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REVIEW

Sustainable Development of Apparel Industry in Bangladesh: A Critical Review

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ABSTRACT

Bangladesh's apparel industry has become the country's economic foundation. The textile and apparel employees especially over four million people. In this major industrial sector, it is critical to encourage sustainability. When the apparel market and corporations focus on environmentally friendly products, Bangladesh's textile and apparel sectors remain far behind, putting the country at risk of losing market share. It is right of passage to implement techniques and a long-term strategy to sustainability. Bangladeshi apparel industries are currently facing significant issues in terms of labor conditions. In garment manufacturers, fires are a common occurrence. Thousands of workers have perished because of these dangers. Due to Bangladesh's fire and safety difficulties, several foreign purchasers have already opted not to do business with the country again. Furthermore, workers receive the world's lowest pay, which leaves them dissatisfied and frequently results in conflicts and violence during protests poor wages. This study is conveyed based on theoretical, analytical, and statistical aspects. The goal of this study is to represent the overall picture of sustainability in the apparel industry in Bangladesh. This study illustrates on using a life cycle approach to assessing manufactured products for environmental indicators to attain sustainability, fast fashion, government policy of sustainability, new method and material of garments and compare with the lifestyle of Europe against Bangladesh. This paper investigated Bangladesh's garment industry's working environment, fire, and safety hazards, and made suggestions for important environmental and sustainability activities. This study is helpful to all the people because sustainability is the main concern in a day.

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1. Introduction

In the textile and apparel sector, the concept of sustainable development can be interpreted in a variety of ways. Its main concept, however, is progress that meets current requirements without sacrificing environmental norms, ensuring that future generations can live in a sustainable manner. The repercussions will be more severe if unsustainable methods are used in the textile and garment industries. As a result, it is critical to design ways that would result in a sustainable environment and way of life. 2018 was a lengthy and dramatic year for the textile and garment industry, which saw tremendous growth. Throughout the year, the word "sustainability" was used frequently, and it was not only discussed, but several noteworthy advances occurred across the board. However, environmental, and social sustainability have made greater progress than economic sustainability. Economic sustainability is just as crucial as the other two factors. How can textile and garment producers assure environmental and social sustainability without compromising on economic sustainability? Manufacturers cannot guarantee them for an extended period of time without maintaining economic viability [1]. Bangladesh is currently the world's third largest garment maker and exporter. Despite the fact that the garment manufacturing industry has become the backbone of the country's economic prosperity and social stability, it has recently faced some unforeseen dangers [2]. There have been several fires that have resulted in the deaths of hundreds of garment workers, and flames have become a typical occurrence in the current environment. Furthermore, due to the deaths of hundreds of workers, recent episodes involving labour unrest and garment building collapse in Savar have been a hot topic in Bangladesh and around the world. This tragedy raises concerns about the garment industry's safety and long-term viability in Bangladesh. Several international purchasers have expressed interest in the property. Due to the country's lack of safety and adequate environment, several foreign buyers of readymade garment items have already proclaimed that they will not do business with it. Furthermore, a growing number of purchasing companies are requesting more environmentally friendly products. Some garment manufacturing industries in our country have already begun labelling their products as "green" and incorporating environmental indicators into their websites or product labelling, such as incorporating Life Cycle Assessment, CO_2 emissions, and water footprint due to their manufactured products [3]. They have already begun informing their customers about their production efforts to create a product. Fashion is currently a hot topic in Bangladesh, as it is in the rest of the globe. Consciousness has matured to the point that it can be used daily. Finally, because denim items have emerged as key players in global markets, Bangladesh has a huge possibility to grow in the RMG export markets. In this sense, the government of Bangladesh should place a high priority on apparel sector and provide unwavering support to businesses [4].

2. Challenges and a Comprehensive Overview

Textile industry has played a vital part in Bangladesh's economic development in recent years. Even though the overseas market for Bangladeshi garments has grown significantly in recent years, the country continues to face hurdles in maintaining its normal growth rate of garment exports. Furthermore, there are other elements that contribute to the clothing industry's issues. One of the most essential difficulties to discuss is the global recession, which has resulted in many overseas purchasers placing fewer orders from Bangladesh. Although it is claimed that the global recession had minor impact on Bangladeshi garment exports, new buyers who used to deal with China have switched to Bangladesh. Although it is claimed that the global recession had little impact on Bangladeshi garment exports, new buyers who used to deal with China have switched to Bangladesh. Bangladesh's garment industries face significant hurdles in terms of safety and security. There have been numerous fires and building collapses, resulting in thousands of worker deaths and injuries. These are hot topics for both international buyers and consumers around the world. Aside from these factors, rising production costs due to rising energy and material costs, demand for rising labor expenses, adverse trade policies, and an unstable political scenario all contribute to putting these huge sectors in a difficult position in the future. The most significant challenge is the rising cost of textile manufacture. High inflation, a high interest rate, and a drop in the value of the Bangladeshi rupee against the US dollar are the key causes of rising costs. Higher costs are also imposed by rising energy and fuel prices. Furthermore, people's everyday living expenses have risen in recent years, prompting workers to seek higher wages. The depreciation of the Bangladeshi rupee raises the cost of importing raw materials and machinery. Furthermore, most of the garment industries' equipment and machinery are outdated or lacking in innovative technology. As a result, the constant need to upgrade machinery and equipment is a barrier to worldwide textile competitiveness. Most clothing companies still employ antiquated machinery and work in traditional ways.

3. Sustainable Development of Fashion

Sustainability is undoubtedly the most pressing problem facing fashion firms right now, which is unsurprising given that the industry responsible for around 10% of global CO_2 emissions (more than international flights and shipping combined). However, as fashion firms race to join the sustainability discourse, shoppers may find themselves sifting through tweets, blog posts, and press releases to find the cold, hard facts. Furthermore, brands confront a further challenge in achieving the correct informational balance: too much discourse risks being accused of greenwashing; nevertheless, if you remain mute on the issue, customers may interpret it as a lack of concern and hold you accountable [5]. Fashion sustainability will necessitate radical adjustments in the practices of all parties involved: designers, producers, marketers, and consumers. Consumers, on the other hand, require a vision for sustainable fashion practice. Eco-friendly design sourcing programs have the highest intent to participate of all the studied sustainable social programs, according to a customer study about the intent to contribute in different programs, such as 1:1 funding, ecological design sourcing, an improvement style contest, redesign consulting, and an eco-fashion gallery [6]. The sincerity of a fashion garment's design adds value to it, makes it more appealing, and sets it apart from the everyday of conventional fashion that is created offshore. Fashion firms should seriously evaluate the product creation process and expand stewardship across several product lifecycles, according to another study. The goal of that concept was to help fashion designers who wanted to think about sustainability. Figure 1 indicates The "Three Pillars" of sustainability bounded by the environment (earth, life).

