - iii. Certificates for availing exemption and concessionary facilities with regard to duties and textile from custom authority.

- BTMA authority remains constantly involve with different government departments and other related agencies like Ministry of Finance, Ministry of Commerce, Ministry of Textile and Jute, Government of Bangladesh.
- It provides budgetary proposal regarding Tax, vat & other custom related matter to National Board of Revenue (NBR) with a view to furthering the primary textile sector (PTS).

#### **4. 3. Bangladesh Garments Manufacturers and Exporters Association (BGMEA)**

The BGMEA is one of the largest trade associations in Bangladesh representing the readymade garment industry, particularly the woven garments, knitwear and sweater sub-sectors with equal importance. Its journey was started in 1983. Today BGMEA looks after of an industry that is at the backbone of Bangladesh's economy. Since the introduction, BGMEA is devoted to promote and facilitate the apparel industry through policy commanding to the government, services to members, ensuring workers' rights and social compliance at factories.

The BGMEA works with vision to promote the RMG industry of Bangladesh and the economic condition of the country. BGMEA followed out the following missions and its strategic direction is paved accordingly,

Firstly, in order to protect and develop the interests of the industry; thus ensuring a sustained growth in the foreign exchange earnings of the country.

Secondly, BGMEA is involved to ensure all legal rights and privileges of the garment workers. The association is also going toward the betterment of the society and environment.

#### **4.4. Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA)**

The BKMEA is a national trade organization of knitwear manufactures in Bangladesh and located in Dhaka, Bangladesh. BKMEA has started its journey in 1996. It was formed as a trade association in order to facilitate and promote knitwear business. The BKMEA, involves to innovation and creativity so that the sector based policy making process becomes realistically and strategically perfect and provides the result that expedites its developmental phase. The prime objectives of BKMEA are as follows:

- To promote and expansion of global market share for knitwear manufactures of Bangladesh.
- To policy support for the sustainable development the knitwear sector.
- To bolster the capacity building process across the sector.

- To raise awareness on basic rights and business principles among the worker and entrepreneurs of knitwear sector.
- To introduce international standards in knitwear sector of Bangladesh.
- To formulation of sector friendly policy in consultation with the Government of Bangladesh.

The major activities of BKMEA are:

- Product diversification and market promotion with the line of demand pattern of global apparel market.
- Consultancy for green industry development.
- Consultancy for social and environmental compliance factory building.
- Factory based productivity improvement campaign program.
- Training on fire fighting technique.
- In house up-skilling training program for both worker and mid-level management to raise their productivity.
- Civil engineering and architectural assistance for ensuring structural safety of factory building.
- Research and development activities for catering the recent trend of world apparel market.

#### **4.5. Bangladesh Handloom Board (BHLB)**

The BHLB is a government owned and operated statutory public sector organization in Dhaka, Bangladesh. It was established in January 1978. It is conducted by the Ministry of Textiles and Jute. It observes the work of 1.5 million individual handloom workers in Bangladesh. The primary mission of BHLB is to make overall development and expansion of handloom sector through improved technology and by improving the socio-economic condition of the weavers all over the country. The primary mission of BHLB functioning with the mission to (i) develop the weavers as well as provide services to the weavers through the field level officers (ii) organize the handloom weavers by forming them into various groups and the different co- operative societies and (iii) offer training in order to increase their efficiency and develop the quality of production of handloom fabrics and achieve the special technical skill.

#### **4.6. Bangladesh Cotton Development Board (BCDB)**

The BCDB, established in 1972 with the primary objective to introduce and promote cotton cultivation. Cotton research has now been strengthened with the following objectives: (i) evaluation of essential characteristics of a commercial variety for the country and judgement of the acceptability of local and introduced germplasm (ii) establishment of a selection and breeding program designed to meet present needs (iii) agronomic work to provide information on best cotton cultural practices (iv) assessment of the extent and timing of pest damage and the development of appropriate control measures and (v) detection of cotton diseases and development of preventive and control measures. The main commitments of BCDB are in cotton cultivation, research, production and distribution, marketing.

#### **4.7. Bangladesh Dyed Yarn Exporters Association (BDYEA)**

The BDYEA was established in 2006 in Dhaka. The yarn dyeing industry, even though considered to be one of the most environmental- polluting industries of the world, it plays an important role in the economic growth of Bangladesh. The prime vision of this trade association is to form a flexible business environment for the export oriented dyed yarn industry. The effectively produced dyed yarn of Bangladesh is exported the knitting industries, wherein it is used to produce finished products, which are then export foreign buyers.

#### **4.8. Bangladesh Jute Research Institute (BJRI)**

The organization jute research first started in Dhaka with the birth of a fiber expert's position under the Department of Agriculture, and the assumption of responsibility by Sir RS Finlow in 1904. The BJRI in its present form and functions, developed from the first Jute Agricultural Research Laboratory (JARL) established by the Indian Central Jute Committee (ICJC) at Dhaka Farm in 1936. The main research objectives of JARL, Dhaka, at that time were to bring improvement of the jute plant both in regard to quality and yield; to improve methods of jute growing; to lessen losses caused by diseases and insect pests, and to introduce improved methods of retting. Recently they successfully accomplished the jute genome project.

The Indian Jute Mills Association (IJMA) also started a Research Department of its own in 1937. This was later transformed into Indian Central Jute Mills Association Research Institute (ICJMARI). During 1936-47 the effective infrastructure required for broad-spectrum jute research activities was established. But due to the partition of India in



1947, jute research activities in Dhaka suffered a setback for many obvious reasons. Pakistan Central Jute Committee (PCJC) reorganized the Jute Research Laboratory as the Jute Research Institute (JRI) at its present location in 1951. In its original plan, the JRI meant to have three main branches, namely, Agricultural Research on Jute; Technological Research on Jute; and Marketing and Economic Research on Jute. The JRI started functioning from 1951 only with the Agricultural Research on Jute branch. Jute research during 1947-71 brought some important developments and released some high yielding varieties. After the birth of Bangladesh in 1971, the jute sector was taken up so that it could be given a realistic outlook. And in 1996 it was modified with some major functions.

The major functions of BJRI:

- Development of high yielding varieties for favorable ecosystems, with short duration, early sowing, and light or temperature tolerance. The yield should at least be 3-4 Metric ton per hectare.
- Development of varieties for adverse environment, high yielding varieties tolerant to soil salinity, flooding depth of about 30 cm and drought and varieties for coastal and hilly areas.
- Refinement of crop, soil, water and fertilizer management technologies.
- Strengthening of participatory jute farming research and fine-tuning of jute cropping patterns.
- Generation of industrial technologies like-paper pulp for the jute and paper pulp industries and geo-jute for road construction.

#### **4.9. Bangladesh Sericulture Board (BSB)**

The BSB was established in 1978 and is located in Rajshahi with the following objectives:

- i. To plan and develop sericulture and the silk industry.
- ii. To undertake, assist or encourage scientific, technological and economic research and training in sericulture,
- iii. To devise means for improved methods of cultivation of Mulberry, Castor, and other related plants.

## **5. EDUCATIONAL INSTITUTES RELATED TO THE TEXTILE SECTOR**

There are government and private textile engineering colleges under universities that offer B.Sc. in Textile Engineering courses including specialization in yarn manufacturing, fabric manufacturing, wet processing, garments manufacturing and fashion design. The institutions are as below :

### **5.1 Public Institutes**

- Bangladesh University of Textiles (BUTEX), Dhaka, Bangladesh (all colleges mentioned below are under BUTEX)
- Khulna University of Engineering and Technology, Khulna
- Dhaka University of Engineering and Technology, Joydevpur, Gazipur
- Mawlana Bhashani Science and Technology University, Tangail
- Bangabandhu Textile Engineering College, Tangail
- Begumgonj Textile Engineering College, Noakhali
- Pabna Textile Engineering College, Pabna
- Textile Engineering College, Chittagong, Chittagong
- Shaheed Abdur Rab Seriniabad Textile Engineering College, Barishal
- Jhenaidah Textile Engineering College, Jhenaidah
- Dr. M. A. Wajed Miah Textile Engineering College, Rangpur

### **5.2 Public private partnership (PPP) institute**

- National Institute of Textile Engineering and Research, Savar, Dhaka

### **5.3 Private Institutes**

- Bangladesh University of Business and Technology, Mirpur, Dhaka
- Port City International University, Chittagong
- Green University Of Bangladesh, Mirpur, Dhaka
- BGMEA University of Fashion and Technology, Dhaka, Bangladesh
- European University of Bangladesh, Shyamoli, Dhaka
- Southeast University, Dhaka

- Daffodil International University, Dhanmondi, Dhaka
- Ahsanullah University of Science & Technology, Tejgaon, Dhaka
- City University, Banani, Dhaka
- Primeasia University, Banani, Dhaka
- Northern University Bangladesh, Banani, Dhaka
- University of South Asia, Banani, Dhaka
- Uttara University, Uttara
- World University of Bangladesh, Dhanmondi, Dhaka
- The People's University Of Bangladesh, Uttara, Dhaka
- Atish Dipankor University of Science and Technology
- European University of Bangladesh, Shymoli, Dhaka
- Sonargaon University Mohakhali, Dhaka
- Shanto-Mariam University of Creative Technology, Dhaka
- The National Institute of Fashion Technology (NIFT)
- Shyamoli Textile Engineering College (STEC), Dhaka
- Raffles Design Institute, Gulshan Commercial Area, Dhaka 1212
- Sikder College of Textile & Fashion Technology (SCTFT), Malibagh, Dhaka-1219.
- BCMC College of Engineering & Technology, Jessore-7400.
- Bangladesh Home Economics College, Dhaka 1215
- National College of Home Economics, Lalmatia, Dhaka-1207
- KCC Women's College, Khulna.

#### **5.4 Textile Diploma Institutes in Bangladesh**

There are six government textile diploma institutes in Bangladesh. Those institutes are operated by the Bangladesh Technical Education Board (BTEB):

- Textile Institute, Tangail
- Textile Institute, Dinajpur
- Textile Institute, Barisal

- Textile Institute, Natore
- Textile Institute, Rangpur
- Textile Institute, Chittagong
- Textile Institute, Pabna
- Textile Institute, Jessore
- Textile Institute, Gopalganj

There are more than hundreds private diploma institutes in Bangladesh. They offer 4 years diploma engineering and various certificate course and training. They also operated by BTEB. They are situated in capital city and different other districts. To give technological knowledge about textile there are 40 government textile vocational institutes have established in Bangladesh. The numbers of textile related institutes are increasing day by day. Textile vocational institutes are proscribed by Ministry of Jute and Textile, Government of the People's Republic Bangladesh.

## **6. PROCESSES FROM FIBER TO GARMENT**

Textile manufacturing is a very complex and lengthy process. It is based in the conversion of three types of fiber into yarn, then fabric, then textiles. Today garments are not only for fulfilling the basic need of clothing but also to satisfy our aesthetic senses. Garment manufacturing is not only an activity now; it has become a journey of art. This journey of fiber to garment starts from selection of fibers. All these processes have to be carried out with precision. Normally, the whole textile manufacturing process is divided by four branches. These are:

- Yarn manufacturing from fiber or spinning (Department of Yarn Manufacturing Engineering).
- Fabric manufacturing or weaving (Department of Fabric Manufacturing Engineering).
- Dyeing, printing and finishing (Department of Wet Processing Engineering).
- Garments manufacturing or apparel making (Department of Apparel Manufacturing Engineering).
- Varieties of garments design (Department of Fashion Design).
- Management of overall process (Industry and Management).

A flow chart denoting the processes from fiber to garment manufacturing is shown in Fig.1.

