

## **Prioritizing the factors which affect the sustainable supply chain in RMG industry using AHP method**

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### **Introduction:**

Apparel and textile sector are very crucial for Bangladesh. this sector not only provide the financial support to the country but also provide huge employment to the people. The RMG sector contributed 9.25 percent of GDP in FY22. Bangladesh's total RMG export revenues were USD 42613.15 million, a 35.47 percent increase over the previous fiscal year. Of the 6.08 crore total workforce of the country, RMG and textile industry is said to generate almost 45 lakh employment together. But sustainability issues are highly compromised in this sector. Over the last two decades, Bangladesh has had an average annual increase in CO2 emissions of 8%. The readymade garment (RMG) sector contributes the most CO2 emissions (15.4%), followed by the textile sector (12.4%).

The goal of this research is to better understand the role of SSCM in the RMG sector in Bangladesh, as well as to identify SSCM hurdles that this sector faces. These hurdles are drawn from the existing literature and are organized in a way that will aid scholars in their study of this sector. The goal of this research is to identify existing obstacles in the textile and clothing sectors and investigate the link utilizing a hybrid MCDM technique, ISM-DEMETAL technique, and FMICMAC technique to learn more about the features of recognized barriers.

## 2. Literature Review:

Literature review shows the overall scenario of the RMG sector, its associated with the growth of this sector and barriers its going to be faced in recent future. Despite its significant contribution to export earnings, the sector faces numerous hurdles in reaching its full potential. Islam (2015) carries out that.

The RMG sector alone employs about 4.4 million people, 80% of whom are women, hence empowering women. It has the largest share of export earnings, accounting for roughly BUFT Journal 2015, Rakib and Adnan exported 79 \$23 billion in 2015, accounting for 81% of total exports. Despite being a major economic driver, RMG industries have issues such as maintaining worker safety and welfare, poor infrastructure, a lack of training and research, low productivity, a shortage of skilled labor, and intense competition from neighboring countries.

RMG industry helps to increases the GDP by 4.39 %. In fiscal year 2011- 2012 RMG exports raised at a figure of USD 19.91 billion and around 81% of state export earnings, that was about 4%-5% total exports around the world. Hasan (2013) examines that since 2005, the challenge becomes the unbound opportunities. In FY21, the RMG industry contributed 7.66% of GDP. Bangladesh's overall RMG export revenue is USD 31456.73 million, a 12.55 percent rise over the previous fiscal year.

The industry has immerged with its full potential with low cost apparels and low cost labor. But the industry is also facing some new challenges as the industry is going towards its full potentiality such as poor infrastructure, lack of backward linkages, high lead time and market and product diversification. Despite the epic growth of our RMG industry, and its bright prospects, challenges are still there. One of the biggest challenges currently faced by our RMG industry is to ensure workplace safety and better working conditions for the millions of garment workers.

The Bangladesh RMG industry has grown from strength to strength and has become a global powerhouse for apparel sourcing, thanks to its excellent manufacturing skills and robust ecosystem. There are currently approximately four thousand factories in the industry. RMG exports from Bangladesh comprise a diverse range of knitwear and woven clothes such as shirts, trousers, T-shirts, jeans, jackets, sweaters, and so on.

RMG exports from Bangladesh more than doubled between 2011 and 2019, growing at a 7% yearly rate. Total exports around USD 27.4 billion as of December 2020, accounting for 6.30% of the \$435 billion global garment export industry. While the industry experienced a short setback as a result of covid19, demand has begun to rebound and stabilize.

Bangladesh currently leads the world in green garment manufacturing, with 150 LEED (Leadership in Environmental and Energy in Design) accredited facilities and another 500 awaiting certification from the United States Green Building Council (USGBC). Bangladesh currently has nine of the top ten green garment factories and 40 of the top 100. Following the successful implementation of initiatives such as the Accord on Fire and Building Safety in Bangladesh, the Alliance for Bangladesh Worker Safety, and the RMG Sustainability Council, Bangladesh's RMG sector has now transformed into a highly transparent and compliant industry in terms of factory safety and value-chain responsibility.

### **3. Identification of Barriers:**

Although the RMG industry is the most important sector in Bangladesh, accounting for around 83.49% of total export earnings, it faces a wide range of marketing challenges.