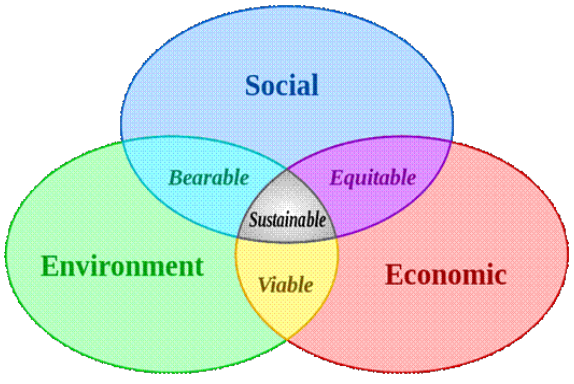

Figure 1. The "Three Pillars" of sustainability bounded by the environment (earth, life) [7]

3.1 The Impact of Fast Fashion in Bangladesh

Demand governs fast fashion. For stores to have the clothing in stock before the trend passes, the industry must produce items swiftly. The steady rise in American and European demand for Bangladeshi goods results in lower salaries, riskier working conditions, and negative environmental effects. Estimated monthly wages for Bangladeshi garment workers range from $25 to $75 [8]. Living on this salary is not possible, especially in Bangladesh's major cities like Dhaka, where most the country's textile factories are situated. "We are cheap labor - that is why we are terrified; we need money, we need to survive," said Nazma Akter, a seamstress in Bangladesh who started working in factories at the age of 11. An unlivable life follows from an unlivable pay. Human rights violations have significant financial repercussions. Few residents can invest in Bangladesh, spend money to stimulate the economy, and aid in Bangladesh's rise out of poverty because such a significant part of the population lives on so little. Following the implementation of market-oriented policies, the industrial class grew, ushering in a new entrepreneurial class that has created hundreds of thousands of jobs for Bangladeshi villagers. Bangladesh adopted garment assembly as a strategy for export-driven growth, relying on its sizable pool of low-wage laborers. Although Bangladesh may appear to have changed for the better from the outside looking in, the textile sector has negative impacts on workers who have no other employment options [9]. Bangladesh has a large pool of labor that multinational corporations may easily take advantage of by offering dreadful working conditions and meager pay at their factories. However, the $28 billion garments industry generates significant sums of tax money for the Bangladeshi government and employs millions of Bangladeshis. It represents a staggering 81% of the nation's exports. Therefore, if the government takes any action against these firms, all the advantages of hosting them in the first place could be lost. As a result, multinational corporations can undermine state sovereignty and force developing countries like Bangladesh to do as they like in order to maintain their economic security [10]. Supply chains have expanded internationally as a result of globalization and the development of a world economy, moving the production of textiles, apparel, and fibers to regions with lower labor costs [11]. Cheaper clothing is produced as a result of rising demand, and prices are kept low by outsourcing manufacturing to nations with low and moderate incomes (LMICs).

3.2 Lifestyle of Europe

Although the majority of the framework's components—including material living conditions, living environment, leisure and social interactions, employment, etc.—deal with people's objective functional capabilities,

any measurement of quality of life should also encompass people's subjective well-being. Perhaps the only way to account for people's various choices, goals, and values is to measure subjective well-being in addition to aggregating people's experiences of these objective aspects by implicitly evaluating their own preferences. In a comparative European perspective, we must recognize that these vastly divergent objectives and values are also influenced by societal structures, customs, and cultural backgrounds, which might vary between nations [12]. Therefore, the weight given to each of the objective measures of quality of life may vary at the overall national level. The role that objective capabilities play as well-being determinants can be better understood by measuring subjective well-being. Even with these factors considered, gauging well-being has inherent appeal because it is undoubtedly the main objective of all EU initiatives and the unifying theme that unites them all. One of the main objectives of the European Union, as stated by the Treaty on European Union, is to promote the welfare of people in Europe. Numerous EU measures currently place a strong emphasis on the issue of life quality. The general goal of the Treaty of Rome was to enhance the living and working conditions of Europeans as early as 1957. Additionally, it sought to harmonize them "while improvement is maintained", which refers to achieving a catch-up in the standard of living and employment in the less developed nations. However, until the 1980s, there wasn't much action taken in this area at the European level. After Greece, Portugal, and Spain joined the Community, the situation altered, bringing attention to the varied degrees of modernization within the Community. Under the broad heading of economic and social cohesion, new policy instruments were devised to close these disparities in living and working situations [13].

4. Bangladesh's Textile and Apparel Sector is Committed to Long-term Sustainability

2018 was a lengthy and dramatic year for the textile and garment industry, which saw tremendous growth. Throughout the year, the word "sustainability" was used frequently, and it was not only discussed, but several noteworthy advances occurred across the board. However, environmental and social sustainability have made greater progress than economic sustainability. Economic sustainability is just as crucial as the other two factors. How can textile and garment producers assure environmental and social sustainability without compromising on economic sustainability? Manufacturers cannot guarantee them for an extended period of time without maintaining economic viability [14]. Bangladesh, the world's second-largest supplier of ready-made garments, has led the way in sustainable green industrialization, with several top-ranked green factories. Bangladesh now has established itself as a global leader in textile and garment green manufacturing. Bangladesh's RMG industry now has 67 Leadership in Energy and Environmental Design (LEED) green factories, according to the US Green Building Council (USGBC). 13 of them are LEED Platinum certified, and more than 280 Bangladeshi textile manufacturers will be LEED certified soon. Even though Bangladesh's garment or clothing manufacturing business is rapidly expanding, it has already begun to encounter several issues in many areas. Many readymade clothing companies begin as local household tailoring outfits at first. After a period, it begins to receive sub-orders from other major Bangladeshi garment exporting enterprises, eventually transforming into a large independent garment manufacturer. As a result, no industrial building structure or policies have been followed since the start of the project. Furthermore, many people come directly from the rural region to work in these small industries, having previously worked in agriculture or having no prior work experience. Figure 2 indicates sustainable development of RMG factories.

Figure 2. Sustainable development of RMG factories [15]

4.1 A Minimum Wage

Bangladeshi textile workers earn the world's lowest wages, which is a source of immense sadness. This is the primary reason for the low production costs that attract overseas purchasers looking to trade at a reasonable cost [16]. Since 1994, the wage of garment workers has been increased three times. The minimum monthly pay at the time was 930 taka (8.3 Euro), which was raised to 1662 taka (15 Euro) after a long period of time in 2006. However, it was insufficient to cover living expenses. As a result, employees continued to demonstrate against poor salaries. As a result, the minimum salary was raised to 3000 taka (27 Euro) per month by the wage board in 2010. Although the workers demanded 5000 taka (45 Euro) in salaries. The most recent minimum wage decision (November

2013) was set at 50 Euro per month. The pay board is an entity inside the Ministry of Labor and Employment that determines the government's salary scale. In the garment sector, the role of the labor has become quite important. The importance of labor has not been diminished because of the economic reforms.The liberalization of the economy has thrust workers into the spotlight. Human resources are seen as a critical component in increasing productivity, improving quality, and lowering costs, all of which are required to compete in today's world.

