

Review Article

An Overview of Sustainability on Apparel Manufacturing Industry in Bangladesh

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Abstract: The purpose of this paper was to investigate the overview of sustainability in apparel manufacturing industry and why developing country suppliers are adopting environmentally and socially sustainable practices and how the implementation process is both hindered and enabled. Presently sustainability of fashion industry in the worldwide is the major considerable issue. The much talked concern is for the favor of fashion's sustainability around the world. Many organizations and fashion conscious personalities have come forward to uphold the further extension of the campaign of good environment for tomorrows, but the Bangladeshi garment and textile industries are far beyond of this consciousness and it poses a risk of losing the world market. On the other hand, fashion for the morality or ethical issues is one of the key concepts for the humanity and sustainability point of view. It is high time to implement special strategies and approaches towards the sustainability. Social sustainability improvements benefit vulnerable workers, help suppliers develop longer term relationships with transnational companies and contribute to economic growth. In terms of the working environment, Bangladeshi apparel industries are facing great challenges at present. Fire accidents are common in garment factories and recent building collapses pose a great threat to its future. Moreover, the workers receive the lowest wages of the world that makes them unsatisfied, causes often clashes and violence during protests against low wages. This study has considered the working environment, fire and safety issues of the garment industries of Bangladesh and suggests significant initiatives towards better environment and sustainability.

Keywords: Sustainability, Fashion, Denim, Life Cycle Assessment (LCA), Organic Cotton

1. Introduction

It goes without saying that, apparel manufacturing industry has emerged as the leading exporting sector in Bangladesh. This export oriented industry has been expanded since the time of 1970's [1]. The productivity attained from apparel manufacturing sector has become higher than the agriculture sector. At present about three million people have been working directly and indirectly involved with garment industries in Bangladesh. The history of setting up garment industry in Bangladesh is quite recent compared to other industries. After liberation during late 70's the garments industries started to grow up. There were only nine garments factories in 1978. These mainly used to manufacture for the domestic market. They also started exporting at a small scale. One of the oldest garment factories named 'Reaz Garments'

was set up in 1960 as tailor shop. Later in 1973, it was renamed M/S Reaz Garments Ltd and got export orders for the first time in garments history of Bangladesh. It exported men's shirts to France in 1978. It was only worth to 13 million francs. The rapid expansion of this sector creates job opportunities as well as promotes reducing poverty and increasing social security. Therefore the economic growth of the Bangladesh was surprisingly steady and gradually increasing during the last decade. Even during the time of world economic downturn period, the crisis affected Bangladesh very little. At present Bangladesh is the third largest garment manufacturer and exporter country in the world [2]. Even though the garment manufacturing industries have become the backbone of the country's economic growth and social safety, it also possesses some unexpected threats recently. There are a number of fire accidents, which caused

death of hundreds of garment workers and fires have become common issue in present situation. Besides, some recent incidents relating to labor unrest and garment building collapse in Savar turned into a hot issue in Bangladesh as well as in the rest of the world due to its thousands of labors death [3]. This incident addresses the question of safety and sustainability of the garments industries in Bangladesh. A number of foreign buyers of the readymade garment products have already declared not to have any deal with the country due to lack of its safety and proper environment. Moreover, many buyer companies demand more environment friendly products. Some garments manufacturing industries in our country have already started marking their products as green products and include some environmental indicators in their website or product labelling; for example, introducing Life Cycle Assessment, CO₂ emissions, Water footprint due to their products manufactured. They already have started update their consumers about their manufacturing related activities to make a product. Now in Bangladesh fashion is a topic for much discussion as like whole over the world. Consciousness have there been grown up for the day to day use of clothing and fashion as well. From 1987 the much talked issues about fashion is eco fashion or sustainable fashion as a term in the fashion world. It is a part of growing design philosophy and trend of sustainability that environmentally friendly with social responsibility. Sustainable fashion is the part of larger trend of sustainable design where a product is created or produced with the consideration of environment and social (even moral) impact throughout the total life span including its “carbon footprint”. According to the fashion magazine, *Vogue* (May, 2007); sustainable fashion is not merely a short term trend but one which could last many seasons. Here environmentalism used to manifest itself in the fashion world by a donation of percentage of sales of a product to a charitable cause. Fashion designers are eco-conscious and re-introducing environment friendly methods through using eco-friendly material and socially accountable production process. Designers say that they are making effort in incorporate sustainable practices into modern clothing rather than dusty, hippy clothing. But, sustainable fashion is typically more expensive than clothing made by conventional methods. Several like Bono and Stella McCartney have recently drawn attention to the socially conscious and eco-friendly fashion. Since 2005, Portland Fashion Week has been featuring sustainable designer’s works in apparel. But it is a matter of great sorrow that, most of the garment industries or producers of our country still not aware of the growing demand for eco-friendly or environmentally friendly products. They do not implement yet the environment friendly way and fail to provide their products with sustainability indicators. The garment industries in Bangladesh at present are suffering most risks of losing the world market, which can lead economic collapse of the country quickly.