#### **1. Communication gap among stakeholders:**

Stakeholders in an organization require effective communication. The process and communication hurdles with stakeholders determine communication efficacy. Communication obstacles are hurdles to communication that occur when receivers misinterpret signals. The communication process is influenced by a number of aspects, including "emotional," "psychological," "practical," and "social" factors. Language barriers (inappropriate words, variations in language, effort comprehending), physical barriers (large working spaces, environmental issues), emotional barriers (aggression, anger, resentment, and fear), and poor subject knowledge (ignorance, unrelated, and unconfirmed things) all contribute to poor communication in terms of message delivery between individuals. Organizations must remove communication impediments that limit productive stakeholder relationships. Organizations may accomplish seamless communication and develop a culture of knowledge-sharing, trust, and collaboration with the appropriate approach and technologies. [1]

#### **1. Increase cost of adopting SSCM:**

Implementing various RM approaches is expensive. SCRM preventive methods begin with massive data collection and analysis, which can be costly. A significant quantity of money is also required to maintain massive infrastructure and staff. Evaluating the barriers to and options for managing supply chain risk in an emerging economy. Creating a budget to bear this huge cost, for example, is tough

for a developing country like Bangladesh, where budgeting for RM is not a priority for industries. [2]

## 2. **Adoption of modern technologies for cleaner production:**

Adoption of cutting-edge equipment, AI-driven automation, and sustainable materials can result in cleaner manufacturing processes and have a favorable impact on the supply chain in the textile industry. These innovations can boost the industry's overall sustainability, increase energy efficiency, decrease water use, limit waste, and benefit the environment as well as supply chain participants.

CP is promoted as a method for identifying preventive steps to decrease emissions and residues from industrial processes used in the textile industry by substituting some synthetic components with natural ones.

According to studies that evaluated the adoption of CP in the textile industries from an economic and environmental standpoint, less water and electricity was used, less gas was released, and less toxic or more biodegradable products were substituted in the production processes thanks to new methods or technological advancements.

Additionally, it should be noted that the environmental benefits of CP adoption in the textile industry are concentrated and only indirectly associated with three of the 17 Sustainable Development Goals of the 2030 Agenda: the first refers to Industry, Innovation, and Infrastructure; the second refers to Responsive Production and Consumption; and the third refers to the preservation of Life on Land. [3]

## 3. **Poor**

## **Infrastructure:**

At the start of the RMG business, most garment factories were set up in an unplanned way, usually in converted and shared buildings; there were no purpose-built buildings at the time. The ramifications of those unforeseen complications are now on display.

Despite the occurrence of disastrous disasters such as Rana Plaza and Tazrin garments, which killed over 2000 people and injured thousands more. These

concerns are increasingly causing concern among EU and US buyers. They are now more concerned with building and workplace safety. Accord and Alliance were created to confront and correct fundamental flaws and problems in the workplace.

Poor highway quality as a result of inappropriate construction and maintenance poses a significant threat to the improvement of RMG lead time. The Dhaka-Chittagong highway, which serves as a key mode of transit, is always congested, taking up to 12 hours to complete the journey. The small two-lane highways and movement of all types of transportation delay transportation. Also, despite having a lot of promise in terms of freight and uninterrupted transit, rail lines remain underutilized. The rail container storage facilities in Chittagong and Dhaka are insufficient, decreasing exporters' and importers' interest. Inefficient wagon management and an unsuitable yard layout might also contribute to the problems.

The Chittagong port, which handles approximately 85 percent of the country's commercial goods, is plagued by labor issues, bad management, and a shortage of equipment. These inefficiencies in bureaucratic red tape and corruption have a significant impact on Bangladeshi garment competitiveness in the global market. Transportation issues occur as a result of national and local political agendas. Chittagong port's productivity and efficiency are not competitive when compared to other South Asian ports such as Colombo and Mumbai. Chittagong port also suffers from long lead times for marine freight due to the lack of a deep-water harbor required for the mother vessel's entry. [4]

#### 4. **Use of conventional machineries:**

The state of procuring new technology and machines is not very satisfactory in our ready-made garments sector which is certainly affecting the quality of the product and also the lead time. Conventional machineries in the RMG sector often rely on outdated technologies that consume a significant amount of energy. This leads to higher carbon emissions and contributes to climate change. We are constantly driven to do more with less. Long term gains will always have preference over long term yields.

In order to increase productivity, apart from having trained personnel in the

company, the company must purchase new machines and technology so that they can keep pace with the change. Otherwise, excessive resource consumption by conventional machines not only depletes natural resources but also increases production costs and waste generation.