4.2 Long-term Working Hour

Another issue is working long hours. Workers frequently work overtime in order to supplement their income and offset rising living expenses. In many circumstances, workers are forced to work overtime in order to satisfy the supplier's demand on time. The Bangladeshi labor code of 2006 defines a standard workday as eight hours per day and six days per week. As a result, a work week is defined as 48 hours, which can be extended to a maximum of 60 hours, including overtime. Bangladeshi garment workers work an average of 76 hours per week, which is significantly longer than the normal work week. According to the Labor Act of 2006, a worker should be compensated within 7 working days of completion. Unfortunately, the majority of factories do not adhere to these guidelines [17].

4.3 Equality of the Males and Females

The growth of Bangladesh's textile industries has created a wealth of opportunities for women. Women made about 1.5 million of the 1.8 million textile workers who worked in 3480 firms in 2004. It is estimated that roughly 80% of garment workers are female. Women are drawn to work in the garment industry despite poor pay due to a lack of education and work skills. Most of them were previously unemployed and worked in the family or in agriculture. The garment entrepreneurs took advantage of the situation to offer lower wages to the newly relocated women from rural areas. According to many studies, most female workers are unmarried and younger. According to one study, 40 to 50 percent of female workers are married and even working mothers. Poverty, family turmoil, and divorce are the main motivators for people to work in the clothing industry [18]. Working in the garment industry gives women improved economic opportunities, even if the pay is modest, as well as new social opportunities as they gain new job identities [19]. There are various injustices at work in the garment manufacturing industry, which employ a high number of women. In comparison to men, women are more likely to be employed in jobs that need less or no technical skill. Furthermore, female workers are paid less than male workers doing equivalent labor. Another typical infraction is sexual harassment of female employees. Many female employees have been harassed while receiving pay or working a night shift. In the majority of situations, it is the boss or senior supervisors that harass their male coworkers. Because they are afraid of losing their jobs, most female workers do not report abuse to authorities or police. Lack of a proper recruitment process, a lack of skills and documentation of work, and social neglect towards victims. Female workers are sometimes forced to cut off a particular amount of money during salary payment time in the name of a so-called development fund, and a desire to object results in physical punishment. Most female workers do not receive any pay when pregnant. In fact, they frequently lose their jobs. Figure 3 indicates Women workers working in a garment factory, Bangladesh.

Figure 3. Women workers working in a garment factory, Bangladesh [20]

4.4 Risks to Fire Safety and Protection

Bangladesh's garment industries have one of the most dangerous safety records in the world. Fires have occurred often in recent years because of weak infrastructure and security risk management difficulties. The recent collapse of a manufacturing building has added a new form of risk to the textile industry. According to the Bangladesh Fire Department, 414 garment workers died in 213 factory fires between 2006 and 2009. Factory fires claimed the lives of 79 people in 2010. Bangladesh's ready-made garment sector (RMG) has become the country's economic backbone, accounting for over 80% of the country's exports. It is presently the world's second largest garment exporter, with over US$17 billion worth of clothes exported in 2011. The sector has boomed in recent years, and the number of clothing factories has increased dramatically. Bangladesh today has between 4,000 and 5,000 garment factories, ranging from huge first-tier suppliers to tiny firms that mostly work as subcontractors for larger clients.

To compete with its competitors, the sector is characterized by low-cost, quick production that relies on low-cost labor and production costs. Bangladesh's garment industry employs over three million people, the most of them are young women, and it continues to pay the lowest wages in the world. Due to a lack of other career opportunities and pervasive poverty, many women are forced to accept low-paying positions in companies that do not meet even the most basic health and safety standards [21]. Statistics show that textile items have had a key role in fire hazards that have resulted in human deaths. Clothing (including oversuits, underwear, work wear, and suiting), bedsheets, floor coverings, upholstered textiles in chairs, bedding, and home furnishings are examples of such products. These textile materials are constantly in contact with humans. Textiles composed of natural fibers are flammable or combustible, and hence can be used to start a fire. Actual fire instances revealed that textiles and garments were the primary causes of human harm and death. Concerns about the use of fire-retarding fabrics for the protection of human lives and property resulted in legislation [22]. Table 1 indicates Major factory incidents in the history of Bangladesh since 2005.

4.5 Trade Union

Bangladeshi garment workers' union membership is extremely low, accounting for only about 1.12 percent of the total workforce. Restrictive rules on forming unions and trade union centers, as well as deliberate intimidation and harassment of union activists, are among the causes behind this. In export zones, nursing, and rural electrification, union organizing is completely prohibited. Bangladesh was named one of the top ten worst countries for workers in the annual Global Rights Index published by the International Trade Union Confederation (ITUC) in 2020. Another problem is that practically all Bangladeshi unions are linked with political parties, which makes it difficult for them to work together in collective bargaining especially because the majority of Bangladesh's legislators are factory owners themselves [24]. Bangladesh, on the other hand, is on track to graduate from LDC to middle-income rank in 2024, after which it will need to comply with and ratify 27 basic international accords in order to receive such a facility (GSP Plus). "It was emphasized in this context that EBA preferences, as well as any future trade partnership, are conditional on respect for human rights, particularly labor rights, as embodied in the international conventions mentioned in the GSP Regulation", the joint statement stated [25].