1.1. Significance of the Study

The study can lead towards a new epoch of sustainability

practices both socially and environmentally in garment manufacturing industries. The findings behind the various accidents can concern authorities to take necessary steps on it. This study will further reduce hazard in this sector. Besides the proposed sustainable way the study will demonstrate the country better practices and pathways for the textile processing industry specifically garment manufacturing industry and will help to rebuild the garment policy and regulation. All these steps can give back the country's prominence and will make the country's economy stronger by attracting and dealing with more foreign buyers.

1.2. General Overview and Challenges

In recent years, textile industries play a significant role in the economic development of Bangladesh. Although, the foreign market of Bangladeshi garment products have increased highly for the last few years, the country is facing several challenges in its regular growth rate of garment products exported. In addition to that, there are many factors that are working behind facing challenges in garment industries. The global recession is one of the important issues to mention for which many foreign buyers placing less order from Bangladesh. Although it is said that the world recession did not touch Bangladeshi garment exports severally due to turning of new buyers who used to deal with China.

The major challenges of the Bangladeshi garment industries are their safety and security issues. There are many fire accident and some building collapse accidents including thousands of workers death and injuries. These issues are burning topic for the foreign buyers as well as its consumers worldwide. Besides these, increasing production costs due to increasing price of energy and materials, demand of increasing labor costs, unfavorable trade policies and unstable political situation also plays important role to push this large industries in to a great challenge in the future. Increasing cost of textile production is the most important challenge facing most of the small industries. The main reasons of increasing cost are high inflation, high interest rate, lowering the value of Bangladeshi currency against US dollar. The increasing price of energy and fuel also enforces to higher cost. Moreover, the daily life expenditure of the people increased dramatically for last few years which lead the workers to demand of increased salaries.

Depreciation of Bangladeshi currency makes high import cost of raw materials as well as importing machineries. Besides, the equipment and machineries used in most of the garment sectors are not modern or not equipped with latest technologies. Therefore, the regular need of updating machinery and equipments is a challenge to the global textile competitiveness. Most of the garment factories use old machineries and follow traditional ways. Power shut down is a common thing as a consequence of electricity crisis in Bangladesh especially during the summer time. Regular power shut down interrupts the smooth production and decreases the production rate.

2. Sustainability in Fashion

In the year 2011, Kathryn Reiley and Marilyn DeLong investigated that, sustainability in fashion is going to require a radical change in the practices of all together: designers, manufacturers, marketers and consumers. But customers especially need a spirit for sustainable fashion practice. However, in their research they wanted to examine fashion practices related to consumer's passion for a unique exterior and sources of clothing attainment. For the study they have taken as sample from female university students and the number was Ninety-seven of a Midwestern university in the USA and has completed the Desire for Unique Consumer Products (DUCP) Scale developed by Lynn and Harris. The result of the research is if we inspired, such individuals could become a guilt-free model for sustainable practices in the future [4]. Based on a customer study about the intent to contribute in different programs, such as 1:1 funding, ecological design sourcing, a improvement style contest, redesign consulting and an eco-fashion gallery, eco-friendly design sourcing programs have the highest intent to participate of all the studied sustainable social programs [5]. The truthfulness of the design of a fashion garment gives it worth, makes it more attractive, and distinguishes it from the everyday of conventional fashion that has been manufactured off shore [6]. In other study, it was observed that, fashion companies should strongly consider the product development process and extend stewardship across the multiple life - cycles of products [7].

In another scholarly works, Maarit Aakko and Ritva Koskenurmi-Sivonen revealed a theoretical model, which illustrates together the elements of sustainability and fashion design. The aim of that model was to serve fashion designers, who wish to take sustainability into consideration [8]. Another research paper, researcher illustrated that, the consumers face bewilderment of information and knowledge, when striving for ecologically sustainable lifestyles and consumption practices; consequently how in the midst of these discursive struggles consumers simultaneously mobilize alternative strategies for sustainable consumption [9].

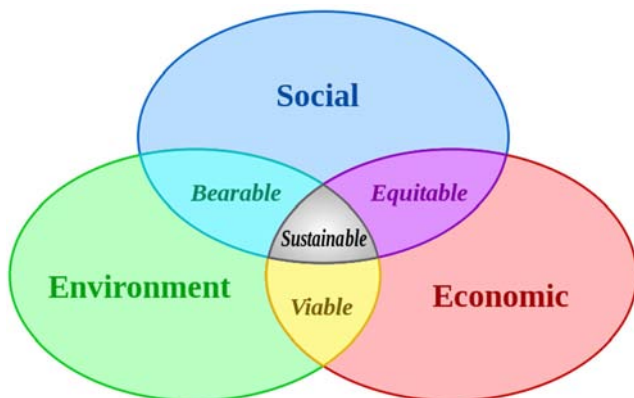


Figure 1. The "Three Pillars" of sustainability bounded by the environment (earth, life) [Source: Wikipedia- Sustainable Fashion].