## **7. PRESENT SCENARIO OF TEXTILE INDUSTRY IN BANGLADESH**

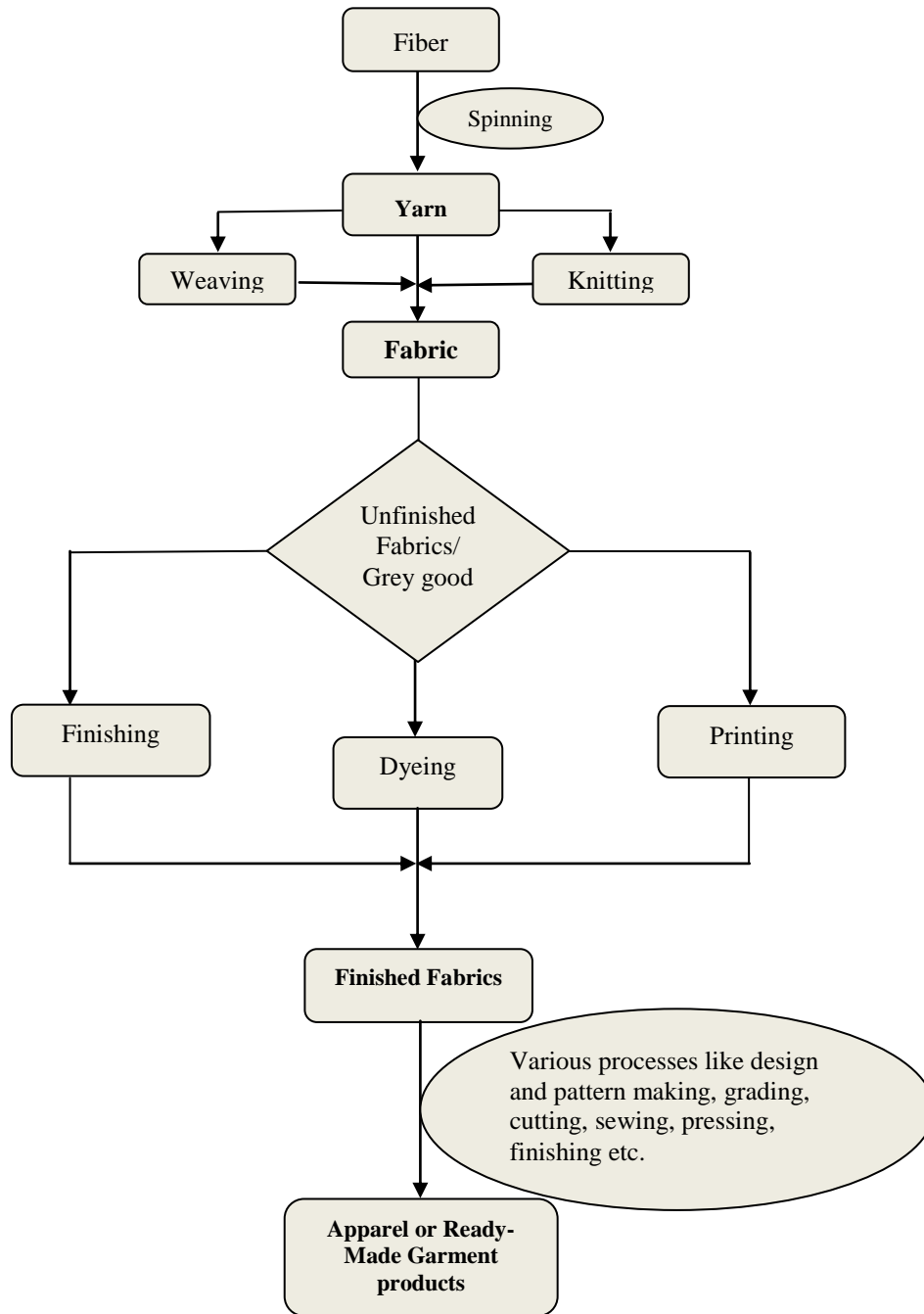
Currently, the textile industry accounts for 45% of all industrial employment in the country and contributes 5% of the total national income. Although the industry is one of the largest in Bangladesh and is still expanding, it faces massive challenges, principally because the country does not produce enough of the raw materials necessary, unfavorable trade policies, and inadequate incentives for expansion.

At present there are about 5,600 garment industries in the country (BGMEA, 2017). The RMG firms are located mainly in four main cities:

- The garments city Gazipur
- The capital city Dhaka,
- The port city Chittagong
- The industrial city Narayanganj

These Industries have employed fifty lacks of people and 85% of them are illiterate rural women. About 76% of our export earning comes from this sector (BGMEA, 2017). The membership and employment in garments sector is given in the Table 2.

From the Table 2, we can notice that the numbers of garments factories are increasing day by day from 1984-85 to 2016-17. From 1984-2004 the number of garments factory increased linearly ( $y = 201.3x - 128.9$ ,  $r = 0.995$ , that is highly statistically significant). The number of factories increased more in 2009-2013. From 2013 to 2016-17 it has remain in stable condition. The number of employees increased linearly from 1984-1998 ( $y = 0.00001x - 0.07$ ,  $r = 0.994$  that is highly statistically significant) also increased more from 2007 to 2010 and it remains in a stable condition.



**Fig. 1.** Flow chart showing processes from fiber to garment.

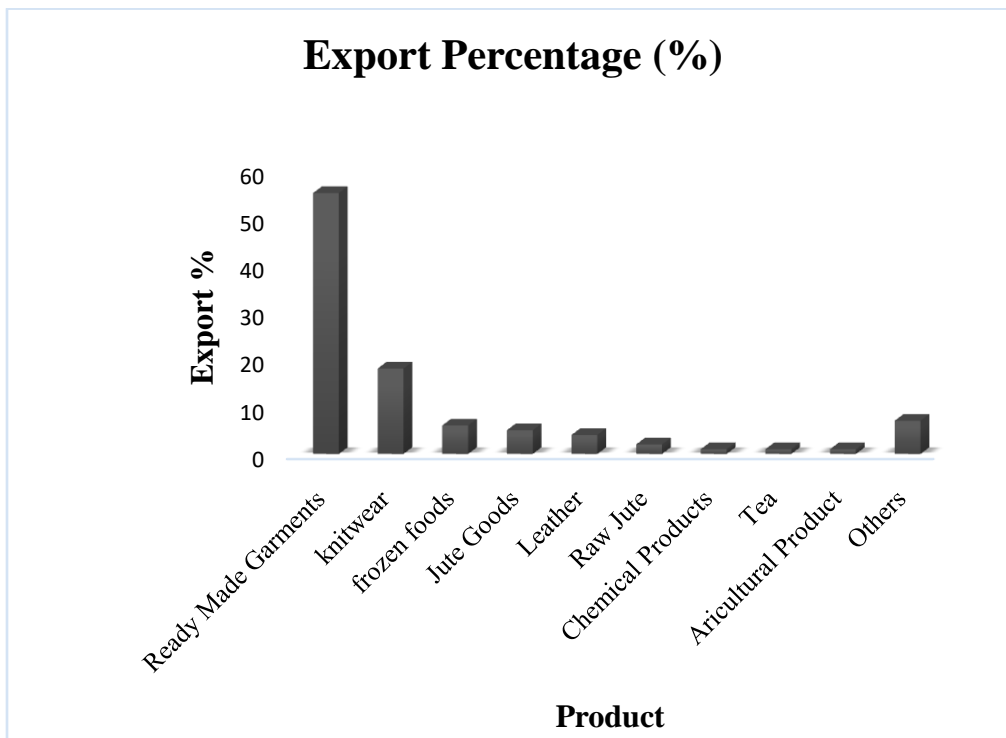
**Table 2. Membership and Employment status in garments sectors\***

<b>Year</b>	<b>Garment factories</b>	<b>Employment (millions)</b>
1984-85	384	0.12
1985-86	594	0.20
1986-87	629	0.28
1987-88	685	0.31
1988-89	725	0.32
1989-90	759	0.34
1990-91	834	0.40
1991-92	1163	0.58
1992-93	1537	0.80
1993-94	1839	0.83
1994-95	2182	1.20
1995-96	2353	1.29
1996-97	2503	1.30
1997-98	2726	1.50
1998-99	2963	1.50
1999-00	3200	1.60
2000-01	3480	1.80
2001-02	3618	1.80
2002-03	3760	2.00
2003-04	3957	2.00
2004-05	4107	2.00
2005-06	4220	2.20
2006-07	4490	2.40
2007-08	4743	2.80
2008-09	4925	3.50
2009-10	5063	3.60
2010-11	5150	3.60
2011-12	5400	4.00
2012-13	5876	4.00
2013-14	4222	4.00
2014-15	4296	4.00
2015-16	4328	4.00
2016-17	4482	4.00

\*Source: BGMEA, 2017.

## 8. TEXTILE EXPORT AND IMPORT

For a developing country, Bangladesh has made remarkable progress as an exporter of manufactured goods, especially readymade garments, but it's highly reliant on the markets of developed countries. The export basket is dominated by the ready-made garment (RMG) sector, which accounts for over 80% of total exports, followed by several other products including agricultural products, frozen food, jute and jute goods, and leather. In the last fiscal year, against a target of USD 37 billion, Bangladesh's overall export earnings stood at USD 34.83 billion, which is 1.68% higher than the previous year's USD 34.25 billion. Among these, the RMG sector alone earned USD 28.15 billion. Bangladesh has set an export target of USD 37.5 billion for the current FY2017-18, which is a 1.35% in the last year (EPB, 2017). Major export product of Bangladesh with their export percentage is given in Fig. 2.



**Fig. 2.** Major export product of Bangladesh with their export percentage (EPB, 2017).

The Fig. 2 inferred that in export percentage RMG contributes highest then other sectors. At present, RMG export becomes more than jute products and agricultural products. So,



it contributes more in GDP than those products. In the Table 3 total export value and RMG export value has been given. From 1985-2015, export percentage of RMG was increased exponentially (the equation is,  $y = 240.3e^{0.1609x}$ ,  $r = 0.973$  that is statistically significant). In 2015 to at present it remains in a stable state in export earnings. Contribution of RMG to total export of the country is also increasing day by day. It increased remarkably after 1990. From 2015 to in present day it remains in a stable condition.

**Table 3. Export of RMG and total export of Bangladesh\***

Year	Export of RMG ( million USD)	Total export ( million USD)	% export of RMG to total
1984-85	116.20	934.43	12.44
1985-86	131.48	819.21	16.05
1986-87	298.67	1076.61	27.74
1987-88	433.92	1231.20	35.24
1988-89	471.09	1291.56	36.47
1989-90	624.16	1923.70	32.45
1990-91	866.82	1717.55	50.47
1991-92	1182.57	1993.90	59.31
1992-93	1445.02	2382.89	60.64
1993-94	1555.79	2533.90	61.40
1994-95	2228.35	3472.56	64.17
1995-96	2547.13	3882.42	65.61
1996-97	3001.25	4418.28	67.93
1997-98	3781.94	5161.20	73.28
1998-99	4019.98	5312.86	75.67
1999-00	4349.41	5752.20	75.61
2000-01	4859.83	6467.30	75.14
2001-02	4583.75	5986.09	76.57

2002-03	4912.09	6548.44	75.01
2003-04	5686.09	7602.99	74.79
2004-05	6417.67	8654.52	74.15
2005-06	7000.80	10526.16	75.06
2006-07	9211.33	12177.86	75.64
2007-08	10699.80	14110.80	75.83
2008-09	12347.77	15565.19	79.33
2009-10	12496.72	16204.65	77.12
2010-11	17914.46	22924.38	78.15
2011-12	19089.73	24301.90	78.55
2012-13	21515.73	27027.36	79.61
2013-14	24491.88	30186.62	81.13
2014-15	25491.40	31208.94	81.68
2015-16	28094.16	34257.18	82.01
2016-17	28149.84	34655.92	81.23

\*Source: Export Promotion Bureau, compiled by BGMEA, 2017.

Bangladesh is the second largest global apparel exporter. More than four million people are women, work in Bangladesh's clothing sector, making it second largest apparel exporters behind China. With a tradition of producing globally recognized one of the finest fabrics in the world namely 'MOSLIN' Bangladesh has emerged as second largest apparel exporters in the world. The apparel industry is almost 40 years old and it is in the best position now to deliver more efficiently and effectively to the world. According to FY 2016-2017 Bangladesh exports retained its growth energy in November fetching USD 3.06 billion on the back of higher shipments of garments, jute and jute goods, frozen fish and footwear. According to the Export Promotion Bureau (EPB, 2018) in the last month's receipts rose 6.22% compared to the same month last year when Bangladesh shipped goods worth USD 2.88 billion. The total shipment in the July-November period stood at USD 14.56 billion, a 6.86% rise year-on-year. Garments that account for more than 82% of the total national exports logged USD 11.96 billion in the first five months of the fiscal

year, 7.46% up from the same period a year ago. Knitwear exports went up 10.86% year-on-year to USD 6.24 billion in July-November while woven garments rose 3.99% to USD 5.72 billion. Table 4, shows the Bangladesh export earnings from RMG sector in FY2017-18.

**Table 4. Bangladesh export earnings (USD) from RMG sector during 2017-18 (EPB, 2018).**

Products	Export for 2017-2018	Export Target of 2017-2018	Strategic Target for July-Nov 2017-2018	Export Performance for July-Nov, 2017-2018	% Change of Export Performance over 5% export target	Export Performance for July- Nov, 2016-2017	% Change of Export Performance July-Nov, 2017-2018 over, July-Nov, 2016-2017
RMG	26149.8	30160	11628.39	11907.24	2.87	11133.35	7.46
Knitwear garments	13757.3	15100	5822.16	6244.30	7.25	5632.74	10.86
Woveng arments	14392.6	15060	5806.73	5717.94	-1.53	5494.61	3.99

The export earnings of RMG sector in two categories knitwear and woven garments. In knitwear sector export target of 2017-18 was USD 15100 and the export was USD 13757.3 that were almost close to the target (Table 4). Export performance was USD 6244.30 and the strategic target for July-Nov USD 5,822.16 i.e. 7.25% change of export performance over 5% export targets. Export performance for July-Nov 2016-2017 was 5632.64 so, the change of export performance in July-Nov and July-Nov 2016-2017 is 10.86% i.e. export performance percentage has been increased than previous year same thing occur in the woven garments. In the RMG sector export performance for July-Nov, 2017-18 was 5717.94 where in July-Nov, 2016-17 was 5494.61, though here % change of export performance over 5% export target was 1.53% it was 3.99 % increased than previous year. As the export percentage increases both in knitwear and woven sector so the export performance of total RMG sector has been increased. In RMG sector export performance of July-Nov 2017-18 over 2016-17 has been increased 7.46%.