At present, buyers are giving more importance on lead time reduction. They prefer manufacturers that can deliver products in a shorter lead time. Lead time has become the most important factor in selecting the supplier of their demanded products. Timely shipment by the suppliers has been placed in second position while selecting the suppliers followed by cost minimization. Bangladesh RMG sector needs to increase the overall capability of the entire industry by procuring new technology and machineries so that they can meet up with the changed preference of the buyers. Also, they should facilitate knowledge-sharing platforms and training programs to educate manufacturers and workers about the benefits and implementation of sustainable machinery. [5]

## 5. Unskilled

## Worker:

The overall impact of the ready-made garment export industry is certainly one of the most significant social and economic developments in Bangladesh. But it's a fact that there is a big challenge always awaiting us in the RMG sector with unskilled labor. Unskilled labor with low productivity results in increased per unit cost of production, increased in lead times which is directly affecting the sustainability in ready-made garments of Bangladesh. Growth and development of an industry requires sufficient skills and expertise. Out of its current 4 million workers, 90 percent are women, most of whom are illiterate, unskilled and come from the rural part of the country. To develop productivity and efficiency levels, capacity building training and retraining activities for employers and workers in the RMG sector should be undertaken. Sound initiatives in research, training, and development to increase the workers efficiency should be taken especially by the BGMEA. [6]

## 6. Lack of training and education about sustainability:

Sustainability means creating better scope for the generation to come. Sustainable ready-made garments are those that have experienced environmental, economic, and social issues at the same period, following the definition of sustainability presented above. But it is a matter of regret that most companies have not achieved social sustainability, which is the key aspect of these three aspects. Many workers, supervisors, and management personnel in the RMG sectors have limited education, awareness, training and knowledge about sustainability and its implications. They are not familiar with sustainable practices, their benefits, and how to implement them effectively. This lack of awareness can hinder the integration of sustainability into daily operations. Several researchers (Ametepey et al., 2015; Bhanot et al., 2017, 2015; Diabat et al., 2014) mentioned that training and education has a lot of influence on SCM practices. Also, lacking of proper HR policies and procedures about the training method which should be given upon the workers for the better understanding of sustainability of the RMG sector. Education plays a crucial role in building a sustainable mindset. Many workers in the RMG sector may have limited access to formal education opportunities, making it difficult for them to understand and engage in sustainability initiatives.

Language and cultural barriers can further impede the dissemination of knowledge and training on sustainability.

Most of the garment's factories fail to achieve success due to their unwillingness to improve the working situation of the workers, giving them proper knowledge and training about the economic, social and environmental sustainability.

Addressing the lack of training and education about sustainability requires concerted efforts from multiple stakeholders. Poor HR planning and management is one of the main reasons for which the workers are not getting enough information about the sustainability. [7], [8]

## **7. Lack of eco-literacy amongst supply chain partners:**

Eco-literacy refers to the understanding of ecological principles and the ability to apply them in decision-making. Lack of eco-literacy among the Supply chain members is one of the barriers which thwart the implementation of green supply Chain. Therefore, eco-literacy programs are considered as an important strategy for human resource development. By imparting training in the areas of green materials, processes and pollution prevention, the organization can improve Its environmental performance to a significant extent. Environmental Education and training

programs among supply chain partners also construct a collaborative relationship which facilitates the implementation of green SCM. Therefore, suitable training programs should be arranged periodically for the professionals along with involvement of government and regulating agencies to issue the guidelines of green SCM . Lack of top management commitment (TMC) drives lack of trust and environmental partnership (TEP), lack of reward system for suppliers (RS) and lack of eco-literacy and training (ELT). [9]

**Factors**

- Increase cost of adopting SSCM
- Communication gap among supply chain stakeholders
- Poor Infrastructure
- Use of conventional machineries
- Unskilled Worker
- Lack of training and education about sustainability
- Lack of eco-literacy amongst supply chain partners

Methodology

Table- Pairwise comparison among the factors

Communication gap among supply chain stakeholders	0.5	1	0.2	1	0.5	2	3
Poor Infrastructure	2	5	1	3	3	5	6
Use of conventional machineries	0.5	1	0.3333	1	0.3333	3	4
Unskilled Worker	0.5	2	0.3333	3	1	4	5
Lack of training and education about sustainability	0.3333	0.5	0.2	0.3333	0.25	1	3
Lack of eco-literacy amongst supply chain partners	0.2	0.3333	0.1666	0.25	0.2	0.3333	1
	0.1974	0.0905	0.3432	0.1050	0.1743	0.0565	0.0327
	14	44	9	59	43	55	95



## Methodology

In this method study, the problem will be solved by The Analytic Hierarchy Process (AHP).

### Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a decision-making technique that involves the use of pairwise comparisons to establish priority scales, relying on the expertise and judgments of individuals [10]. The aforementioned tool has gained significant popularity as a means of facilitating decision-making processes involving multiple criteria. The tool is utilized by decision makers and researchers due to its efficacy and simplicity [11]. The method was developed by Thomas L. Saaty with the aim of establishing a systematic approach for defining priorities and facilitating complex decision-making processes.