At the present phase of industrialization, manufacturing environment friendly products in a sustainable way is the most important and emerging issue. The main focus comprises not only to the products quality sustainability but also it focuses on the manufacture processes including raw material resources from cradle to grave. Now a days, many companies and organizations focus on the environment friendly way of production. Sustainability of the garments industry is also a burning issue, needed to adopt cleaner and improved technology and management for better environment.

2.1. Introducing Life Cycle Assessment

Some researchers investigated that, introducing Life Cycle Assessment (LCA) is an important tool for achieving environment friendly products. Many companies in our country specifically apparel manufacturing industries have recently committed to apply LCA for their manufactured products. Life cycle assessment is such kind of assessment tool helps to inform the consumer about the environmental effects and consequences including eutrophication process, water usage and CO₂ emission during the entire life of the product. This assessment tool helps reduction of water use, CO₂ emission as well as the level of eutrophication process if it followed strictly and in a systematic way. Introducing LCA of the garment products will promote eco-labelling of garment products. In an article, Anika Kozlowski, Michal Bardecki and Cory Searcy offer a conceptual and analytical framework by conflating life-cycle and stakeholder analyses to develop responses for the fashion industry. They exemplify that identification of stakeholders and their interests, responsibilities and accountability that can provide a basis for the development and implementation of appropriate policies and programmes to respond to environmental and social concerns within the circumstance of corporate social responsibility (CSR of the Company) [10]. In the AUTEX 2011 Conference, 8th – 10th June, 2011, Mulhouse, France, titled "150 Years of Innovation and Research in Textile Science", some researchers found that, there is a strong involvement of individuals in fashion, when the environmental concern has been evolving and the strong need for action in the field of clothing sustainability, especially through the services of designing or redesigning, where the collection of textile waste should be incorporated into all stages of product life cycle to better maximize reuse and recycling [11].

2.2. Conceptual Model Regarding Denim Products

The spread of denim culture, all over the world brought with it a trend of fast changing fashions. One after another, several washes were introduced such as stone wash, acid wash, moon wash, monkey wash, frosted wash, white wash, mud wash, distressed wash etc. Over the last 6-8 years, India has probably seen the most dramatic and exciting changes in the washing of denim garments.

Although the denim manufacturing industry has long been

known to be resource intensive, a full picture wasn't known publicly until Levi Strauss and Co. shared results of its life cycle assessment on what went into making one pair of its iconic Levi's 501s style. Examining the 2006 production year for jeans headed to the U.S. market, Levi's found that making one pair of jeans required almost 920 gallons of water, 400 mega joules of energy and expelled 32 kilograms of carbon dioxide. Levi's said this was equivalent to running a garden hose for 106 minutes, driving 78 miles and powering a computer for 556 hours [12].



Figure 2. Impact of wastes on environment due to denim processing.

There are huge ecological and ethical concerns as this business is an enormous affair. To give an example, more

than 520 million pairs of jeans are sold in USA alone each year. The majority of which have been colored with dyes, acid bathed, sandblasted and chemically doused to give the aged, worn in look we all so desire. The life cycle of denim starts with the cotton boll, amid the vast cotton crops recorded as covering 2.4% of the world's farm land. If not organically grown the valuable crops will be drenched in toxic pesticides to protect them from insects and weeds. Organophosphates are used which are poisonous and ultimately pass into the soil and reek havoc with wildlife. Cotton fibers are spun into yarn and the denim yarn is "sized" using starch to give it strength and "mercerized" in caustic soda. Starch is biodegradable but if released into the rivers the microbes that devour it also consume the oxygen. This in turn kills off the aquatic life in the water as does the toxic caustic soda. Other shocking facts are that it takes 1,500 gallons of water to produce 1.5 lbs of cotton needed to make one pair of jeans. To achieve the correct blue shade, the denim is doused in vats of synthetic indigo. Environmental regulations are not upheld in many developing countries. Apart from the initial dyeing the stone washing or distressing of the denim is achieved by repeated washing and rinsing and bleaching, chemical blasting with such toxic substances such silica, dye stripped or bleached with potassium permanganate [12].