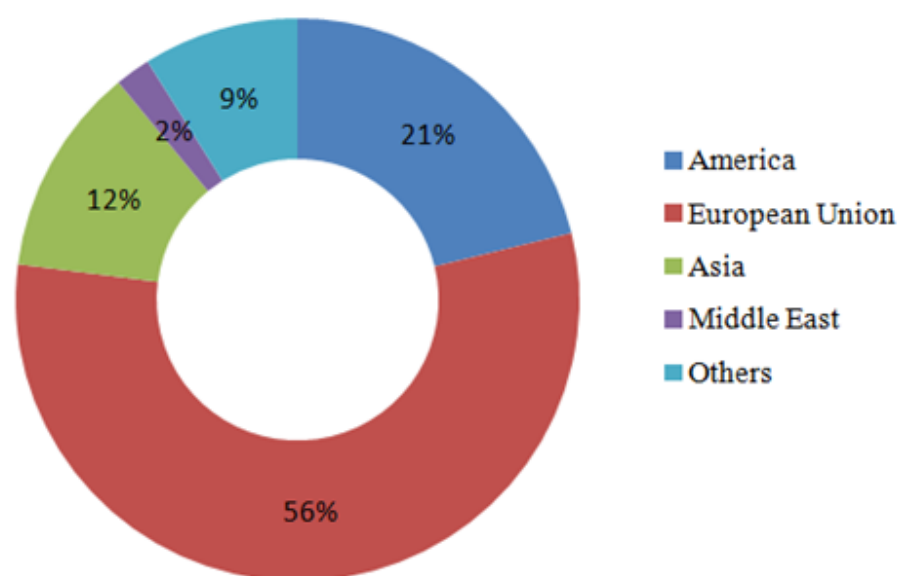
At present the Bangladesh Garment Manufacturers and Exporters Association thought that the garment shipment should grow 12-15% a year to hit the USD 50 billion export target by 2021 and suggested helping bolster exports by offering cash incentives to exporters and improving infrastructure at Chittagong Port and Hazrat Shahjalal International airport as well as called for measures so that exporters can ship goods through direct cargo flights (Daily Star, 2018).

Apparel exports grew 9.37% year-on-year to USD 25.30 billion in the first 10 months of the Fiscal Year (FY) 2017-2018. Knitwear exports rose 11.43 percent to USD 12.54 billion and woven garments exports were up 7.42% to USD 12.76 billion. According to the data from the Export Promotion Bureau (EPB, 2018) overall, exports increased 6.41 percent year-on-year to USD 30.40 billion in the July-April period. The earnings slightly missed the periodic target of USD 30.49 billion. Exports rose 7.11% year-on-year to USD 2.95 billion in April riding on the higher shipment of garment items. Although the receipt is 0.51 percent higher than the monthly target of USD 2.94 billion, it was the lowest in six months before. According to the report of EPB for FY 2017-18 July-April, cotton products, and yarn exports went up by 19.01 % to USD 108.22 million, jute and jute goods increased 7.66% to USD 889.74 million, home textile exports rose 13.07% to USD 751.67 million (The Daily Star, 2018).

Bangladesh exports to Asian countries are still low due to absence of proper preferential trade agreements and quality products, even though there are huge trade opportunities in the region. Exporters and trade analysts argued that removing non-tariff barriers, signing trade-friendly bilateral agreements and proper usage of preferential trade deals can boost Bangladesh's exports to the region. They also said that high dependency on developed countries in North America and Europe could risk export earnings. According to Export Promotion Bureau data (EPB, 2017) Bangladesh's exports to Asian countries were worth USD 4.16 billion in FY2016-17, which is 12% of total exports. At the same time European Union (EU) imported 55.83% (USD 19.35 billion) of Bangladesh's total exports and the United States 21.19% (USD 7.34 billion).

According to Export Promotion Bureau of Bangladesh (EPB, 2017) Bangladesh exports to Asian countries are still low due to absence of proper preferential trade exports to Asian countries were worth USD 4.16 billion in FY2016-17, which is 12% of total exports. At the same time, European Union (EU) imported 55.83% (USD 19.35 billion) of Bangladesh's Exporters and trade analysts say that removing non-tariff barriers signing trade-friendly bilateral agreements and proper usage of preferential total exports her goods sector down 10.02% to USD 916.74 million. The country's export earnings from the United States (US) and European countries have registered a significant growth

in the July-October quarter of FY 2017-18. Bangladesh exports percentage of RMG in different countries is shown in Fig. 3.



**Fig. 3.** Bangladesh export share of RMG products in different region (BGMEA, 2017). The Fig. 3 showed that Bangladesh export mostly in USA (56%) and least in Middle East (2%). A good number of products also exported in European Union. Bangladesh earns a good amount of currency from textile sector every year. The value of total apparel export has shown in Table 5.

**Table 5. Value of total apparel (Modified from BEGMA, 2017)**

Year	Total export (in million USD)		
	Woven	Knit	Total
1992-93	1240.48	204.54	1445.02
1993-94	1291.65	264.14	1555.79
1994-95	1835.09	393.26	2228.35
1995-96	1948.81	598.32	2547.13
1996-97	2237.95	763.30	3001.25
1997-98	2844.43	937.51	3781.94
1998-99	2984.96	1035.02	4019.98

1999-00	3081.19	1268.22	4349.41
2000-01	3364.32	1495.51	4859.83
2001-02	3124.82	1458.93	4583.75
2002-03	3258.27	1653.82	4912.09
2003-04	3538.07	2148.02	5686.09
2004-05	3598.20	2819.47	6417.67
2005-06	4083.82	3816.98	7900.80
2006-07	4657.63	4553.60	9211.23
2007-08	5167.28	5532.52	10699.80
2008-09	5918.51	6429.26	12347.77
2009-10	6013.43	6483.39	12496.72
2010-11	8432.40	9482.06	17914.46
2011-12	9603.34	9486.39	19089.73
2012-13	11039.85	10475.88	21515.73
2013-14	12442.07	12049.81	24491.88
2014-15	13064.61	12426.79	25491.40
2015-16	14738.74	13355.42	28094.16
2016-17	14392.59	13757.25	28148.84

The Table 5 indicates that the price is increasing with increased year. In 1990 the price of woven and knitwear were very low. With time its value has been increasing in an arithmetic way but in 2010 it increases sharply than before and now it comes in a stable condition.

Recently the direct export of garments accessories opening a new era for Bangladesh. Direct export of Bangladesh garments accessories items have been increased by 66.67 % year-on-year to USD 1 billion in the last fiscal year as per the current information of Bangladesh Garment Accessories and Packaging Manufacturing & Exporters Association (BGAPMEA). However the association also has informed that if indirect export is considered Bangladesh's accessories industry is providing about USD 6.7 billion export support to current export oriented apparel industry. The information suggests that besides supporting local demand, now Bangladesh has turned into a major source for garment accessories for other garment making countries as well. Importers of Bangladeshi garment accessories are mainly Hong Kong and China. Bangladesh is now a lucrative source of such items, with spiraling demand coming from international buyers of many

garment-making nations. Accessories items displaying at the GAPEXPO on 24 January 2018 at ICCB in the capital is shown in Fig. 4.



**Fig. 4.** Accessories items displaying at the GAPEXPO on 24 January 2018 at ICCB in the capital.

Meanwhile garment accessories and packaging (GAP) manufacturers urged the government to declare garment accessories and packaging products as the product of the year for 2019. The manufacturers have called the government to provide them with long term policy support including cash incentives and equal corporate tax, low interest loan for the backward linkage industry to enlarge direct export.

## **9. BANGLADESH RMG COMPETENCIES IN GLOBAL MARKET**

Though Bangladesh's share in the global export has continued to increase in recent times, the country is facing tough challenges mainly from internal forces (Table 6). A recent statistics of Bangladesh Garment Manufacturers and Exporters Association (BGMEA) has informed that continuous price loss of RMG products in UK, USA and European Union (EU) in the context of BREXIT referendum, US election and price falling of Euro have impacted RMG's growth of Bangladesh.

**Table 6. Export in value thousand USD (ITC-WTO, 2017).**

Exporters	Year				
	2012	2013	2014	2015	2016
World	405,112,300	440,248,728	474,684,870	442,354,875	442,123,993
China	148,269,585	165,044,601	173,437,980	162,348,987	147,793,700
Bangladesh	19,271,198	19,567,733	N/A*	26,532,326	33,452,933
Vietnam	14,078,822	16,745,481	19,699,178	21,434,183	24,655,528
Turkey	13,849,886	14,959,139	16,256,751	14,845,200	14,784,503
Germany	17,650,924	18,297,393	19,461,448	16,656,698	17,116,335
India	12,896,322	15,702,657	16,538,203	17,131,190	16,961,165
Italy	20,345,172	21,639,999	22,938,683	19,400,009	19,968,409
Hong Kong	21,280,613	20,717,212	19,387,296	17,445,637	14,915,743
Cambodia	4,005,756	4,806,443	5,319,879	5,916,473	10,277,967
Indonesia	7,184,170	7,383,998	7,359,754	7,283,375	7,171,032
Sri Lanka	3,780,770	4,270,811	4,681,465	4,547,691	4,598,051
Pakistan	3,700,676	3,960,247	4,387,275	4,487,070	5,613,238

\*Not available

Recent reports of Export Promotion Bureau (EPB, 2017) Bangladesh shows Bangladesh RMG is not being able to achieve export targets which could be a setback in reaching the 2021 goal of the country to reach 50 billion export. EPB shows Bangladesh exported 28.6 billion USD in 2016 though ITC data shows Bangladesh exported 33.45 billion USD in 2016 (Table 6). However, latest information from EPB shows that the country is still maintaining a growth in RMG export but the growth rate is going down significantly. In first ten months of the financial year 2016-17, the country exported 23.14 billion USD



which is only 2.26 % higher than the export of the same period of the previous year. It is most likely that the country will miss the target of current fiscal year. In the first ten months of the FY, export quantity was 6.06 % short of the target.

## 10. SOCIAL IMPACTS OF THE RMG SECTOR

RMG sector ensured social development through opening a new industrial side. It has created many opportunities for building a gradually developed society.

Many poor people got an alluring opportunity to alleviate their conditions due to the RMG sector. It has provided the poor people with a secured working opportunity through which they can fulfill their needs, get a better living standard and improve their social conditions.

RMG sector has been proved as a blessing for the unemployed educated youth. As the population of the country was increasing since few decades, unemployment problem was so acute. Young people after completing study did not get any job. But RMG sector has opened a new dimension to lessen this problem.

It is well recognized that participation of women in generating income offers them a better position within their families and provides them with considerable freedom. A job ensures impartial access to household resources (nutrition) and larger investment on female human capital (health and education). The income by the female member reduces dependency on male. Thus it reduces their vulnerability. It also reduces the occurrence of domestic violence against women. Employment in the RMG sector has provided direct access to income to many poor women. In Fig.5 the women working in different RMG industries are shown.



**Fig. 5.** Women workers working in a garment factory.

Regular earning by the garment workers enables them to go for savings. Workers investments on family pension schemes etc. create savings. A higher proportion of workers have now bank accounts in the EPZ.

The elimination of child labor is among the core labor standards in the ILO Convention. The Bangladesh RMG sector set a peerless example through collective efforts which eventually led to the development of a system free from child labors. Many of the retrenched child workers have been placed in schools and are receiving a monthly stipend. Being successful to address, this issue has created a very good image about Bangladesh in abroad market and has promised continued market access for the sector.

Employment opportunities especially for women have created a positive impact on family planning and population control in the country. Working-women are getting more independent and conscious about the advantages of a small family, and are figured to modern family planning methods.

## **11. STRENGTH, WEAKNESS, OPPORTUNITY & THREAT (SWOT ANALYSIS) OF RMG OF BANGLADESH**

### **11.1 Strength**

- Work force is available at cheap labor charges.
- Low price of Energy
- Road, railroad, river and air communication are easily accessible
- Foreign Direct Investment (FDI) is legally permitted.
- Moderately open economy, particularly in the export promotion zones.
- Bank interest rate 7% for financing exports GSP under EBA (Everything but Arms)
- Improved GSP advantages under regional cumulative.
- Looking forward to duty free excess to US, talks are on, and appear to be on hopeful track.
- Investment assured under foreign private investment (Promotion and Protection Act, 1980) which secures all foreign investments in Bangladesh.
- Overseas private investment corporation, USA insurance and finance agendas operable.
- Bangladesh is a member of Multilateral Investment Guarantee Agency (MIGA) under which protection and safety measures is available.