5. The Importance of Sustainability in the Textile Industry

Anyone who wants to make their firm more sustainable should consider going green in the textile industry [26]. There are various more things you can do to make your facility more environmentally friendly, including unique ways to impact the supply chain, manage planning in a sustainable manner, and participate in organically grown fiber production. The textile industry is notorious for using a lot of energy, water, and natural resources. The textile sector has been obliged to pursue the route of sustainability due to its considerable environmental effect. Consumers are becoming aware of the greenhouse gas emissions, global warming, and rising carbon footprint caused by textile pollution. As a result, the demand for sustainable textiles has increased. The entire manufacturing process, from the creation of the fiber to the finished garment, is extremely hazardous to the environment. Sustainable textile production and processing not only helps to avoid negative environmental impacts, but also helps millions of employees earn fair salaries and work in safe conditions [27]. Sustainability enhances our quality of life while also safeguarding our ecosystem and natural resources for future generations. In the business world, sustainability is

Table 1. Major factory incidents in the history of Bangladesh since 2005 [23]

Name of the factory	Date of incidence	Number of victims	Types of hazard
Palmal Group	8 October, 2013	10 workers	Fire
Tung Hai	9 May 2013	9 workers killed	Fire
Rana Plaza	24 April, 2013	1129 workers killed, 2515 injured	Building collapse
Smart Garments	February, 2013	9 workers killed	Fire
Tazreen factory	24 November 2012	122 workers killed, 200 injured	Fire
Eurotex	3 December, 2011	2 dead, 64 injured	Fire
Sportswear (Hameem Group)	14 December, 2010	29 dead, 11 injured	Fire
Garib and Garib	25 February, 2010	21 dead, 50 injured	Fire
Sayem Fashions	6 March, 2006	3 dead, 50 injured	Fire
Phoenix Building	25 February, 2006	22 dead, 50 injured	Building collapse

linked to a company's comprehensive approach, which considers everything from manufacturing to logistics to customer service. Going green and sustainable is not only good for business; it also enhances the long-term benefits of an environmental focus [28]. The textile sector has various reasons to prioritize sustainability, including lower prices, environmental preservation, and customer loyalty for environmentally responsible methods [29]. These are the government's sustainable development policies. Poverty reduction is the main objective of policy. The initiatives offering underprivileged people more employment options should be launched. Investments in public utilities, such as the provision of drinking water and sanitary facilities, etc., would enhance the environment of the nation. Subsidies for the usage of resources like power, fertilizer, insecticides, and diesel, among others, should be eliminated in order to lessen environmental harm. These subsidies encourage its careless use. These contribute to environmental issues as well. Adopting market-based strategies for environmental protection is urgently needed. They want to make consumers and businesses aware of the impact that exploiting natural resources has on the environment [30]. The best course of action is to use instruments based on the market. These tools take the form of environmental taxes, which also include user fees and emission levies. Incentive structures for quantity, price, and technology can also be more beneficial. For the number of pollutants in air, water, and land use, resource users are typically given incentives in the form of variable fees. If they produce less trash or pollution than the government-mandated criteria, they receive refunds. Environmental circumstances can be improved through public involvement and awareness. Environment management education programs should be undertaken in both formal and informal settings. Participating the public can help with park management, wildlife conservation, and other important tasks. It is believed that taking part in international environmental initiatives can reduce the harm caused by environmental degradation. As a result, efforts should be undertaken to reach environmental protection agreements. Trade policy places a strong emphasis on the development of less polluting industries outside of urban areas as well as the use of environmentally friendly techniques for polluting sectors through the adoption of newer technologies [31].

5.1 Environmental Implications of Dyeing Effluent

Textile dyeing effluent is one of the most environmentally hazardous industrial processes [32]. As a result, the industrial manufacturing and use of synthetic dyestuffs for textile dyeing has grown into a massive industry. Synthetic dyestuffs have brought a wide spectrum of colourfastness' and vibrant hues to the market. Nonetheless, their toxicity has become a source of major environmental concern. Synthetic dyestuffs have negative effects on all kinds of life. The textile dyeing water effluent is particularly toxic due to the presence of naphthol, vat dyestuffs, nitrates, acetic acid, soaping chemicals, enzyme substrates, chromium-based compounds, heavy metals, and other dyeing auxiliaries. Formaldehyde-based color fixing auxiliaries, chlorine-based stain removers, hydrocarbon-based softeners, and other non-biodegradable dyeing auxiliaries are among the other harmful compounds. As a result, the textile dyeing business has needed to explore innovations, ecologically friendly remediation technologies, and alternative eco-systems. Biocolors, natural mordants, and supercritical carbon-dioxide assisted waterless dyeing are just a few of the eco-systems that have been investigated [33]. At present, several methods are applied in the textile dying process. Among them continuous, semi-continuous and batch dyeing are commonly used [34]. The type of dyeing procedure used is determined on the yarn, fiber, fabric, and garment quality. The dyeing industry, on the other hand, is regarded as one of the most polluting. Many dyeing enterprises have sprouted up in Bangladesh, and they play an important part in the country's economic development. The majority of these dyeing businesses are in the Narayanganj, Gazipur, and Savar areas [35]. Surface water is used by residents in these locations for household cleaning, bathing, irrigation, fish culture, and other essential tasks. Furthermore, no systemic data on the water quality of these places had been acquired. As a result, proper analysis is required to estimate the level of pollution, as well as to safeguard the environment and natural resources. Such information is critical for the authorities to take appropriate action in preventing pollution in the area and ensuring the population's health. As a result, in the current study, we attempted to characterize the effluents of the textile dyeing industry by determining the extent of pollution levels of several physicochemical parameters and heavy metals. In addition, we conducted an environmental impact assessment in the Gazipur area using important environmental indicators and produced an EIA report based on it [36].

5.2 Health Risk to Workers

The mixed solvent is commonly a combination of sulphuric and nitric acids and working with acids necessitates extreme attention because it may damage skin badly if not handled properly. These acids are typically used in conjunction with nitration toluene and benzene. Those who work in the factory's dyeing process are more

susceptible to the health hazard. They can be directly or indirectly affected. The chemical components utilized in the dying process are mostly to blame for the toxicity. The respiratory system can be stimulated by nitric-peroxide and nitrogen fumes, which can cause harm to the human body. Bronchial difficulties and catastrophic pulmonary edema may result [37]. The first method for preventing poisoning in the dye industry is to ensure that buildings are appropriately ventilated and equipped. The utilization of the best manufacturing procedures, as well as the selection of workers, is critical. The dye business's risks include those associated with any industry, as well as the dangerous chemicals that must be handled in the creation of dye materials. Strong acids, such as nitric and sulphuric acid, or a mixture of the two known as mixed acid, are the first hazard we encounter in the dye industry. Exposure to these vapours should be regarded as an accident that occurs as a result of a nitrator fire or a significant spill.

5.3 Effluents and Wastewater

Sewage that has been processed in a septic tank or water treatment plant is referred to as effluent. It's also known as "wastewater" or "trade effluent". Effluent is waste that does not come from homes or bathrooms, nor does it come from surface water or residential sewage. Any industrial or commercial facility can create and discharge it. Effluent normally flows directly from the premises into the main sewer system, and it cannot enter a river, reservoir, stream, or lake without first being cleaned and treated [38]. It goes without saying that the dying waste water is vibrant and dark. Dyes often contain a variety of chemical compounds with varied functional groups. The functional groups amine, carboxylic, and azo are all frequent among them. Azo dyes are the most often used textile dyes. Azo dye produces extremely carcinogenic aromatic amines and other degradation products [39]. The largest use of industrial water is the textile manufacturing industry. Several chemicals are employed during the cleaning and dyeing process. Textile mill wastewater effluents, unsurprisingly, include high quantities of hazardous pollutants, with heavy metals being particularly prominent. Most textile industry effluents are discharged into rivers untreated; as a result, textile effluents pollute a considerable amount of available water, and water-borne diseases account for two-thirds of all infections in Bangladesh. In Bangladesh, there are many distinct types of industries. Each of these industries has its own set of waste issues. Tables 2 & 3 indicate Water pollution source and their ranking in Bangladesh and Water consumption during wet processing.