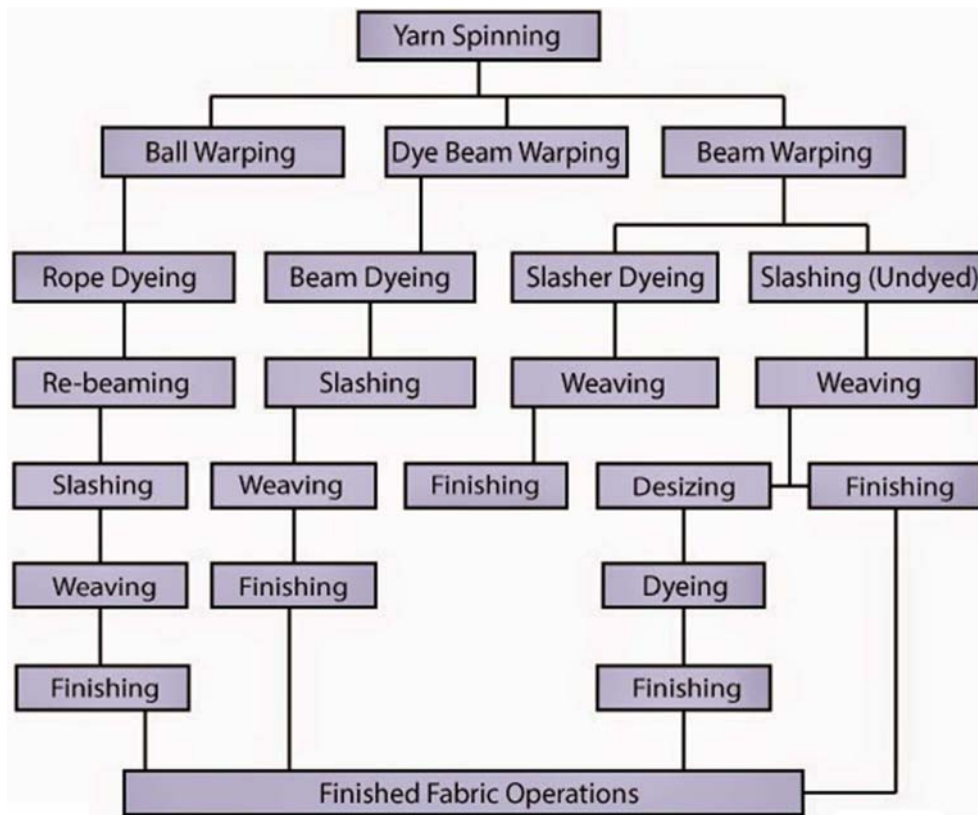


Figure 3. Conceptual model related to denim manufacturing.

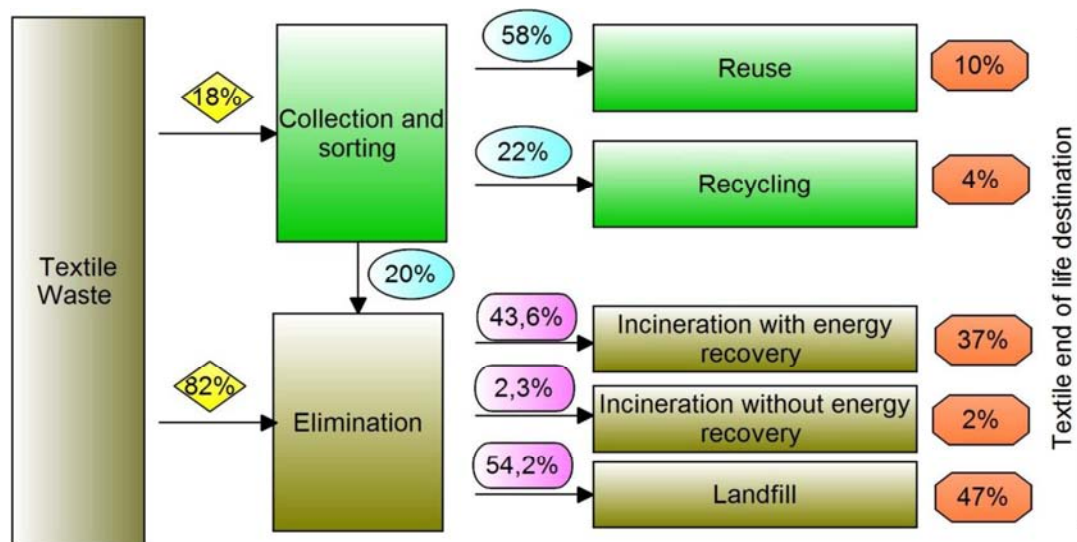


Figure 4. Textile disposal scenario with average French data [13]

2.3. Consumption of Bio-resources

A major driver of human impact on Earth systems is the destruction of biophysical resources, and especially, the Earth's ecosystems. The environmental impact of a community or of humankind as a whole depends both on population and impact per person, which in turn depends in complex ways on what resources are being used, whether or not those resources are renewable, and the scale of the human activity relative to the carrying capacity of the ecosystems involved. Careful resource management can be applied at many scales, from economic sectors like agriculture, manufacturing and industry, to work organizations, the consumption patterns of households and individuals and to the resource demands of individual goods and services [14, 15]. One of the initial attempts to express human impact mathematically was developed in the 1970s and is called the IPAT formula. This formulation attempts to explain human consumption in terms of three components: population numbers, levels of consumption (which it terms "affluence", although the usage is different), and impact per unit of resource use (which is termed "technology", because this impact depends on the technology used). The equation is expressed:

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

Where:

I = Environmental impact,
 P = Population,
 A = Affluence,
 T = Technology [16]

The research in 2005, "Philosophy and ethical consumption", authors initiated some basic philosophical approaches that are practical in understanding and evaluating ethical consumption issues and ethical consumer behavior. They have argued that such formalistic philosophical positions can be too demanding and abstract for application in everyday consumption [17]. In another research paper, authors looked into consumers' perspectives

on sustainable clothing consumption and examine some specific ways in which information could pressure retailers' policies [18].