- Adjudication service of the International Centre for the Settlement of Investment Dispute (ICSID) offered.
- Excellent Tele-communications network of E-mail, Internet, FAX, ISD, and NWD and Cellular phone services.

### **11.2 Weakness**

- Lack of marketing tactics.
- Absence of easily on-hand middle management.
- A small number of manufacturing methods.
- Lack of high skilled labor.
- Low acquiescence: there is an international pressure group to compel the local Producers and the government to implement social acquiescence. The US GSP may be cancelled and purchasing from US and EU may decrease significantly.
- M/C advancement is necessary. The machinery required to assess add on a garment or increase competence are missing in most industries.
- Lack of training organizations for industrial workers, supervisors and managers.
- Autocratic approach of nearly all the investors.
- Fewer process units for textiles and garments.
- Sluggish backward or forward blending procedure.
- Incompetent ports, entry/exit complicated and loading/unloading takes much time.
- Speed money culture.
- Time-consuming custom clearance.
- Lack of health and safety rules.
- Communication gap created by inadequate knowledge of English.
- Subject to natural calamities.
- Bangladesh is included in the Developing Countries.

### **11.3 Opportunity**

- EU is willing to establish industry in a big way as an option to china particularly for knits, including sweaters.

- Good reputation of product quality
- If skilled technicians are available to instruct, prearranged garment is an option because labor and energy cost are inexpensive.
- Foundation garments for ladies for the FDI promise is significant because both, the technicians and highly developed machinery are essential for better competence and output
- Japan to be observed, as conventionally they purchase handloom textiles, home furniture and garments. This section can be encouraged and expanded with continued progress in quality.

#### **11.4 Threat**

- Risk of losing competitive advantages on international market if manufacturing companies do not take development steps.
- Risk of price of raw materials
- Political unrest situation of the country
- Poor capital formation
- Increased international competition
- Woven sector requires huge investment
- Single market concentration
- Total dependence on other for raw materials
- Labor unrest in garments.
- Increasing international competition concerning Cut and Make (CM) and full price business mainly from far eastern countries and east European countries.

## **12. ENVIRONMENT AND RMG INDUSTRIES**

Most of the garments factories in Bangladesh, in terms of pollution, have been uncomfortable. RMG industry is characterized not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes. Textile processing generates many waste streams, including liquid, gaseous and solid wastes, some of which may be hazardous, a scenario of which is shown in Fig.6. There is a long sequence of wet processing stages requiring inputs of water, chemical and energy and generating wastes at each stage.



**Fig. 6.** Garments factory waste generation (adapted from Alom, 2016).

**Table 7. Types of Garments Waste (Alom, 2016).**

Types of waste	Total waste (%)
Cutting	59%
Dyeing	21%
Knitting	13%
Sewing	3%
Others	4%

From Table 7 it is very prominent that cutting wastes are more than half of the total garment waste followed by 21% of dyeing waste. The sewing wastes are the least in amount.

### 12.1 Problems of Improper Garment Waste Management

Various problems are found which are created by the garments waste. Some kinds of problems are environmental and some are human health related. Improper garments waste management affects: i) human health ii) socio-economic conditions iii) coastal and marine environment iv) rivers v) affects soil by land filling vi) textile machineries cause noise pollution and vii) over-usage of natural resources like plants, water depletes or disturbs ecological balance.

The different types of problems associated with improper garment waste management are: health risk, insects, toxic substances and odor.

## **12.2 Waste Management System**

The compositions of various wastes vary over time and location, with industrial development and which is directly linked to waste materials. Some of the components of waste have beneficial value and can be recycled once correctly recovered. Proper management of waste can reduce the negative impacts on environment and society.

Waste management system can be divided into five key components which are: i) generation ii) storage iii) collection iv) transportation and v) disposal of waste.

In European textile waste management, there are important activities which are included in the field of waste management. The term is called reverse logistics. Reverse logistics is the process of implementing, controlling the efficiency, making cost effective flow of raw materials, updating and keeping information within logistics activities which are interlinked to each other such as, process inventory, finished goods and other information from the point of origin to the point of consumption and other process of disposal. Applications of logistics are important in textile waste management, when the process of logistics comes into the category of green logistics; “green logistic” is the process which manages all the activities at minimum cost of process.

## **12.3 Environmental Pollutions Associated with RMG Industries**

The main environmental problems associated with textile industry are typically those associated with soil and water body pollution caused by the discharge of untreated effluents. Other environmental issues of equal importance are air emission, notably Volatile Organic Compounds (VOC)’s and excessive noise or odor as well as workspace safety.

### **12.3.1 Air Pollution**

Most processes performed in textile mills produce atmospheric emissions. Gaseous emissions have been identified as the second greatest pollution problem (after effluent quality) for the textile industry. Air pollution is the most difficult type of pollution to sample, test, and quantify in an audit.

Air emissions can be classified according to the nature of their sources:

- Point sources: These include- Boilers, Ovens, and Storage tanks.
- Diffusive: These include- Solvent-based, Wastewater treatments, Warehouses, Spills.

Fig. 7 is about the gas emission from the textile industries that results in air pollution.



**Fig. 7.** Air pollution from textile industries.

Textile mills usually generate nitrogen and sulphur oxides from boilers. Other significant sources of air emissions in textile operations include resin finishing and drying operations, printing, dyeing, fabric preparation, and wastewater treatment plants. Hydrocarbons are emitted from drying ovens and from mineral oils in high-temperature drying/curing. These processes can emit formaldehyde, acids, softeners, and other volatile compounds.

### 12.3.2 Water Pollution

The textile industry uses high volumes of water throughout its operations, from the washing of fiber to bleaching, dyeing and washing of finished products. On average, approximately 200 liters of water are required to produce 1 kg of textiles (Table 8).

**Table 8.** Average water consumption of various types of fabrics (Parvathi et al., 2009).

Processing subcategory	Water consumption (m <sup>3</sup> /ton fiber material)	
	Minimum	Maximum
Wool	111	285
Woven	5	114
Knit	20	84
Carpet	8.3	47
Stock/yarn	3.3	100
Nonwoven	2.5	40
Felted fabric finishing	33	213

The large volumes of wastewater generated also contain a wide variety of chemicals, used throughout processing. These can cause damage if not properly treated before being discharged into the environment. Of all the steps involved in textiles processing, wet processing creates the highest volume of wastewater. Fig. 8 shows the wastewater coming from RMG industries and polluting the water bodies.



**Fig. 8.** Water pollution by RMG.

The sources of aquatic toxicity from RMG industries can include: salt, surfactants, ionic metals and their metal complexes, toxic organic chemicals, biocides and toxic anions etc.

Most textile dyes have low aquatic toxicity. On the other hand, surfactants and related compounds, such as detergents, emulsifiers and dispersants are used in almost each textile process and can be an important contributor to effluent aquatic toxicity, BOD and foaming.

### **12.3.3 Solid Waste Pollution/Soil Pollution**

The primary residual solid wastes generated from the textile industry are non-hazardous (Table 9) directly discharges to soil. The wastes included scraps of fabric and yarn, off-specification yarn and fabric and packaging waste. There are also wastes associated with the storage and production of yarns and textiles, such as chemical storage drums, cardboard reels for storing fabric and cones used to hold yarns for dyeing and knitting.



**Table 9. Summary of air, water and solid wastes/pollutants generated during textile manufacturing processes (Parvathi et al., 2009).**

Process	Emissions	Wastewater	Solid waste
Fibre preparation	Little or none	Little or none	Fibre waste and packaging waste
Yarn spinning	Little or none	Little or none	Packaging waste, sized yarn, fibre waste, cleaning and processing waste
Slashing/sizing	VOCs	BOD, COD, metals	Fibre lint, yarn waste, packaging waste, and cleaning waste
Weaving	Little or none	Little or none	Packaging waste, yarn and fabric scraps, off-spec fabrics, used oil
Knitting	Little or none	Little or none	Packaging waste, yarn and fabric scraps, off-spec fabrics
Tufting	Little or none	Little or none	Packaging waste, yarn and fabric scraps, off-spec fabrics
Desizing	VOCs from glycol ethers	BOD from lubricants, biocides, anti-static compounds	Packaging waste, fiber lint, yarn waste, cleaning and maintenance material
Scouring	VOCs from glycol ethers and scouring solvents	Disinfectants, insecticide residues, NaOH, detergents, oils, knitting lubricants, spin finishes, spent solvents	Little or none
Bleaching	Little or none	H <sub>2</sub> O <sub>2</sub> , stabilizers, high pH	Little or none, even if little, the impact could be considerable.
Singeing	Small amount of exhausted gases from the burners exhausted components	Little or none	Little or none

Mercerizing	Little or none	High pH, NaOH	Little or none
Heat setting	Volatilization of spin finished agents, synthetic fibre manufacture	Little or none	Little or none
Dyeing	VOCs	Metals, salt, surfactants, organic processing assistants, cationic materials, color, BOD, COD, sulphide, acidity/alkalinity, spent solvents	Little or none
Printing	Solvents, acetic acid, drying and curing oven emissions, combustion gases	Suspended solids, urea, solvents, color, metals, heat, BOD, foam	Little or none
Finishing	VOCs, contaminants in purchased chemicals, formaldehyde vapors, combustion gases	COD, suspended solids, toxic materials, spent solvents	Fabric scraps and trimmings, packaging waste.

From the Table 9, it can be estimated that in the processes like-fiber preparation, yarn spinning, sizing, weaving, knitting, tufting etc. solid wastes generates in huge quantity but little or no emissions and waste water, whereas in the processes like- singeing, mercerizing, heat setting, dyeing and printing, solid wastes are very little or none but huge quantity of waste water and emissions occur. In RMG sector, bleaching is perhaps the only process which creates none of the pollutions; only little amount of waste water. All three types of Pollutions occur in the most dangerous way in desiring and scouring processes. So preventive measures should be taken accordingly where these are needed most.

#### **12.4 Sustainability Issues Regarding RMG Industry**

Sustainable industrialization is a long-term process of transformation towards a desired vision of an industrialized economy that contributes to wealth creation, social

development and environmental sustainability. Sustainability in industrial development means that while industries carry on business and make economic profits (economic sustainability), hand in hand, by avoiding activities that damage the environment and by investing some percentage of their profit into environmental repair and protection (Fig. 9).

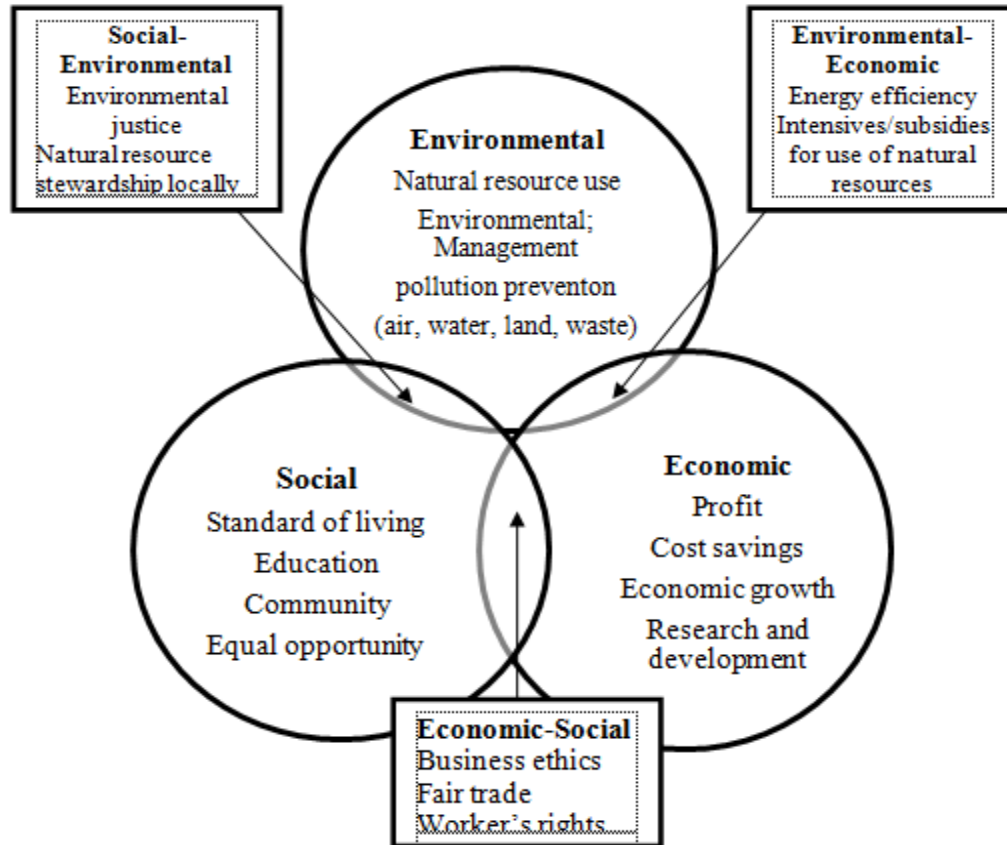


Fig. 9. The three spheres of sustainability.