Table 2. Water pollution source and their ranking in Bangladesh [40]

Industry	Wastewater	Pollution product	Ranking
Agriculture	Moderate	1.08	3
Textile	Big	3.35	1
Transport	Small	0.02	6
Construction	Small	0.14	5
paper	Very big	0.67	4
leather	Extreme	1.88	2
Suger	Extreme	1.72	2

Table 3. Water consumption during wet processing

Process	Percent water consumed
Bleaching	38%
Dyeing	16%
printing	8%
Boiler	14%
Other uses	24%

5.4 New Technology & Material of Sustainability

The Bangladeshi textile and apparel industry has embraced new heat recovery technologies to utilize the waste heat energy from gas burners installed to power the factories, even as numerous large weavings, washing, and spinning mills have embraced these new technologies for a green transformation while also maintaining their competitiveness [41]. The waste heat recovery system, according to media reports, offers textile mills an affordable and environmentally friendly way to conserve valuable energy. They also emphasized that, unlike in the past, when burner exhausts were previously released into the air, millers now use them to run air conditioning, boil water, and other equipment, enabling them to save energy and money. Huge sustainable benefits result from integrating technology into the production of physical clothing. Beyond the advantages to be gained in terms of fabric consumption and usage, manufacturing efficiencies, and logistics, technology can provide alternatives in terms of power supply through the use of solar, hydro, or wind energy, alternative forms of transportation to carbon-emitting vehicles, massive reductions in the use of water and hazardous chemicals in the laundering process of garments, and substantial reduction in energy usage through innovations like smart. Undoubtedly, technology in the apparel supply chain can have a significant positive impact on sustainability and the global environmental impact of our industry. From the fiber to the finished product, there are numerous initiatives and products that enable the creation of innovative designs, fabrics, and

finishes with little negative impact on the environment or working conditions. In addition to reducing the inherent negative health and safety aspects of our industry on our personnel, innovations in dyeing procedures, manufacturing processes, and garment processing techniques offer enormous gains in terms of water and power consumption [42]. The largest RMG exporter in the world right now is Bangladesh. Bangladesh has been expanding its garment industry recently. Top consumers of Bangladeshi clothing, or RMG (Ready Made Garments), come primarily from the United States, United Kingdom, Canada, Australia, Switzerland, Italy, France, and the entire continent of Europe, among many other nations. Bangladesh's garment industry is expanding so quickly because it has reduced production costs because to the country's affordable labor costs and ability to produce high-quality goods. Our market need is growing daily since we have the knowledge to produce in accordance with consumer demand throughout the world. Due to more convenient communication systems, customers from European countries can now contact merchants of clothing [43]. Table 4 indicates Key apparel items to focus for export.

Table 4. Key apparel items to focus for export [44]

Cotton made garments	Man-made fiber items
Babies' garments	Brassieres
Shirt	Anoraks
T-shirts	Jackets and blazers
Singlets	Overcoats
Underpants, briefs, and panties	Full-length or knee-length stockings
Trousers	Socks
Blouses	Other hosieries

6. Eco- friendly Textile Fiber

Cotton production consumes a lot of water, even though it's difficult to track how much water is used. Cotton fiber manufacturing also necessitates a significant level of pesticide use. Cotton crop cultivation consumes 55 percent of all pesticides used in India. India's cotton crop accounts for barely 5% of the country's total agricultural land utilization. Cotton, as the most water and pest-intensive crop, consumes around 11% of the world's total pesticide. As a result, cotton cultivation and production should be done in an environmentally friendly manner. Many operational operations in the textile industry create flow processes. Every procedure has a different impact on the environment and human health. As a result, several environmentally friendly fibers have been developed that do not require the use of pesticides or chemicals, such as bamboo, hemp, Ramie, mud silk, and so on. Cotton fiber, for example, is free of impurities when no toxic herbicides or insecticides are employed in its production. If this is the case, it is eco-friendly. Even if they are manufactured without any of these dangerous elements, the textile chemicals used on them might lead them to become "polluted" when processed into yarns and fabrics [45]. Animal fibers, such as wool, can become polluted as a result of pesticides used in sheep dips or a number of medications used to treat animal ailments. However, only when the plant fiber, such as cotton, is grown without the use of toxic pesticides and with the aid of composted manures and cover crops can it be called "organic".

6.1 Organic Cotton

One of the most natural materials available is organic cotton. It is cultivated and processed without the use of pesticides or synthetic fertilizers. Organic cotton production consumes 62 percent less energy and 88 percent less water than traditional cotton farming (which is, to the surprise of many, one of the single dirtiest crops around). There are numerous certifications that may be used with sustainable and ethical cotton to ensure that it was a. grown without the use of chemicals or machine harvesting, and b. processed without the use of chemicals, resulting in a chemical-free final garment [46]. Other relevant certifications ensure that farmers are paid fairly and have safe working conditions (though not being exposed to chemicals in the field is already a huge component in that regard). Organic cotton is farmed without the use of genetically modified crops, fertilizers, pesticides, or other synthetic agro chemicals that are hazardous to the environment. As a result, a new form of organic cotton has been produced that is soft to the touch while still being chemical-free. Organic cotton is generally more expensive, but its environmental impact is minimal. Figure 4 indicates organic cotton.

Figure 4. Organic Cotton [47]

6.2 Organic Fabric

Organic farming is the most environmentally friendly method of producing high-quality organic fiber, which is subsequently turned into fabric [18]. Organic fabric refers to natural fabrics that are produced using organic production processes from the fiber to the finished product. Organic farming is growing fibers in controlled environments without the use of pesticides, synthetic fertilizers, or hazardous chemicals. Furthermore, the use of genetically altered seed in organic farming is prohibited by federal legislation. Organic cotton is a well-known organic fabric that is widely available and frequently used in the production of organic clothes. In comparison to conventional cotton, 100 percent certified organic cotton fabric is the most environmentally friendly because it has very little or no impact on the environment. To distinguish organic cotton from regular cotton, organic yarn spinners use separate processing areas. There are many environmental advantages to using organic fabrics such as: When organic cotton is grown on farms, no chemical pesticides, herbicides, or chemicals are utilized. Maintains and replenishes soil fertility. Cotton farmed organically can be used to make organic food for humans and animals. As a result, organic cotton is significant not just in the apparel industry, but also in the food industry. Organic cotton growing emits significantly less CO_2. Organic farming removes 1.5 tonnes of CO_2 from the atmosphere per acre each year. Organic cotton cultivation can save up to 60% more water than traditional cotton production. Pesticide or herbicide residues are not released into the environment by unintentionally. Rates in agricultural environment that is naturally varied, and chemical pesticides and herbicides are not used on humans or animals.