In the year 2006, some scholars introduced better understanding of ethical fashion consumption; even though consumers demand more ethical responsibility from companies [19]. In an article, researcher shows the structure of sustainable fashion supply chain including eco-material preparation, sustainable manufacturing, green distribution, green retailing, and ethical consumers based on the extant literature [20]. The fashion industry today is a global industry and has a huge effect on our environment as well as on people. It is dominated by fast fashion and just-in-time production that has lead to increased seasons and mini-collections in season, which generate new low price items in store every week and even every day [21].

2.4. Environmental Concern and Ethical Issues

Many growing factors considered which are distinguished ethical from traditional fashion including use of sweatshop-free labor, energy-efficient processes, alternative energy and low impact dyes in manufacturing. Nevertheless, fashion consumers now-a-days are trying to choose an ethical wardrobe to pick up eco-friendly garment or fabrics. There are three criteria for selecting eco-friendly fabrics as

- The use of fewer toxic chemicals.
- The use of less land and water.
- The reduction of green house gases.

In fact, some of the fabrics may perform better than others based on the above criteria. It may in more cases, one fabric is more preferable according to one of the criteria but less preferable according to another, making for complicating choice in fabric qualities, cost, labor conditions or carbon footprint of product transportation. Now, many cotton firms or industries have a vibrant campaign promoting their products as sustainable pointing that due to new technologies and farming methods. The industry has greatly reduced its

use of energy, water and toxic chemicals. But very few farming has the significant success of reducing soil erosion, improved irrigation methods to reduce water use, improve methods of pest management, have reduced pesticides and most significantly, the use of genetically modified (GMO) cotton has reduced the use of land and toxic chemicals. A general statistics has shown that, growing enough cotton to make a single cotton T-shirt a third of a pound of toxic chemical (including pesticides, fertilizer and defoliation chemicals) [22].

3. Cotton Processing and Treatment of Effluent

Most people think of cotton as a “natural” product. The

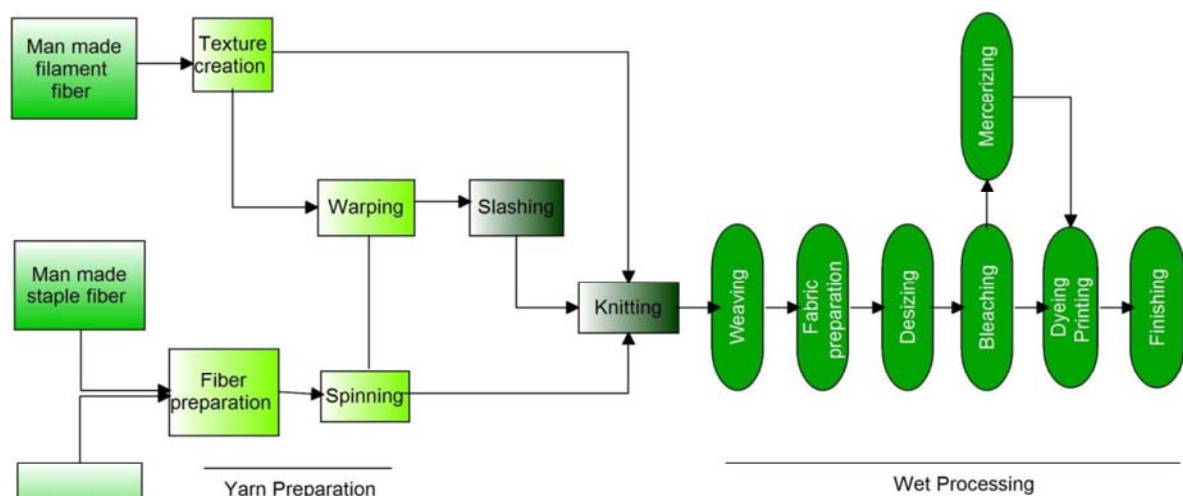


Figure 5. Flow diagram of various stages of textile processing (fiber stage to wet processing).

Most of the effluents are released at the wet processing of textile fabric. During the de-sizing sub-stage, about 50% of water pollution occur containing high amount of BOD [23]. In this stage, starches are removed as its presence can hinder the dyeing penetration into the fibers. Usually, starch are either removed or converted to water soluble products by hydrolysis or an oxidation process. For this, diluted mineral acids, sodium chlorite, sodium bromide etc are used [24].