In terms of sustainability, Bangladeshi garment industries are far behind. If the three spheres of sustainability are considered, there are many issues that are lacking. Among environment, social and economic perspective of Bangladesh garment industries only the economic conditions may have reasonable and good achievement. The environmental aspects of garment industries show poor conditions. Many textile industries did not establish ETP for their effluent treatment. Instead they directly discharge their waste water and solid wastes to nature and contribute to huge pollution and contamination. The chemical and fertilizer usage is also significant for raw material production.

The social aspect of garment industry has the worst situation. The living standards of the workers are very poor as they get the lowest wage. The workers live in most of the slum areas and are socially considered as lower class people.

With all the negative achievements, garments manufacturing industries in Bangladesh trying to gain sustainability for better and concrete future but the progress is too slow. It is essential to reconsider and reform the entire garment industry framework. The concerned actors must have to take serious initiatives towards sustainability.

### **12.5 Environmental Sustainable Initiatives for RMG industries**

Bangladesh, the second largest ready-made garment exporter in the world, has taken a leading position in sustainable green industrialization. Some RMG factories on top of the capability pyramid have started thinking of going green. The steps taken are given below:

- Cleaner Production (CP)
- Water PaCT (Partnership for Cleaner Textile)
- TREES (Towards Resource Efficiency and Environmental Sustainability)- Environmental Performance improvement project with German International Co-operation.
- Textile Technology Business Centre (TTBC)
- Textile Sustainability Platform (TSP)
- Zero Discharge of Hazardous Chemicals (ZDHC)
- Zero Liquid Discharge (ZLD)
- Research on sustainability
- Partnership with world class technology providers
- GREEN Factory building
- Policy revisiting
- Best practice by factories BGMEA as the apex trade body of RMGs.

#### **12.5.1 Cleaner Production (CP)**

CP is a preventive, company-specific initiative intended to minimize use of inputs such as energy, water, raw material; reduce waste and emissions.

The continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase overall efficiency and reduce risks to humans and the environment (UNEP). To ensure the cleaner production following should be included:

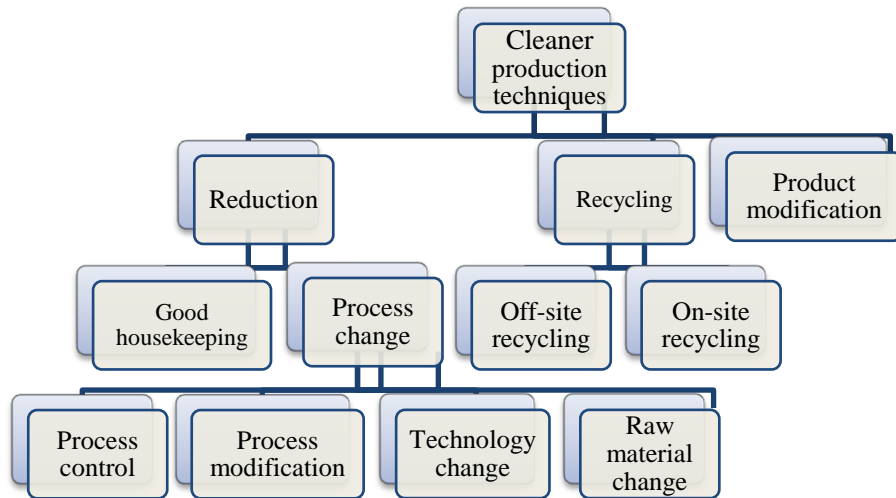
- Production processes: conserving raw materials and energy, eliminating toxic materials and reducing the quantity and toxicity of all emissions and wastes.
- Products: reducing the negative impacts along the life cycle of a product, from raw material extraction to ultimate disposal.

- Services: incorporating environmental concerns into designing and delivery services.

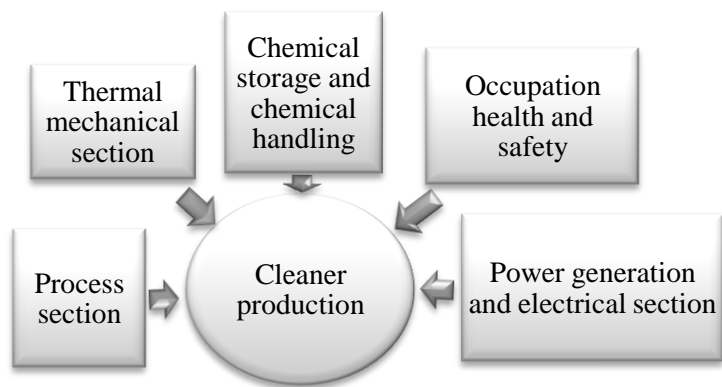
There are 4 elements of CP:

- The precautionary principle.
- The preventive principle.
- The public participation principle
- The holistic principle.

Cleaner production techniques are shown in Fig. 10



**Fig. 10.** Techniques of CP.



**Fig. 11.** Areas of cleaner production.

### Benefits of CP

- Increased profitability
- Lower production costs
- Enhanced productivity
- Increased product yield
- More efficient use of energy and raw materials
- Improved product quality
- Increased staff motivation
- Active worker participation in idea generation and implementation
- Reduced consumer risks
- Reduced risk of environmental accidents
- Supported by employees, local communities, customers and the public

#### **12.5.2 PaCT (Partnership for Cleaner Textile)-A Unique Partnership**

It is a joint initiative, working with the textile wet processing sector towards the adoption of Cleaner Production (CP) practices. Led by the International Finance Corporation (IFC), PaCT is working in partnership with NGO Solidaridad, the Embassy of the Kingdom of the Netherlands, 13 global apparel brands and 2 technology suppliers, textile factories, and the Bangladesh Garment Manufacturers and Exporters Association (BGMEA). PaCT is playing a leading role in driving the long-term competitiveness and environmental sustainability of the textile wet processing sector by addressing high water, energy and chemical use through the adaption of best practices in the textile sector.

To date, PaCT has partnered with 200 textile factories (BGMEA 2017) to support them to implement sustainable resource efficient projects. These projects have not only led to huge savings in resources, but are also getting cumulative cost savings of USD 16.3 million year<sup>-1</sup> for these factories.

PaCT can be builds on four pillars shown in Fig. 12.

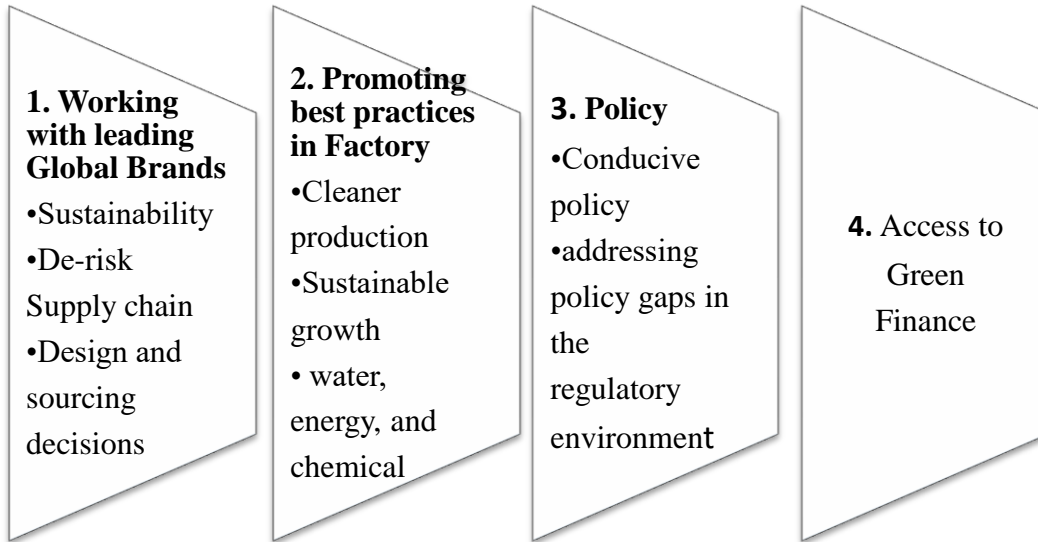


Fig. 12. Pillars of PaCT.

(Modified from <https://www.slideshare.net/mobile/sajjadbd92/environmental-precaution-regulation-and-initiatives>).

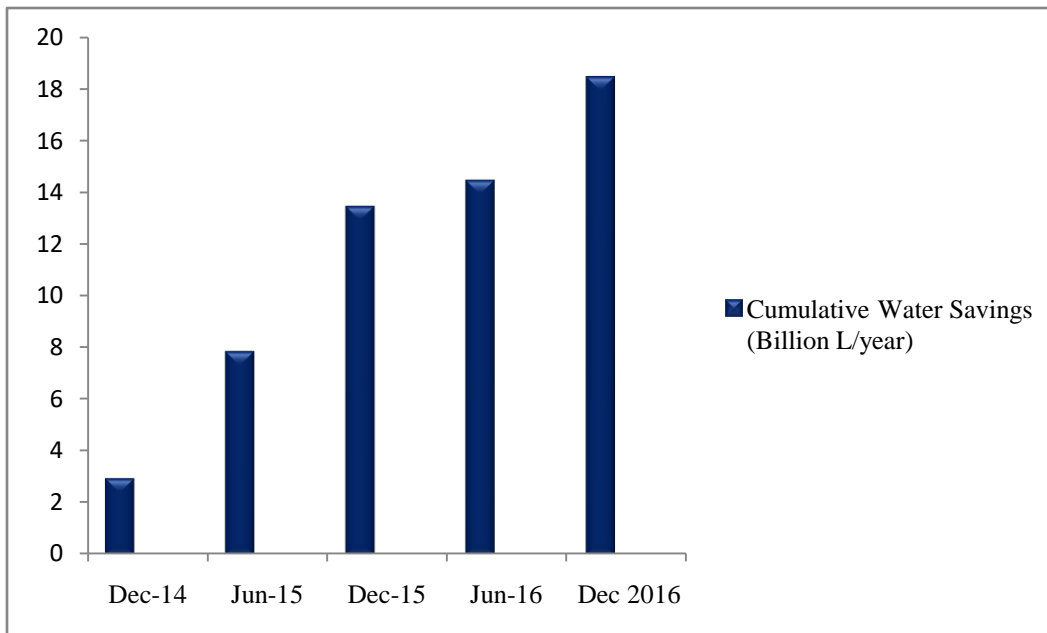


Fig. 13. Water consumption efficiency after PaCT.

(Modified from <http://www.textilepact.net/about-us/what-is-pact.html> ).

The Fig. 13 shows how the partner factories are cumulatively saving water through resource efficiency and best practices over the years.

### **12.5.3 Textile Technology Business Centre**

- IFC and BGMEA jointly set up TTBC.
- TTBC is a Knowledge center act as a platform to collaborate between industry and academy.
- Provide unbiased information to factories on technology.
- Match making between service providers and industry.
- Act as a depository of knowledge on best practice in the area of environmental sustainability.

### **12.5.4 Trees**

- TREE is the BGMEA's initiative for factories which are challenged in the area of environmental sustainability
- Being implemented in 10 factories, 5 non-wet and 5 wet processing factories (BGMEA 2017).
- Involves detailed environmental assessment of factories, energy audit and provide action plan to minimize impact and maximize efficiency.
- Provide custom made solutions to improve:
  - WaSH (Water Sanitation and Hygiene)
  - Waste management
  - Carbon emission reduction
  - Water footprint
  - Chemical management
  - EMS (Environmental Management System)

### **12.5.5 Zero Discharge of Hazardous Chemicals (ZDHC)**

- A group of major apparel and footwear brands and retailers made a shared commitment to help lead the industry towards zero discharge of hazardous chemicals by 2020.



The ZDHC is working on 7 specific work streams as below:

- Chemical hazard assessment, prioritization and action
- Training and capacity development
- Right to know
- Assessments and audits
- Chemicals management best practices
- Stakeholder partnering
- Management systems approach, structure and documentation

#### **12.5.6 Green Factory**

Bangladesh, the second largest ready-made garment exporter in the world, has taken a leading position in sustainable green industrialization with the world's several top ranked green factories (Tzschentke et al., 2008). The top three environment-friendly garment and textile factories in the world are located in Bangladesh, keeping pace with the growing demand of green factories worldwide. They have taken the garment and textile factories of Bangladesh to new heights.

These are:

- Envoy Textiles, Mymensingh
- Remi Holdings, Narayanganj
- Plummy Fashions, Narayanganj.