### Constructing the Pairwise Matrix

The Pairwise matrix was constructed by conducting a survey. The survey was on 20 RMG experts who rated the factors based on their importance with each other.

**Table 1: AHP importance scale**

Equal importance/quality	1
Somewhat more important/better	3
Definitely more important/better	5
Much more important/better	7
Very much more important/better	9

**Table 2: Pairwise Comparison Matrix for Barriers to Sustainable Supply Chain in RMG Industries**

	Increase cost of adopting SSCM	Communication gap among supply chain stakeholders	Poor Infrastructure	Use of conventional machineries	Unskilled Worker	Lack of training and education about sustainability	Lack of eco-literacy amongst supply chain partners
Increase cost of adopting SSCM	1	2	0.5	2	2	3	5
Communication gap among supply chain stakeholders	0.5	1	0.2	1	0.5	2	3
Poor Infrastructure	2	5	1	3	3	5	6
Use of conventional machineries	0.5	1	0.333333	1	0.333333	3	4
Unskilled Worker	0.5	2	0.333333	3	1	4	5
Lack of training and education about sustainability	0.333333	0.5	0.2	0.333333	0.25	1	3
Lack of eco-literacy amongst supply chain partners	0.2	0.333333	0.166667	0.25	0.2	0.333333	1

The normalized weights of the factors are

**Table 3: Normalized Weights of the Barriers**

Increase cost of adopting SSCM	0.197
Communication gap among supply chain stakeholders	0.092
Poor Infrastructure	0.339
Use of conventional machineries	0.104
Unskilled Worker	0.168
Lack of training and education about sustainability	0.055
Lack of eco-literacy amongst supply chain partners	0.032
Sum	1

The Consistency Ratio (CR) is calculated to make sure that the results derived from the pairwise comparisons are reliable and consistent. The consistency of the judgments as compared to a random collection of judgments is gauged by this ratio.

Step 1: Calculate the principal eigenvalue ( $\lambda_{max}$ ) from the pairwise comparison matrix.

Step 2: Compute the Consistency Index (CI) using the formula:

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)}$$

Where  $n$  is the order (size) of the pairwise comparison matrix.

Step 3: The RI value, which is derived from a table of average random consistency indices for matrices of various sizes, is then compared with the CI value. The CR is determined by the CI to RI ratio:

$$CR = \frac{CI}{RI}$$

**Table 4: The value of Random Consistency Index [12]**

Dimension	RI
1	0
2	0

3	0.5799
4	0.8921
5	1.1159
6	1.2358
7	1.3322
8	1.3952
9	1.4537
10	1.4882

The computed  $\lambda_{max}$  is approximately 7.30667406. For this analysis, the calculated CR value is 0.0388. In general, a CR value of less than 0.10 is regarded as acceptable [13], signifying that the conclusions drawn from the pairwise comparisons are sufficiently consistent.

The pairwise comparison matrix utilized in this study shows an acceptable level of consistency with a CR value of 0.0388.

## Discussion:

From methodology, we observe that the factor “Poor Infrastructure” has the highest weight of 0.339, indicating it's the most critical or influential factor based on your AHP analysis.

Increase cost of adopting SSCM is the next most important factor with a weight of 0.197.

Unskilled Worker has a weight of 0.168, making it the third most important factor.

## Conclusion:

Within a short period of time, the readymade garments sector evolved as a massive business that appeared to be critical to our economy as a source of export revenues and job creation. The country's socioeconomic landscape is changing as a huge workforce becomes involved in this industry due to the constant rise of the RMG sector. Adverse effects on this industry stem from a

variety of sources, including a lack of communication among stakeholders, an increase in the cost of implementing SSCM, the adoption of modern technology for cleaner production, and a lack of infrastructure. These obstacles are impeding Bangladesh's RMG sector from reaching its full potential. Controlling or reducing these issues, as well as maximizing the exploitation of competitive assets such as a large supply of labor at fair wage, can produce a boom in the Bangladeshi economy and fundamentally change the standard of life and economy in a favorable way. To close the gap between expectation and reality, collaborative and cohesive actions should be implemented. Sustainable infrastructure should be developed by establishing specialized RMG industry zones, ensuring adequate power and utility, developing long-term and profitable partnerships between buyers and sellers through effective political and commercial negotiations, and establishing effective and fully implacable technical education facilities to create expertise in this trend and increase the efficiency of the existing workforce. The Bangladeshi ready-made clothing industry faces obstacles on one side and a more glistening future on the other. That would enable this sector to advance to a new level.

A prosperous future is waiting for Bangladesh's RMG sector in the near future

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