3.1. Dyeing Effluent and Environmental Effects

Dyeing of textiles is the ancient art going back to the Bronze Age. Gradually, it became a sophisticated technique with using plants and fruits. Later on with the advance of science the age of chemical dyeing was introduced and various synthetic compounds were used for dyeing especially for commercial purposes. At present, several methods are applied in the textile dyeing process. Among them continuous, semi-continuous and batch dyeing are commonly used [25]. The type of dyeing method depends on the type of yarn, fiber, fabric and quality of garment. However, the dyeing industries are considered one of the most pollution creators. There are many dyeing industries which grew up in Bangladesh and

reality: Cotton is one of the most chemically intensive crops in the world. According to the U.S. Department of Agriculture, 84 million pounds of pesticides were applied to the nation's 14.4 million acres of cotton in the year 2000, and more than two billion pounds of fertilizers were spread on those same fields. Seven of the 15 pesticides commonly used on cotton in the United States are listed as “possible,” “likely,” “probable” or “known” human carcinogens by the Environmental Protection Agency. From raw cotton to finished textile product consists of several stages. Sometimes all these stages comprise in a single industry but in most of the cases, it diverges into several small units of different factories. The textile cotton production process starts with preparing cotton fibers, transforming into yarn, weaving, converting yarn to cotton fabric, dyeing and finishing the textile.

which play a great role of the economic growth of the country. Most of these dyeing industries are located in Narayanganj, Gazipur and Savar area [26].

3.2. Health Risk to Workers

The mixed acid is usually a mixture of Sulphuric acid and Nitric acid and while workings with acids need an extensively higher precaution to handle, otherwise it can burn skin horribly. Together with nitration toluene and benzene, these acids are commonly used [26]. The health hazard poses higher risk to those people who handle the dyeing process within the factory. They can be affected directly or indirectly. The toxicity comes mainly from the chemical components used for dyeing process. Nitric-per-oxide and Nitrous fumes can effect on human body by irritating of the respiratory system. This may cause bronchial problems and fatal pulmonary edema [27].

3.3. Waste Water with Effluents

It is needless to say that, the dyeing waste water is colorful and dark. Dyes usually contain various organic compounds

including different functional groups. Amine, carboxylic and azo functional groups are common among them. Azo dyes are the mostly used dyes for textile. Azo dye produces aromatic amines and other degradation products that are highly carcinogenic [28]. Thus these dyes pose serious environmental impact and affect easily on aquatic ecosystem. Dyeing waste water contains a high COD/BOD quota, different solids and chromium (Table 1).

Table 1. Average composition of textile dyeing waste water [23].

Substances	Values
pH	9.8-11.8
Alkalinity	17-22 mg/l as CaCO ₃
BOD	760-900 mg/l
COD	1400-1700 mg/l
Total solids	6000-7000 mg/l
Total Chromium	10-13 mg/l

4. Eco-friendly Textile Fibers

As cotton production consumes highly water intensive resources although it is difficult to measure the amount of water usage. The production of cotton fibers also needs a huge amount of pesticide usage. At about 55% of whole pesticide usage in India goes to cotton crop production. The interesting fact is cotton production of India represents only 5% of whole agriculture land use. An investigation revealed that, cotton being a most water and pest intensive crop consumes approximately 11% of the whole world's total pesticide [29]. Therefore, the cultivation of cotton and production should consider an environment friendly way.

4.1. Organic Cotton

Organic cotton is grown without the use of any genetically modification to the crops, without the use of any fertilizers, pesticides, and other synthetic agro-chemicals harmful to the land. Consequently a new type of organic cotton has been developed which is soft to the touch and at the same time, grown without chemicals. Organic cotton tends to be more expensive, but its impact on the environment is kept to a minimum. All cotton marketed as organic in the United States is required to fulfill strict federal regulations regarding how the cotton is grown [30].



Figure 6. Organic Cotton.

4.2. 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. According to the United States Environmental Protection Agency's 2008 report on Municipal Solid Waste (MSW), generation, recycling and disposal in the United States defines clothing as non-durable – generally lasts less than three years – textiles. In 2008, approximately 8.78 millions of tons of textiles were generated; 1.45 millions of tons were recovered and saved from landfills resulting in a rate of almost 17%. The EPA report also states that the amount of MSW being “discarded” is 54%, “recovered” is 33% and “combusted with energy recovery” is 13% [31]. Approximately two-thirds of clothing materials are sent to landfills, making it the fastest growing component of waste in the household waste stream. Within the last five years, textiles disposed of in landfill sites have raised from 7% to 30% [32].