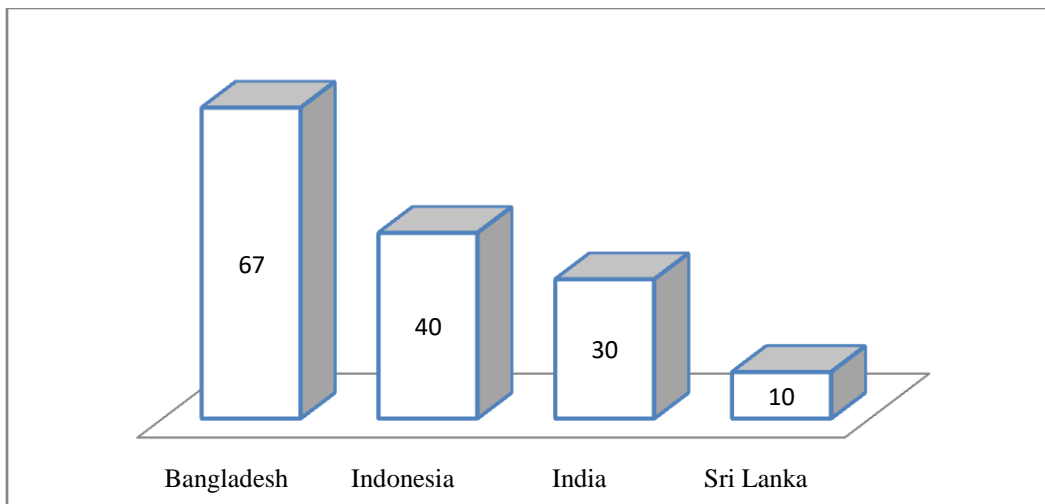
Envoy Textiles is the first denim-producing green factory in the world. Remi Holdings tops as a green garment factory, and Plummy Fashion ranks first as a green knitwear factory.

These green factories have less carbon emission, higher production, and save more gas, electricity and water compared to other factories. Fig. 14 shows some designs of green factories.



**Fig. 14.** Green factories.

According to BGMEA, Bangladesh has the greenest RMG factories in the world (Fig 15); Indonesia is the second largest with 40 green factories followed by India with 30 and Sri Lanka with 10.



**Fig. 15.** Country wise green factories (USGBC, 2018).

The US Green Building Council (USGBC) gives LEED (Leadership in Energy and Environmental Design) certificates to the green factories if the projects satisfy certain requirements and earn points to achieve different levels of certification. Bangladesh has 67 LEED green factories certified by the USGBC, of which 13 were platinum rated. Seven of those platinum-rated Bangladeshi factories have ranked among top 10 green factories of the world. 280 more factories in Bangladesh were registered with the USGBC for LEED certification. (New Age online, 2018).

The factories received LEED Green Factory Award (2018) is listed below:

- a) Remi Holdings Limited.
- b) Tarasima Apparels Ltd.
- c) Plummy Fashion Ltd.
- d) Vintage Denim Studio Ltd.
- e) Columbia Washing Plant Ltd.
- f) Echotex Ltd.
- g) SQ Celsius Unit Ltd.
- h) Kaniz Fashion Ltd.
- i) Genrsis Fashion Ltd.
- j) Envoy Textiles Ltd.

The highest rated LEED Platinum denim factory, knit factory, washing plant and textile mill are all situated in Bangladesh and the entrepreneurs of our RMG sector are the architects of this achievement in green industrialization. Tarasima Apparels Ltd. and Remi Holdings Ltd. were recognized for the highest scoring LEED platinum certified companies in Bangladesh and for Remi Holdings, the highest in the world, scoring 97 out of 110. Plummy Fashion Ltd. is the highest rated LEED Platinum knit factory in the world (USGBC 2018).

#### **12.5.7 Major Policy Changes**

- Implementing Zero Liquid Discharge has been identified as KPI (Key Performance Indicator) of Department of Environment as
- A draft sludge management guideline has been made

- Low cost green finance has been made available for the factories
- Efficiency of captive power generator has to be increase up to 60% (Through Cogeneration, EGB, heat recovery etc.)

### **12.5.7 Best Practices by Factories**

Apart from the legal and buyer compliance, factories are implementing a numbers of best practices to improve their efficiency and sustainability. These are:

- Rain Water Harvesting
- Reduce, Reuse, and Recycle of water
- Cogeneration
- Condensate recovery boiler
- Use of renewable energy (solar panel)
- Prismatic skylight
- T5 and LED light
- Sustainability reporting and etc.

## **13. MAJOR RMG FACTORY INCIDENTS IN BANGLADESH**

The garment industries of Bangladesh represent one of the worst records of the world in terms of safety. The types of factory incidents mainly falls in the category like- fire, boiler, machine explosion, contaminated drinking water, false fire alarm, building collapse (Table 10). Among these, fire is the most frequently occurring incident. Others occur very rarely. But, to date, only one building collapse incident took place and it took the highest amount of lives in the history of garment incident. So, the two main categories of incidents in RMG sector are- fire accidents and building collapse.

### **13.1 An Overview at Some of the Worst Bangladesh's Garment Incidents Since 2005**

In the last 12 years (2005-2017), there have been many garment industry accidents in the country, which has created poor infrastructural and security risk management issues.

From 2005-2017, about 1,234 people died and about 4,000 people got injured due to garment incidents (Table 10).

**Table 10. Categories of major garment factory incidents in the history of Bangladesh and their effects from 2005-2017 (collected and calculated from various Bangladeshi Newspaper and BBS).**

Name of incident	Number incident	Death	Injury
Fire	129	70	615
Boiler	5	29	158
Machine explosion	1	0	2
False fire alarm	2	0	150
Contaminated drinking water	1	0	600
Building collapse	1	1134	2500

### 13.2 Fire Accidents

It is the most frequently occurring incident in garment industries. The main causes of fire incidents are- short circuit, sparks from welding, coil, gas leakage, chemical fire, cigarette etc.



**Fig. 14.** Fire in a garment factory, Bangladesh (Source: [www.euronews.com](http://www.euronews.com)).

### **13.3 Building Collapse**

Building collapse has appeared as the second type of major hazard in garment industries. The main reason behind this is unauthorized and unplanned structure of the building. Many garment factories illegally extend their building upward without having proper permission. The foundation of the building does not support extra load and as a result the building collapses. For example, Rana plaza of Savar was an eight story building, but it had permit only four floors. The upper four floors were made without permit and as a result it was collapsed in April, 2013 and killed 1134 workers and injured about 2500 people.



**Fig. 16.** Savar Rana Plaza building collapse (New Age Online, 2013).

Table 10 shows that fire is the most frequent incident among RMG incidents which occurred 129 times from 2005-2017. But in the history of garment industry, building collapse occurred only once named, the Rana Plaza building collapse which was the most serious and took life of more than 1000 workers.

## **14. INNOVATIVE CHALLENGES OF RMG SECTOR**

### **14.1 Unskilled Workers**

Growth and development of an industry always requires sufficient skills and expertise. However in spite of the growth of the industry, its development may be constrained by lack of skilled workforce. Out of current workers, 90 percent is women, most of who are illiterate, unskilled and come from the rural parts of the country. Most of the factories do not have in-house training facilities, and those have, the existing training facilities are very poor in quality due to lack of professional qualified trainers, weak training program

(irregular courses and covered only workers), lack of training aids, no systematic training needs assessment or evaluation program, no follow up and feedback intervention, etc.

#### **14.2 Insufficient Infrastructure**

Infrastructure like transport and utilities is the single largest issue hampering Bangladesh's RMG industry. The Chittagong port, which handles nearly 85 percent of the country's trade merchandise, suffers from labor problems, poor management, and lack of equipment. Productivity and efficiency of Chittagong port is not competitive in comparison to other South Asian ports and it suffers from high lead time as well. The alternative mode of transportation such as Bangladesh railways and Dhaka-Chittagong Airports provides very less carrying and handling facilities.

#### **14.3 Energy Crisis**

Gas, oil, electricity, and water are the basic prerequisite of industrial development. The load-shedding of electricity caused a rapid decrease in production that led to reduced export supply. The frequent electricity disruptions force factory owners to use alternative source of energy like generator and independent power plant (IPP) which increase their cost of production further. Thus, the cost of production rises due to instant increase in electricity tariff. It is argued that 60 to 70 per cent of the factory had been affected due to extreme Gas and Electricity shortage and was unable to accept export orders from around the globe. Power shortfall resulted in loss of production worth of USD 1.6 million per day due to electricity crisis (Azim and Uddin, 2003).

#### **14.4 Industrial Safety and other Issues**

At the point of the RMG industry, factory buildings were in an unplanned manner that resulted into conversion of common buildings for factory purpose. As a consequence, several disastrous collapses took place such Rana plaza and Tazrin incidents which took away thousands of lives and injured another thousand. These have brought the safety issue as a priority concern. Recently, Bangladesh is facing a lot of difficulties regarding the GSP facilities. USTR hearing held in Washington on March 28, 2013. Here, Bangladesh has failed to prove the implementation and sincerity on occupational safety as Rana Plaza, Savar collapsed on April 24, 2013 causing a death of 1,127 people (New Age Online, 2013).

#### **14.5 Bank Credit and High Rate of Interest**

Bank credit is an important source of development finance anywhere in the world. The lower the cost of capital, the higher is the momentum of industrialization. However, the

lending rate of interest has been historically remained very high in Bangladesh that led to increased cost of production. The RMG exporters face severe competition in the international market due to high interest rates on bank credit.

#### **14.6 Tax Rate/ Tight Monetary Policy**

The RMG exporters are likely to find it challenging to pay enhanced tax on their export earnings in the upcoming fiscal years. Due to high interest rate financing cost increases which cause a severe effect on production.

#### **14.7 Social Compliance**

Social compliance in Bangladesh RMG industry has been a fundamental requirement for many of the western buyers and it is also considered as the main challenge after the disastrous Tajrin and Rana Plaza incidents. The social compliance in RMG industry has been much talked issue as different NGOs, media and other foreign buyers are closely monitoring the working environment and safety standards. As a result, Bangladesh Labor Law was reformed in July 2013, keeping conformity with ILO. Thus the implementation of labor law in every factory is becoming a challenge as well.

#### **14.8 Political Crisis**

Political volatility has a common issue in the country. According to Asian Studies Centre, Bangladesh is one of the most politically vulnerable countries both in the world and in Asia. The political unrest, complicated policies, backed by corrupted administration is badly damaging the productivity and goodwill of the RMG industry. Political instability is one the main reasons that has made the garments industry suffer along with some of the other industries in Bangladesh.

#### **14.9 Market Diversification**

Bangladesh RMG products are mainly marketed in EU and US who alone accommodate 85% of apparel exports. The EU (European Union) market flourishes because of the low price product range of Bangladesh. In the EU, Germany, UK, France and Italy are the major countries sourcing almost 80% of EU's total apparel exports from Bangladesh. Thus, dependency on only a few big buyers are vulnerable, hence Bangladesh should search for new market in the EU. Nontraditional market such as Japan, Australia, South Korea, Brazil, Mexico, Hong Kong, Taiwan, China, Singapore, Russia and United Arab Emirates could be new potential destinations for Bangladesh's apparel products with quality, low production costs matching with the taste of consumers of those nations.



#### **14.10 Product Diversification**

Bangladesh RMG export is mainly concentrated in T-Shirt, Shirt, Sweater, Shorts, Jeans, ladies and children's wears. These are low-value products with low marginal profits and holds almost 75% of Bangladeshi RMG products. In a globalized and ever-changing fashion world, product diversification is the key to continuous business success. Therefore, the RMG sector has to diversify its product base from ordinary low-value products to sophisticated high value items as well.

#### **14.11 Coverage of Accord and Alliance**

The Accord and Alliance are now become one of the major challenges for Bangladeshi apparel industry. The Accord and alliance are two different independent organization empowered by apparel brands, retailers and importers both from Europe and USA. The objective of accord and alliance is to work towards a safe and healthy RMG industry in Bangladesh. So meet the guidelines and safety instructions regarding the fire and building safety of accord and alliance is a major challenge. Sometimes the condition imposed by the Accord and Alliance requires combined efforts and huge financial investment such as Infrastructural remodeling, factory shifting and relocating and high investment in fire safety equipment.

#### **14.12 Raw Materials**

The post-MFA (Multi-Fiber Arrangement) trade environment has created a dual challenge to Bangladesh: firstly, Bangladesh has needed to access raw materials at a competitive price and also RMG sector is now competing with restricted countries in a quota-free environment. Bangladesh's dependency on imports creates sourcing risks and longer lead times. Whereas the average fabric lead time for woven in Bangladesh is seven days, it increased to up to 15 days when sourced from India and up to 30 days when sourced from China (Berg et al., 2011). Besides prices of cotton and other raw material used in textile industry fluctuate rapidly in Bangladesh.

#### **14.13 Lack of Modernized Machinery and Equipment**

The inability to timely modernize the equipment and machinery has led to the decline of Bangladesh RMG competitiveness. Due to obsolete technology the cost of production is higher in Bangladesh as compared to other countries like India, Pakistan and China.

#### **14.14 Lack of Research and Development**

There exists lack of research and development in many cases especially fashion designing and developing. Our approach is to copy the buyers design but creating and designing is required.

**14.15 Pollution**

As environmental sustainability is a major concern now-a-days, mitigating different forms of environmental pollution caused by RMG industry is a great challenge for Bangladesh.