6.3 Recycled Clothing

Textile recycling also contributes to environmental protection. Clothes that have been recycled take up less space in landfills [48]. Landfills endanger the ecosystem and drinking water supplies. When it rains, water soaks up harmful chemicals and bleaches from the discarded clothing. This water proves to be poisonous. Synthetic textiles do not disintegrate quickly, but wool fabrics emit methane during decomposition. Thus both fibres contribute to global warming. This hazard will be significantly minimized when these fabrics are repurposed. It reduces energy usage because recycled clothes do not need to be re-dyed or sourced. Reduced use of dyes and chemicals reduces their production and, as a result, the negative effects of their production**.** Clothes can be donated to charities, sold in consignment shops, or recycled into other materials, in addition to helping a healthier environment by manufacturing newer clothing produced with sustainable, innovative materials. These strategies help to limit the amount of space that discarded clothing takes up in landfills. Clothing is defined as non-durable – normally lasts less than three years – textiles by the United States Environmental Protection Agency's 2008 report on Municipal Solid Waste (MSW) generation, recycling, and disposal in the United States. In 2008, 8.78 million tons of textiles were produced; 1.45 million tons were recovered and rescued from landfills, resulting in an almost 17 percent recovery rate [49]. According to the EPA report, 54 percent of MSW is "discarded", 33 percent is "recovered", and 13 percent is "combusted with energy recovery". Garment is the fastest-growing component of garbage in the domestic waste stream, accounting for over two-thirds of all clothing materials shipped to landfills. Textiles disposed of in landfill sites have increased from 7% to 30% in the last five years. Figure 5 indicates total MSW generation 251 million tons (before recycling).

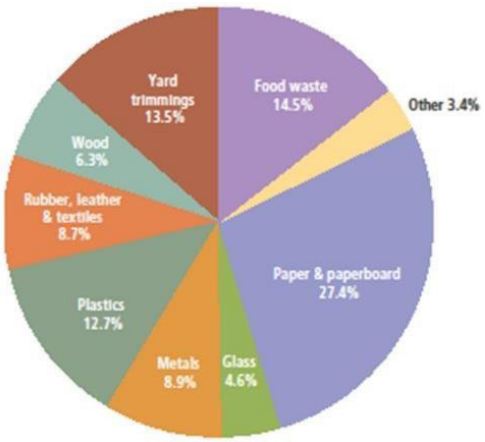

Figure 5. Total MSW generation 251 Million Tons (before recycling) [50]

7. Introducing Life Cycle Assessment

The Life Cycle Assessment (LCA) approach was designed to assess the environmental impact of buildings in terms of their processes, materials, and consumption (energy) throughout the course of their whole life cycle [51]. It should not be confused with Life Cycle Costs, which focuses on cost reduction and is particularly useful for designing and building Nearly Zero Energy Buildings (NZEBs). According to the ISO14040:2006 standard, the goal of LCA is to examine the environmental implications of a product from its manufacture to its end of life, including possible recycling. Human health, the natural environment (sometimes known as ecosystems), and natural resources are the three areas of protection that are generally

regarded. One of the most effective approaches to determine the environmental impact of construction processes, energy concepts, components, and products is to use Life Cycle Assessment. This refers to all aspects of planning that occur during the construction of a new structure or a renovation project. LCA can thus be viewed as a method for reducing finite resource use while also ensuring that environmentally sensitive air, water, and soil contamination is kept to a minimum during the life of a structure. To encourage designers and building contractors to apply life cycle assessment, the DGNB (German Sustainable Building Council) has created a set of principles with the primary purpose of planning, operating, and using the built environment. The Life Cycle Assessment (LCA) method is used to evaluate the environmental implications of a product, process, or activity over the course of its whole life cycle, from raw material extraction to processing, transportation, usage, and disposal. It can take many different shapes, ranging from simple matrix techniques to complicated and data-intensive models. While there are still some methodological concerns to be handled, LCA has matured to the point where it can be used as an environmental management tool [52].

7.1 Sustainability in Denim

The most up-to-date information on sustainable textiles and processes may be found in Sustainability in Denim. Denim has numerous environmental impacts, ranging from cotton farming to manufacturing to end-of-life disposal, including water consumption and contamination, destruction of large-scale ecosystems, and transportation pollution. Furthermore, new advancements in denim manufacturing, such as the usage of textiles like as elastane and polyester, have limited the high-end recycling of denim [53]. Concerns about the environmental and health effects of textiles in general, and denim in particular, are increasing pressure on manufacturers to use more environmentally friendly production processes. Using a micro-irrigation system to save water throughout the early stages of denim's life cycle is one example of these environmentally responsible techniques. Textile producers can also use organic insecticides to prevent worker exposure to chemicals and toxic waste discharged into bodies of water. According to C&EN, digital printing has become available as a more sustainable alternative to dying and related procedures for producing the classic denim effect. It can help to mitigate the negative effects of cloth dyeing on the environment, such as the production of hazardous waste and human exposure to harmful chemicals [54]. Eco-friendly fabrics or products cannot be achieved instantly in the denim processing business. This supply chain must be deployed and analyzed at every stage. It also necessitates the engagement and cooperation of all stakeholders, including customers. For any significant change to occur, customers must be involved and cooperate in the eco-friendly denim process. To clean up polluted water and other resources, more money is needed. Sulphur dyes have a 50 percent efficiency in the trough, contaminating water supplies and being the most difficult to remove from water. It's one of the denim industry's most serious issues. From a sustainability standpoint, less water-based methods such as laser, plasma, ozone, and sandblasting have been investigated for denim washing and have yielded outstanding fabric handling. The laser treatment has been discovered to be a valuable technique for the color fading of denim fabric with adequate level maintenance in fastening and precise fabric production by managing the laser process parameters [55].