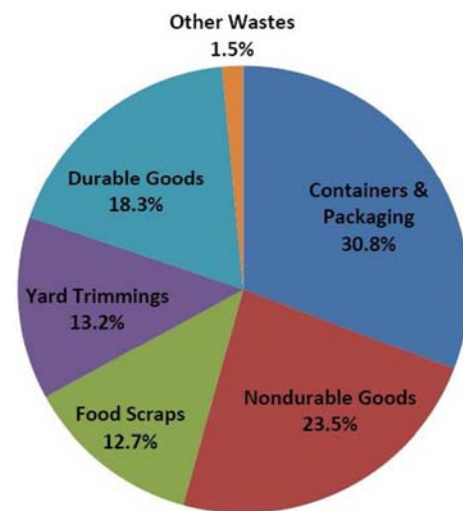


Figure 7. Total MSW (Generation by category), 2008, 250 million tons (before recycling).

5. Apparel Manufacturing Industry and Sustainability

Although the garment or apparel manufacturing industry of Bangladesh is expanding dramatically day by day, it already has started to face several problems in different aspects. At initial stage, many readymade garment factories start as local domestic tailoring outfits. After a certain time, it starts to get sub-order from other big garment exporting companies of Bangladesh and gradually grow up as a big independent garment factory later on. Therefore, from the very beginning of the set up, no industrial building structure or policies are followed. Moreover, many of workers come to start working these small factories directly from village area who used to work at agriculture before or having no work

experience. The lack of skill and gap of living style from village to city area, these poor people will become the most victims of garment violence and tragedy.

5.1. Poor Wages

It is a matter of great sorrow that, garment workers of Bangladesh receive the lowest wages of the worlds. This is the main reason behind the low production costs that attracts the foreign buyers to trade with a cheap price. The salary of the garment workers has been increased three times since 1994. During that time the minimum salary was 930 taka (8.3 Euro) per month which was changed after a long time to 1662 taka (15 Euro) in 2006. But it was not sufficient enough to maintain living costs. Therefore the workers continued to protest against low wages. As a result, in 2010 the wage board raised the minimum wage to 3000 taka (27 Euro) per month. Although the demand of wages of the workers were 5000 taka (45 Euro) [2]. The most recent updated (November, 2013) minimum wage was decided 50 Euro per month. The wage board is an organization under Ministry of Labor and Employment who decides the wage scale from government's perspective.

5.2. Overtime Working

Working excessively overtime is another problem. Workers often do overtime due to earn extra money to cover high living costs. In many cases, the workers are compelled to work overtime due to meet up the demand of supplier in time. According to Bangladeshi labor law 2006, eight hours per day comprises a standard workday and six days a week. Therefore 48 hours per week is considered as work week that can be extended to maximum 60 hours including overtime. Bangladeshi garment workers do average 76 hours per week which is far away from the standard work week. The labor act 2006 also states that a worker should have been paid within 7 working days of completion. Unfortunately, most of the factories practically do not follow this. In general, around 50% of net profit of the industry goes to workers wage which is commonly practiced worldwide, but in Bangladesh only 30% of net profit is spent on workers wage [1].

5.3. Gender Equality

The expansion of garment industries of Bangladesh has provided a huge opportunity for women workers. During 2004 among 1.8 million of garment workers of 3480 factories, the numbers of women workers were 1.5 million. It shows that around 80% of garment workers are women (Figure 8). The lack of education and lack of work skill attracts women to work in garment sector even with low salary. Before employed, most of them were unemployed and used to do household work or agriculture. The garment owners took it as opportunity to provide lower wages to these newly moved women from village areas. Many literatures suggest that most of the women workers are unmarried and younger [33]. A researcher claimed that about 40 to 50% of the women

workers are married and even working mothers. The major factors that drive them to engage at garment industries are poverty, family conflict and divorce [34]. Working at garment industries provides women better economic capabilities even with a low wage as well as social capabilities as they get new job identities.



Figure 8. Women workers working in a garment factory, Bangladesh.

The garments manufacturing industries represent a large portion of female workers there are several inequities at work. Women are usually employed in jobs with less or non technical skill compare to men. In addition to that, female workers are paid lower than that of the man with similar job. Sexual harassment of women workers are another common offense. Many female workers have harassing experiences during getting salary or working at a night shift. Most of the cases, the boss or senior supervisors harass rather than their male colleagues. A majority of the female workers do not complain to authorities or police due to the fear of losing the job. Lack of an informal recruitment process, lack of skill and employment proof, social negligence to victims lead them to keep silence against the sexual violence. Sometimes, during salary payment time, female workers are compelled to cut out certain amount of money in the name of so-called developing fund and a willingness to protest results in physical torture. During pregnancy, most of the female workers do not receive any compensation. In fact in many cases, they lose their job.

5.4. Fire Safety and Security Risk Factors

The garment industries of Bangladesh represent one of the worst records of the world in terms of safety. In recent years, fire accidents occurred frequently due to poor infrastructural and security risk management issues (Figure 9-10). The latest factory building collapse has added another type of hazard in garment industries. According to Bangladesh Fire Department, during 2006 to 2009 periods, about 414 garment workers died in 213 factory fires. In 2010, about 79 workers died due to factory fires [35]. Some major factory incidents since 2005 are mentioned in table 2.