**14.16 Increased Cost of Production**

The cost of production of RMG rises due to many reasons like increasing interest rate, double digit inflation and decreasing value of Bangladeshi taka. The increasing cost of production create problem to compete in international market.

**14.17 Lack of New Investment**

Bangladesh is facing extremely as well as internally problems which restrict the new investment. The unpredictable internal conditions of Bangladesh cause a rapid decrease in foreign investment that affected all industries especially RMG and textile industries.

**14.18 United States and EU Cuts Imports of Textile from Bangladesh**

US cancel huge orders of Bangladesh. The US and EU are the major importer of Bangladesh textile which creates a huge difference in export of Bangladesh textile after imposing a restriction on import of Bangladesh textile goods.

**14.19 Backward Linkage Industries**

Prices of cotton and other raw materials used in RMG industry fluctuate rapidly in Bangladesh due to double digit inflation, and instable internal condition. In order to decrease the price of raw materials we need to increase our production capability. Simultaneously, the government should make arrangement for introducing international system of cotton standardization in Bangladesh to enhance equality and value.

**14.20 Poor Supply Chain**

The phenomenal expansion of the RMG industry in Bangladesh and the dramatic increase in the population in addition to an increased standard of living in the country has led to a large demand-supply gap. Only 21% of the total demand for yarn is met locally in Bangladesh.

**14.21 Global Recession**

The term ‘recession’ means the reduction of a country’s GDP for at least two quarters; or in normal terms, it is a period of reduced economic activity. Bangladesh has developing

economy in the world, and one of the lowest in terms of the dollar. Our economy is also a victim of global recession.

#### **14.22 Effect of Inflation**

Inflation rate is measured as the change in Consumer Price Index (CPI). Inflation is basically a general rise in the price level. It is decline of the real value of the money. Bangladesh is one of the praise of inflation. It still faces high double digit inflation which causes a rise in the cost of production and reduction in export of RMG goods.

#### **14.23 Climate Change and Natural Disaster in Textile Sector**

Bangladesh is a disaster prone country. There are different types of disaster in Bangladesh like-flood, cyclone, drought, river erosion (Rahman et al., 2017) which are increasing remarkably with climate change. These disaster has an effect on textile sector may affect adversely. Conversely, industries that are on coastal region when disaster occurs it has physical disruption as well as people can become mentally depressed which has definitely a negative impact on the garments production. Different diseases of crops impact on the production of raw materials. Diseases like blast of rice and wheat caused by fungal infection and bacterial blight of cotton (Rahman and Uddin et al., 2017) that cause failure of those crops responsible for huge economic loss. To prevent such loss awareness should raise among cotton farmers.

#### **14.24 Impact of Bangladesh being Graduated from LDC to DC**

It is positive news for Bangladesh that it is being graduated from LDC to DC, however, at the same time, it contains some challenges also as Bangladesh was enjoying several benefits being a country of LDC. The actual impact of losing LDC-specific preferences depends on what goods the country exports, as well as other factors; including any trade agreements it may be a part of. For Bangladesh, apparel products are the main goods that are exported and it enjoys duty-free access in European Union and some other countries. Future possible impacts of graduation from LDC may be like- i) Bangladesh will lose duty-free and tariff-free facility in the European countries and some other countries, ii) Bangladesh will lose about 8 percent of its total exports, iii) an additional tariff on its exports by 6.7 percent. (Akter, 2018).

Ways to overcome the future challenges:

- i. Government should emphasize on doing 'Free Trade Agreement', 'GSP Plus' and 'Regional Trade Agreement' with developed countries.
- ii. Reformation of policy and increase in private investment

- iii. Development of infrastructure and enhancement of manpower skills
- iv. Manufacturers have to increase productivity

## **15. NANOTECHNOLOGY IN THE TEXTILE INDUSTRY**

There is no doubt that in the next few years nanotechnology will penetrate into every area of the textile industry (Schrijver, 2008). Nanotechnology has been discovered by the textile industry—in fact; a new area has developed in the area of textile finishing called “Nano-finishing”. Making fabric with nano-sized particles creates many desirable properties in the fabrics without a significant increase in weight, thickness or stiffness, as was the case with previously used techniques. Nano-finishing techniques include: UV blocking, anti-microbial, bacterial and fungal, flame retardant, wrinkle resistant, anti-static, insect and/or water repellent and self-cleaning properties. Finishing of fabrics made of natural and synthetic fibers to achieve desirable hand, surface texture, color, and other special aesthetic and functional properties, has been a primary focus in textile manufacturing. In the last decade, the advent of nanotechnology has spurred significant developments and innovations in this field of textile technology. Fabric finishing has taken new routes and demonstrated a great potential for significant improvements by applications of nanotechnology. There are many ways in which the surface properties of a fabric can be manipulated and enhanced, by implementing appropriate surface finishing, coating, and/or altering techniques, using nanotechnology (Sawney, 2008).

## **16. USE OF NATURAL DYE IN TEXTILE SECTOR**

Natural dyes are considered to be eco-friendly as these are obtained from renewable resources compared to synthetic dyes that are derived from nonrenewable petroleum resources. These are biodegradable and the residual vegetal residues after extraction of dyes can be easily composted and used as fertilizer. They produce soft colors soothing to the eyes and also offer functional benefits to the wearer and users of such textiles. Most of the natural dyes absorb in the ultraviolet region and fabrics dyed with this dyes generally offer good protection from harmful ultraviolet light (Grifoni et al., 2011). Treatment with tannins during mordanting itself improved the UV protection of fabrics. Extracts of tannin-rich pomegranate rind showed strong absorption in UV region and cotton fabrics treated with these extracts showed excellent UV protection which was durable to washing (Saxena et al., 2013). Many of the natural dye materials possess antimicrobial properties (Datta et al., 2013). Fabrics dyed with some natural dyes have been reported by the wearers to be free of odor perhaps due to the antibacterial or bacteriostatic properties of natural dye materials. Users of natural dyed fabrics have also found such fabrics to be mosquito repellent and/or moth repellent as perhaps the plant

material from which these dyes were derived might also have contained natural repellent substances (Ibrahim et al., 2013). In addition, recently, cellulosic textiles treated with natural plant extract have been found to exhibit flame-retardant properties (Basak et al., 2012). Many natural dyes such as myrobolon fruits, turmeric, manjishth root, Arjuna (*Terminalia arjuna*) bark, and safflower florets, among others possess curative properties and have been used in various traditional medicinal systems. Textiles dyed with these materials may also possess healing properties by absorption of medicinal compounds through the skin.

Natural dyes are very useful for environment as well as for health. However, there are many limitations in the usage of natural dyes such as- natural dyes require a longer dyeing time in comparison with synthetic dyes for processing, limited Shade range i.e., only three primary colors—red, yellow and blue can be obtained from natural dyes, very careful management is needed for their processing so it requires more cost (Saxena et al., 2013). If we can recover these drawbacks, natural dyes will be an excellent source of making clothes as well as for saving environment.

### **17. Effluent Treatment Plant in Textile Industry**

The textile and apparel industries generate huge volume of water-based waste containing various chemicals used in dyeing, printing and various chemical processes. This effluent generated in these processes is well beyond the national standard and are highly harmful for the environment. An Effluent Treatment Plant (ETP) is designed to treat these wastes or effluents.

Water is basic necessity of life used for many purposes one of which is industrial use. Industries generally take water from rivers or lakes but they have to pay heavy taxes for that. So it's necessary for them to recycle that to reduce cost and also conserve it. Main function of this ETP is to clean effluent and recycle it for further use.

Rivers like the Buriganga, Shitalakkha, Balu, Turag and Bangshi are continuously being affected by the textile industries. These industries discharge huge amount of wastes into the rivers degrading them every day. The challenge of the industries lies in coping with this untreated waste water through maintaining parameters like, pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS) and sometimes, heavy metals and color of the effluent.

#### **17.1. Types of ETP**

There are three types of ETP in general. They are the biological treatment plant, physicochemical treatment plant, and the combined physicochemical and biological treatment plant.

a) Biological Treatment plant

The design of such a plant typically includes screening, equalization, pH control, aeration, and settling. These can restrict BOD, pH, TSS, oil and grease requirements. But due to toxicity of the industrial effluent to the microorganisms, there is necessity for pretreatment. Especially in the case of dyes which are complex chemicals.

b) Physicochemical treatment plant

This typically includes screening, equalization, pH control, chemical storage tanks, mixing unit, flocculation unit, settling unit and sludge dewatering. Through this treatment, it is difficult to reduce BOD and COD, and it is not possible to remove TDS and maintain the national standard. It is effective in removing color from the processes.

c) Combined physicochemical and biological treatment plant

This is the most common treatment found in the textiles. The physicochemical treatment usually comes before the biological treatment units. The typical components are screening, equalization, pH control, chemical storage, mixing, flocculation, primary settling, aeration and secondary settling. This combination helps to restrict the pollutants according to the national standards.

### **17.2. Effluent Treatment Plant Scenario in Bangladesh**

Under the Environmental Conservation Rules 1997, industrial projects are classified into four categories based on environmental impact and location (Green, Orange A, Orange B and Red). The fabric dyeing and chemical industry in Bangladesh falls under Red. The Act and Environmental Rules (1997) also states that, it is mandatory for textile industries to setup an ETP to treat the waste before it is released to the environment. Furthermore, in order to get an environmental clearance certificate; these industries need to submit their ETP project and plans to the Department of Environment (DoE) for assessment and approval. To protect the environment from the harmful effect of waste water the Department of Environment, Government of Bangladesh fixed the effluent standards for the textile sector (Table 11).

**Table 11. Effluent Standard for Textile Sector (Amin, 2015).**

Parameters	Effluent Discharged Water Standards/Limit (mg/l)	Standard for Wet Processing (mg/l)	Avg. quality of Bangladeshi ETP's (Biological Based) (mg/l)
Total Suspended Solid (TSS)	100	1	15-50
BOD5 20°C	150	50	30-50
COD	200	200	100-150
DO	4.5-8	Not permitted	4-5
Oil and grease	10	1	1-3
Total Dissolved Solids	2100	200	1500-2100
pH	6.5-9	7-8	7-8
Color	-	Colorless	Colorless
Smell	-	Odorless	Odorless

The few basic tips before setting up ETP is to select the appropriate place, knowing that the ETP should not be set up close to the wells or reservoirs of drinking water, wetlands or water discharge zones. Secondly, a design-efficient treatment plant is done at a wasted place or idle place to save land. And a third step could be by choosing an appropriate water treatment technology.

While setting up ETP, choosing the right type of ETP is important, and at the same time maintenance and routine monitoring of the existing ones is equally significant for the entire textile and apparel industry. Choosing the correct ETP for the industry becomes easier, only if the industry is able to understand the effluent characteristic and have proper knowledge regarding the ETP operations. Such initiatives in operating the ETPs by the already existing companies can set examples for the new companies.

## **18. FUTURE OF RMG IN BANGLADESH**

The domestic market demand of RMG is increasing with the increase in standard of living. Bangladesh is the second largest apparel exporter after China. China has competitive advantage in unit price through economies of scale and large production

capacity, while Bangladesh is competing with the advantage of cheap labor. In terms of labor cost Bangladesh is clearly ahead. Hence a huge gap between Bangladesh and China's world share suggests that Bangladesh has a great chance to increase its world market share in apparel sector.

China's consistent rise in the living standard, more orientation to the high-tech expensive investment in capital machineries has increased per unit cost of production. The increase in unit price has made the Chinese apparel slightly unattractive and shifts the large apparel buyers from china to other countries like Vietnam. Bangladesh could be the next destination of those potential buyers. Moreover Bangladesh is also diversifying through new market exploration. Apart from the growth in the traditional market of EU and USA the share of apparel exports to non traditional markets is 20 percent in 2016-17 (BGMEA, 2017). Countries in Far East Asia like Japan, China, South Korea, and big markets such as India, South Africa, Russia, Brazil, Mexico and Chile in terms of population can be lucrative opportunities for market diversification.

Some facts (Nehal and Hossain, 2006) of RMG sector of Bangladesh are stated below:

- Compared to many competing countries, Bangladesh has an advantage of cheap labor, which may attract foreign buyers.
- The EU and USA companies have plans to rise their current sourcing of apparels from Bangladesh, from 20 percent to 25-31 percent by 2020 from Bangladesh.
- Giant Swedish retailer, H&M has decided to double its apparel volume to USD 3 billion from Bangladesh during next 5 years.
- Estimated global apparel demand is USD 650 billion by 2020.
- China's domestic RMG market is worth of USD 310 billion. Bangladesh has a big room to explore there.
- Dhaka Apparel Summit 2014 has envisioned an ambitious target of USD 50 billion RMG export by 2021 that may be realized if challenges are properly addressed.