7.2 Utilization of Bioresources

Organic wastes and spontaneously generated or formable raw materials from human and animal activity are examples of bioresources. They are produced in vast amounts by agriculture, forestry, marine, and municipal businesses, or mills. Processing and manufacturing businesses, such as oil palm mills, use these bioresource feedstocks. Their bioproducts are derived from agricultural plants and are suitable for usage as energy carriers, platform chemicals, or speciality products [56]. In Malaysia and other tropical countries, bioproducts have enormous potential in the forestry, agriculture, marine, and municipal sectors. In terms of bioproducts, these emergent industries are distinct from traditional industries in that the nature and qualities of feedstocks, products, and uses vary widely between sectors. The continual process of carbon mass transfer into various states of utilization is represented. The sun's energy is absorbed by the carbon cycle, which converts it to food, energy, and materials depending on the country's needs. The degradation of biophysical resources, particularly the Earth's ecosystems, is a primary driver of human effect on Earth systems. The environmental impact of a community or of humanity as a whole is dependent on both population and impact per person, which is in turn dependent on a variety of factors such as the resources used, whether those resources are renewable, and the scale of human activity in relation to the ecosystems involved. Careful resource management can be used at many sizes, from economic sectors such as agriculture, manufacturing, and industry, to work organizations, household and individual consumption patterns, and individual goods and service resource demands. Figure 6 indicates Sustainable carbon lifecycle for food, energy,

and materials production.

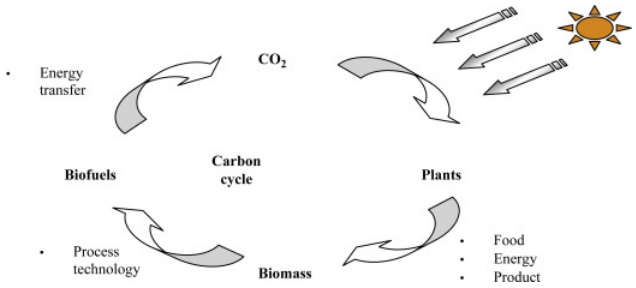

Figure 6. Sustainable carbon lifecycle for food, energy, and materials production [57]

The consumption of biophysical resources is the primary driver of human effect on Earth systems [58]. Human consumption can be broken down into three categories: population, consumption levels (affluence), and impact per unit of resource utilization (which depends on the technology used) [59]. An equation has been devised to express this:

$$I = P \times A \times T$$

where:
I = Environmental impact
P = Population
A = Affluence
T = Technology

Renewable and Non-Renewable Resources

When a resource is described as renewable, it means that it can be regenerated more quickly than it is depleted. A non-renewable resource, on the other hand, cannot be replaced and is depleted once utilized. When renewable resources are mismanaged, they might become non-renewable. If a forest is well-managed, old trees are not logged quicker than new trees can grow, it can be a renewable resource. The forest, on the other hand, might become a non-renewable resource if it is logged in an unsustainable manner. Solar and wind power are examples of renewable energy sources since the energy provided by the sun and wind cannot be depleted. Non-renewable energy comes from fossil fuels including coal, oil, and natural gas. These resources are created over millions of years and so cannot be renewed in a person's lifetime.

7.3 Environmental Sustainability: Ethical Issues

Environmental sustainability entails engaging appropriately with the world in order to preserve natural resources and not threaten future generations' ability to meet their needs [60]. Governments, industry, non-profits, and environmental agencies all have their own definitions and methods to environmental sustainability. Individuals and institutions each have a distinct role to play in ensuring environmental sustainability. The Environmental Protection Agency (EPA) oversees implementing environmental regulations in the United States. Environmental ethics is a branch of philosophy that investigates the moral relationship between humans and the environment's values and moral standing [61]. Even though nature was the focus of nineteenth and twentieth century philosophy, environmental ethics as an academic topic did not exist until the 1970s. Of course, pollution and the depletion of natural resources have not been the only environmental concerns since then: dwindling plant and animal biodiversity, the loss of wilderness, ecosystem degradation, and climate change have all become issues in the public consciousness and public policy in the years since. Environmental ethics are significant because they entail moral decisions that we can make, and even more importantly, that we must make. Our moral obligation to nature and the future is extremely important and urgent, and it is one that we cannot avoid. Environmental ethics boils down to this. Extending moral standing to animals, on the other hand, leads to the development of specific environmental obligations. Animal welfare is important to environmental ethics since animals are part of the natural environment and thus are a concern for environmentalists. In essence, these ethics argue that while evaluating how our activities influence the environment, we should examine not only how they affect humans (now and in the future), but also how they affect the environment. Environmental ethics is a branch of ethics that investigates the relationship between humans and the environment, as well as the role of ethics in this relationship. Humans, as well as other living beings such as plants and animals, are considered members of society, according to environmental ethics. These items are an essential aspect of the world and are seen as a necessary part of human life. As a result, every human being must respect and honor this, as well as utilize morality and ethics when dealing with these species [62].

8. Sustainability Issues in Current Textile and Apparel Industry

Textile sustainability, or sustainable textiles, must be environmentally friendly and meet rational standards to respect social and environmental quality by preventing pollution or installing pollution control systems. Certification, on the other hand, is a purely voluntary process. Any entity conducting business in which a standard exists may request certification of its output or services [63]. Sustainable development is a long-term process consisting of aimed at achieving a desired vision of an industrialised economy that promotes wealth generation, social growth,

and environmental sustainability. In terms of industrial development, sustainability means that industries may continue to operate and make economic profits (economic sustainability) while avoiding actions that harm the environment and devoting a portion of their profits into environmental repair and protection. Bangladeshi garment businesses lag far behind in terms of sustainability. Many concerns are lacking when the three areas of sustainability are evaluated. Only the economic conditions may have reasonable and good achievement among the environment, social, and economic perspectives of Bangladesh garment industry. The benefit of increased earnings flows straight to the owners in this situation. The clothing industry's social side is in the worst possible shape. Workers' living standards are extremely low because they are paid the lowest wage. Gender equality in terms of wage and employment status is not properly maintained. Despite the fact that child labor in garment sectors has decreased considerably since the United States passed the Harkin Bill in 1992, there are still numerous child laborers working in small informal industries. Many of them are 12 to 15-year-old females from rural areas. There is no mature community of workers. Workers dwell in most slum regions and are socially classified as lower-class individuals. Environmental economic circumstances, on the other hand, are not practiced at all. There is no record on energy consumption, and electrical supply is insecure and unreliable. They frequently have to manage alternate energy sources with the help of a fuel-based generator. Because there is no incineration facility, energy recovery from incineration is never used. With all of the bad outcomes, Bangladesh's garment manufacturing businesses are attempting to gain sustainability for a brighter and more secure future; yet progress is difficult. The entire garment industry framework must be reconsidered and reformatted. Because it involves three million workers and the country's economy, the parties involved must take meaningful steps for long-term sustainability. Figure 7 indicates the three spheres of sustainability.

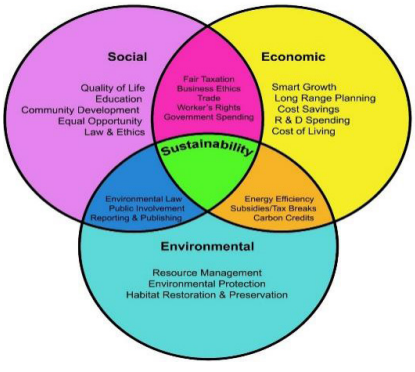

Figure 7. The three spheres of sustainability [64]

9. Suggestions for Sustainable Environment

Respect for the environment has probably always existed in its most basic forms; it is a sort of protection, food included. Nowadays, rapid development and rising living standards have had contradictory effects: on the one hand, environment-focused acts are more cautious, while on the other hand, environmental aggressiveness is on the rise [65]. As a result, it is critical to raise environmental awareness and reinforce environmental stewardship. We believe that education, full awareness of the importance of preserving values as a legacy for future generations, the dissemination of good environmental management practices, a sense of belonging to a specific space – defined by a specific type of environment – the subordination of individual interests to collective ones, and other factors could all play a critical role. There is no doubting that the production of garment items involves not only the creation of a finished product, but also the processing of diverse raw materials. As a result, the process of cotton production to cotton processing must be taken into account. Some textile process recommendations must be followed seriously in order to ensure the textile manufacturing industry's long-term viability. Pesticides are used in large quantities in conventional cotton production. As a result, organic cotton production and the use of natural pesticides should be encouraged. Cotton recycling, reprocessing, and reuse should be prioritized. Natural colors can be used as an alternative to synthetic substances or chemicals. Toxic mordants, such as chromium-based mordants, should be avoided in this scenario.

9.1 Education

Education is one of the most important elements in the long-term consolidation and understanding of environmental respect: both compulsory and non-compulsory. The latter circumstance necessitates the engagement of the media [66]. It should make the consolidation and awareness of spatial respect a primary goal of civic education. Obviously, school knowledge is critical, particularly in geography, biology, geology, and natural science studies. It is the responsibility of instructors to instill in their students an appreciation for the environment and its values in a courteous but forceful manner. They will persuade the young people that the current features of the environment, including its resources, must be kept and modified as little as possible, based on the examples they provide and their own behaviours. The adaptation of communities to their insertion environment has been a historical process, but the interventions that have accelerated in the last century are extremely risky and may result in dysfunctional events

that imperil the lives of future generations. When people understand the process at a young age, they will be more responsible when they grow up to be environmental actors. The aggregate of these individual actions could result in a collective attitude capable of halting economic or human activities that have a negative impact on the environment.

9.2 Building a Feeling of Solidarity

Building a sense of solidarity at various scales will imprint a behaviour of collective participation in the losses caused by environmental restrictions as well as certain types of consumptions, both of which have contributed to the establishment of voluntaristic excessive behaviour in certain spaces for several generations [67]. Long and ultra-long term, the enormous advantages provided by that sense of solidarity will help to sustainable development and provide the resources required for future generations. Solidarity among groups does not preclude feelings of attachment to the environments with which they engage. The potential of reducing the value of the respective space through destructive activity by particular collectivises or interest groups motivated merely by a disproportionate return on investment may strengthen community or population cooperation in defending natural or cultural values. Individual or group interests are sacrificed to regional, national, or global interests, accordingly, to create a sense of togetherness. Starting with the global nature of local actions, the cumulative effects of seemingly ordinary actions, and the trans-spatial nature of the environment, such a convergence of interests leads to coherent and long-lasting economic-social activities, as well as spatial configurations in which natural and human components are balanced.

9.3 Awareness of the Protection for Environment Values

To pass environmental values, people must be aware of how to protect them. An important action axis of environmental respect is to leave the environment as unmodified as possible for future generations [68]. Although it is based on common sense to environmental principles, the awareness process is complex. Good practices at the local, regional, national, and worldwide levels have been proven by recent history, confirming the good benefits of proper environmental behaviour. Starting with the relativity of the notion of value, the 88 key aspect is a correct understanding of the values. The distinction between values and non-values is restricted by one's level of knowledge, which is why a value's perennial and transitory characteristics, as well as its utility, are considered. Perennial values, on the other hand, support the basic pillars of sustainable development, whilst temporary values offer a certain level of "comfort" in the framework of human progress. The importance of the questionably of natural elements – in reality, eternal values – and the selective nature of those belonging to the anthropic environment are highlighted by an examination of the various environment components. The anthropogenic environment, which was developed to help society adapt to the natural environment, makes it more difficult. Social, economic, and environmental progress were all considered to be part of sustainable development [69].

10. Conclusions

Bangladesh's clothing manufacturing industry is the country's economic foundation. Since the late 1970s, Bangladesh's apparel industry has been the single most important exporting sector, accounting for over 80% of total export products in terms of foreign currency earnings. This major industrial sector employs almost three million people, with about 80% of them being women. The clothing industry is quickly developing, which means that professional and unskilled men and women will have plenty of job prospects. This manufacturing industry also helps to alleviate poverty by giving employment possibilities. The country's economic growth has been fairly consistent over the last decade, with garment exports playing a significant part. Bangladesh is currently the world's third largest clothing maker and exporter, trailing only China and the European Union. It is understood that there is competition among all fashion-related individuals, celebrities, and businesses, as well as those who work for fashion-related organizations. The term "sustainability" refers not only to the apparel manufacturing industry, but also to the continuation and development of a new concept among all people for environmental sustainability, such as reducing global warming, restoring ecological balance, reducing natural disasters, conserving vegetation, conserving wildlife, and so on. Most of the world's most well-known brands have already become known for their environmental and ecological conservation policies, which have helped to ensure fashion's long-term viability. Consumers want sweat-free labor, energy-efficient processes in the fashion industry on a sustainable, ethical basis, whilst all companies in the western world are highly cognizant of the same. Because the garment manufacturing industry is one of Bangladesh's most important drivers of economic growth, employees' rights and standard wage levels should be amended and reassessed. No one should have to suffer because of their inadequate working

conditions. The government, in collaboration with plant owners, should verify the workers' personal benefits, as well as their health and safety concerns. To establish a satisfactory position in terms of sustainability, the government, private organizations, and factory owners must take responsible efforts and work for a better working environment. The government policy and new method of apparel sector all this point included in this paper. The result is clear that sustainability is required to develop apparel sector.

Author Contributions

Conceptualization and draft writing, M.T.I; editing and reviewing M.N.H; format tables and figures, M.K; editing and analysing M.A.H.R; reviewing and data analysis, M.M.H.F; draft writing and analysis, M.A.

Conflict of Interest

All authors checked this work and declared no conflict of interest.

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