## **19. RECOMMENDATIONS AND SUGGESTIONS FOR RMG**

Garments industries of Bangladesh can improve their position in the world map by reducing the overall problems such as:

- Management labor conflict,
- Proper management policy,
- Efficiency of the manager,



- Maintainable time schedule for the product,
- Proper strategic plans.
- Development of local supply chain
- Separate zone for garments industry
- Attaining self-sufficiency in yarn and fabric production to ensure that the export oriented RMG industries fabric needs can be met locally.
  - To ensure higher retention
  - To create employment opportunity
  - To eliminate dependability of technician from overseas countries.
- Giving more emphasis on research for:
  - Production development for export diversification and export of higher value added product.
  - Process development for cost minimization and quality improvement.
  - Market research for finding new destinations of export and for sustainable growth of exports.
- Ensuring the sub-sectors of the industry is better articulated resulting in a more synchronized development in the industry.
- Multi-modal transport facilities, sound infrastructure facilities including consistent supply of energy through public-private initiatives is to be set up
- Sound initiatives in research, training and development to innovate new product ideas, increase the workers efficiency are to be taken especially by the BGMEA
- The civil society and other socio-political stakeholders must take able initiatives to ensure congenial political environment to reduce corruption and maintain a trade supportive environment.
- Investment friendly fiscal and monetary policy is to be geared up to reduce the burden of existing and potential investors.
- RMG owners must pay adequate attention to workers welfare, safety and health, and the buyers should help to increase the supply chain's efficiency through investment in backward industry.
- Cost reduction strategy should begin with assigning the highest priority for establishing backward linkage.
- Labor productivity improvement.

- New product development strategy, returning back from producing same products.
- Market Diversification strategy which includes:
  - Market research on product design
  - Market research on product development
  - Market promotion through trade fairs, exhibition etc.
  - Human resources development by providing training.
- Improvement of the road and the communication infrastructure.
- Ensuring power and gas supply.
- Diplomatic efforts to ensure duty free access to USA market and the finding new destinations of export.
- Sustainable energy supply
- Emphasis on quality textile education to supply skilled manpower.
- Appropriate steps ensuring protection of environmental pollution.
- Government also have some responsibility to improve the situation by providing-proper policy to protect the garments industries, solve the license problem, quickly loading facility in the port, providing proper environment for the work, keep the industry free from all kind of political problem and the biasness. Credit must be provided when the industry fall in need.
- Recommendations for sustainable development of RMG industries
  - As a conscious citizen of any country, everyone have some common dreams like neat, clean and poverty free society. Government cannot bear this responsibility alone. Following steps can help the authorities for extensive management of garments waste and reduce the enduring of the city dwellers from physical, social and environmental point of view.
  - The conventional cotton production requires a huge amount of pesticides. Therefore, organic cotton (Fig. 17) production should be encouraged and use of natural pesticides. Focus should go to recycles cotton, reprocessing and reuse.
  - In preference to using synthetic compounds or chemicals, natural dyes can be utilized. In that case, toxic mordant should be avoided such as chromium based mordant.



**Fig. 17.** Organic cotton for RMG.

- Introducing cleaner production can promote pollutant reduction as well as re-circulation of treated water in the system process.
- Waste minimization is the grand policy and can provide a significant decrease of pollution amount as well as production costs and treatment operation costs.
- The workers who are involved with dyeing process need extra high pre-caution and should have regular check-up of health by the company employed doctor.
- Industry can introduce LCA (Life cycle analysis) approach for the manufactured product in order to address Greenhouse gases (GHGs) emissions tracking. The efforts regarding to construct life cycles of the product from raw material processing to disposal will reflect the carbon footprint and water footprint throughout the whole production process.
- Building structure specifically for apparel manufacturing industry should be legal and have a permit from the local authority. The structure should meet the standard construction.
- Must have sufficient fire prevent equipment and fire exit doors in each factory.

- Regular checking of Electrical equipment, outlets, wires and dust free clean electrical outlets.
- Prepare a concrete garment policy for sustainability
- All the employees including workers, managers and other levels should have fire and basic aid training by factory owner's special team.
- Government inspection team should continue regular monitoring to the factories for each day one or more companies for a team and provide certification for a certain period of time until next inspection.
- Set up a special zone for garment industries and not to allow establishment of a factory in residential or commercial areas.
- Should form a health and safety team selected or elected among the workers and other employees who will also monitor and inspect those issues and will suggest according to the necessity.
- Labor unions and trade unions should focus on the issues of workers health, safety and benefits, instead of linking themselves to the political party. Gender equality must be ensured and paid equally. In any circumstance, child labor should not be allowed.
- Government and owner of garments factories should be conscious about Environmental Act and try to follow the rules and regulations strictly.
- Effluent treatment plant (ETP) installation can be mandatory for all garments industry for decreasing the toxicity of the produce waste.
- If the set up cost of ETP is high, adjacent small factories at the same industrial area can establish common ETPs to treat their effluents. Small scale factories will provide employment opportunities for adjacent people in that region.
- Recycled Clothing: In addition to promoting a sounder environment by producing newer clothing made with sustainable, innovative materials, clothing can also be donated to charities, sold into consignment shops or recycled into other materials. These methods reduce the amount of landfill space occupied by discarded clothes.
- For quick transport of waste the vehicles such as Container carrier, Compactor, Arm roller, Van etc. should be on proper operation and if necessary, more vehicles need to be included.
- Effective training program organization about health & hygiene as well as overall environment among the employees of the factory.

- Properly follow the systematic procedure of waste disposal and ensure while handling the wastes, workers must use their safety equipment like mask, hand gloves, boot etc.
- The NGOs- Government partnership should be exhibited and promote the citizen monitoring mechanism to proper evaluation, efficiency and effectiveness of national as well as foreign aid program in the sector of environment.
- The industries like Textile (RMG) and others harmful factories can be transferred outside the City and proper drainage system should be ensured by the government.
- Suggestions regarding fire safety

We need to remember that when there is a fire, the first thing one should do is to run away from it i.e. everyone does in such a situation. But the situation become dangerous and tragic when the escape doorways and gates are found locked. Precautionary should need to be adopted are given below:

- Building should be constructed with fire resisting materials
- Adequate exits and proper escape routes should be designed
- Protection against fire and smoke should be ensured
- Electrical wiring must be properly designed, installed and maintained
- Escape routes should be lighted at all times, kept clear, be indicated by signs
- Regular fire drills should be held
- Doors should be protected and should open along the direction of escape
- Doors should not open on the steps and sufficient space should be provided.
- Smoke/Fire alarm systems must be installed
- Adequate number of extinguishers should be provided
- Prior relationship with local fire services should be established

To be an upper position holder in the world Garments Sector there is no way except follow the above recommendations. We hope by maintaining proper management and policy strategies our country will take the apex position in future.

## 20. CONCLUSION

RMG industry occupies a unique position in the Bangladesh economy. It is the largest exporting industry in Bangladesh, which experienced phenomenal growth during the last 25 years. By taking advantage of an insulated market under the provision of Multifiber Agreement (MFA) of GATT, it attained a high profile in terms of foreign exchange earnings, exports, industrialization and contribution to GDP within a short span of time. The industry plays a key role in employment generation and in the provision of income to the poor. To remain competitive in the post-MFA phase, Bangladesh needs to remove all the structural impediments in the transportation facilities, telecommunication network, and power supply, management of seaport, utility services and in the law and order situation. The government and the RMG sector would have to jointly work together to maintain competitiveness in the global RMG market. Given the remarkable entrepreneurial initiatives and the dedication of its workforce, Bangladesh can look forward to advancing its share of the global RMG market.

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[https://en.m.wikipedia.org/wiki/Bangladesh\\_Textile\\_Mills\\_Association](https://en.m.wikipedia.org/wiki/Bangladesh_Textile_Mills_Association);

<http://www.bkmea.com/BKMEA-at-a-glance.html>; <https://en.m.wikipedia.org>;

[http://en.banglapedia.org/index.php?title=Bangladesh\\_Jute\\_Research\\_Institute](http://en.banglapedia.org/index.php?title=Bangladesh_Jute_Research_Institute);

(<http://www.textilepact.net/about-us/what-is-pact.html>; <http://en.banglapedia.org>;

<http://www.newagebd.net/article/35805/7-out-of-worlds-top-10-green-units-in-bangladesh>; <http://www.bd-directory.com>) in writing the manuscript;

<https://oecotextiles.wordpress.com/2012/08/01/nanotechnology-in-the-textile-industry>;

<http://www.bgmea.com.bd/home/pages/TradeInformation>;

(<https://www.google.com/search?q=organic+cotton&hl=en>.

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**References**

- Akter, A. 2018. LDC to DC, preparation to triumph over the upcoming challenges, *TextileToday*. Available at: <https://www.textiletoday.com.bd/ldc-dc-preparation-triumph-upcoming-challenges/> (Accessed: 6 January 2019).
- Alom. M. M. 2016. Effects on environment and health by garments factory waste in Narayanganj City, Dhaka. *American Journal of Civil Engineering*. **4(3)**:80-83.
- Amin, A. S. M. T. 2015. Textile effluents, their treatment and discharge in Bangladesh, *TextileToday*. Available at: <https://www.textiletoday.com.bd/textile-effluents-treatment-discharge-bangladesh/> (Accessed: 6 January 2019).
- Azim, M. T. and Uddin, N. 2003. Challenges for garments sector in Bangladesh after 2004: Avenues for survival and growth. *Bangladesh Institute of International and Strategic Studies Journal*. **24(1)**:49-82.
- Hossain, M. T. and Moon, J.M. 2014. RMG-The leading earning sector in Bangladesh: A review. *Integrated Journal of Engineering Research and Technology*. **1(3)**:3-27.
- Mazedul, M. I. Adnan, M. K. Monirul, M. I. 2013. Textile industries in Bangladesh and challenges of growth. *Research Journal of Engineering Sciences*. **2(2)**:31-37.
- Nehal, A., Hossain, S. 2006. Future Prospects of Bangladesh's Ready-Made Garments Industry and the Supportive Policy Regime. Policy Note Series: PN 0702, Policy Analysis Uni(PAU), Bangladesh Bank.
- Parvathi. C., Maruthavanan. T. and Prakash. C. 2009. Environmental impacts of textile industries. *The Indian Textile Journal*. **1(3)**:3-27.
- Rahman H.M., Rahman S.M., and Rahman M.M., 2017. Disaster in Bangladesh: Mitigation and Management, *Barisal University Journal Part 1*. **4**:139-163.
- Rahman, H. M., and Uddin, J. M., 2017. Blast : A Threat To Coastal Crops in Bangladesh. *Barisal University Journal Part 1*. **4**:237-260.
- Schrijver D. I., Eufinger K., Heyse P., Vanneste M., Ruys L., 2008. Textiles of the future? Incorporation of nanotechnology in Textile applications”, *UNITEX* nr. 2. Available: [http://www.centexbel.be/files/publication-pdf/unitex\\_2009-2-p4-6.pdf](http://www.centexbel.be/files/publication-pdf/unitex_2009-2-p4-6.pdf)
- Sawney A.P.S. 2008. Modern applications of nanotechnology in textiles. *Textile Research Journal*, **78(8)**:77-75
- Tzschentke, N., Kirk, D. & Lynch, A. 2008. Going green: Decisional factors in small hospitality operators. *International Journal of Hospitality Management*. **27**:12-16.
- Yunus, M. and Yamagata, T. 2012. The Garment Industry in Bangladesh. In : Fukunishi (ed.), *Dynamics of the Garment Industry in Low-Income Countries: Experience of*

- Asia and Africa (Interim Report). Chousakenkyu Houkokusho, IDE-JETRO # 6, pp. 29.
- Basak S., Samanta K. K., Arputhraj A., Saxena S., Mahangade R., Narkar R., 2012. Method of dyeing and protective finishing of cotton textiles using vegetable extract. Indian Patent Application no 3469/MUM/2012.
- Datta S., Uddin M. A., Afreen K. S., Akter S., Bandyopadhyay A., 2013. Assessment of antimicrobial effectiveness of natural dyed fabrics. *Bangladesh Journal Science Industry Research* **48(3)**:179-184.
- Grifoni D., Zipoli G., Albanese L., Sabatini F., 2011. The role of natural dyes in the UV protection of fabrics made of vegetable fibers. *Dyes Pigm.* **91**:279-285.
- Haider M.Z., 2007. Competitiveness of the Bangladesh readymade garment industry in major international markets. *Asia-Pacific Trade and Investment Review.* **3(1)**: 3-27.
- Rashid M.A., 2006. Rise of readymade garments industry in Bangladesh: entrepreneurial ingenuity or public policy. In workshop on Governance and Development, Dhaka. 11-12 pp.
- Ibrahim A.N., El-Zairy W.M., El-Zairy M.R., Ghazal H.A., 2013. Enhancing the UV-protection and antibacterial properties of Polyamide-6 fabric by natural dyeing. *Text Light Indl Sci Technol (TLIST)* **2(1)**:36-41.
- Saxena S., Basak S., Mahangade R. R. 2013. Eco-friendly durable ultraviolet protective finishing of cotton textiles using pomegranate rinds. Paper presented at the international conference on advances in fibers, finishes, technical textiles and nonwovens, AATCC, Mumbai 1-2 Octextes.