Table 2. Major factory incidents in the history of Bangladesh since 2005.

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

**Figure 9.** Fire in a garment factory, Bangladesh (Source: www.euronews.com).

5.5. Trade Union

The trade unions of garment industries are not fully operating. Trade federations and labour unions are mostly connected with the state political parties. Instead of focusing garment worker issues, the union leaders often are kept busy with the dominant political party issues of the country. Therefore, in most of the industries, the trade unions are not functional. Only few trade unions are active. The poor structure of trade union provides the negligence of the workers right as well as poor result of different practical issues with wage calculation, women inequity, harassment and violence.

**Figure 10.** Savar Rana Plaza building collapse (Source: New Age Online, 2013).

5.6. Building Collapse

Building collapse has appeared as the second type of major hazard in garment industries. The main reason behind this due to 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 1129 workers.

5.7. Sustainability Issues Regarding Apparel Industry

Sustainable industrialisation is a long-term process of transformation towards a desired vision of an industrialised 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. 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. In that case the benefit of profit growth directly goes to the owners. The workers barely get any bonus from profit. The economic growth of Bangladesh is also dependent of garment export. As 80% of Bangladesh export consists of garment products, it has strong connection of the country's economy. Bangladesh's GDP growth is stable since 2000 and has continuously a growth rate around 6. 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. Organic cotton is suggested. In addition to that, recycling involves a complex industrial processing requiring the use of some energy, water and chemicals to effectively and efficiently reconvert the waste materials into secondary raw materials to manufacture new products or at least recover energy from the waste materials in the form of heat. It is like getting 'gold from rubbish' and 'silver from sewage'. There is great economic and ecological wisdom in recycling all materials and resources needed for mass consumption by society. Thus reuse and recycling of garment products can provide a better environment [29].

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. Gender equality for a salary and job position is not maintained properly. Although the child labors in garment industries are reduced dramatically after the Harkin Bill of United States in 1992, still there are many child labors working in small informal industries. Most of them are 12 to 15 years old girls coming from village areas. There is no community of workers grown up. The workers live in most of the slum areas and are socially considered as lower class people.

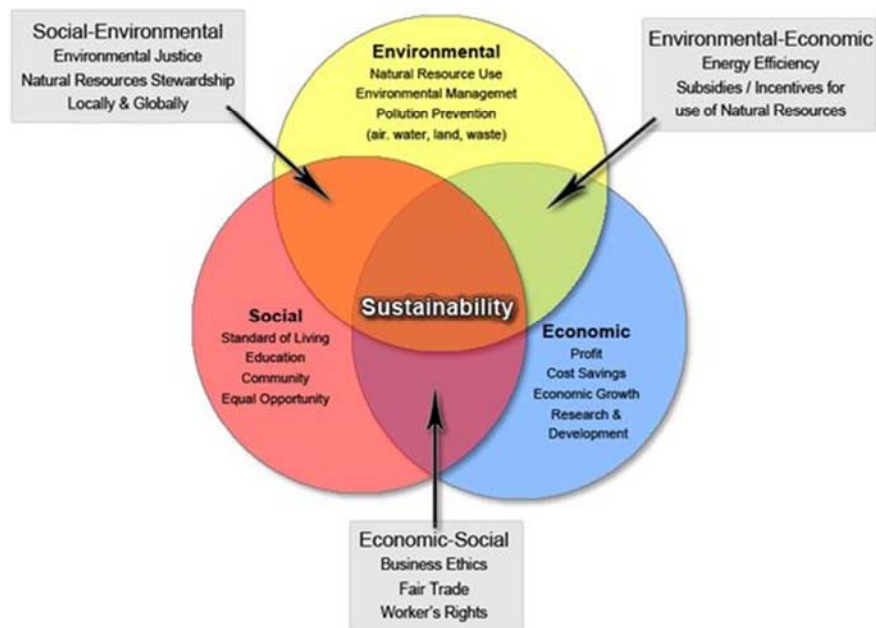


Figure 11. The three spheres of sustainability.

On the other hand, environmental economic conditions are not practiced at all. There is no database for energy use; the supply of electricity is also not stable and often uncertain. Very often they need to manage alternative energy sources using a fuel based generator. Energy recovery from incineration is never applied as there is no incineration plant. 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. As it is related with three million of workers living and the economy of the country, the concerned actors must have to take serious initiatives towards sustainability.

6. Recommendations for Sustainable Environment

There is no denying of the fact that, manufacturing of garment products is not only linked with making of a final product, it also relates to the processing of various raw materials. Therefore, the process related to cotton production to cotton processing need to be under consideration. Some recommendations for textile process must be taken care of seriously for creating sustainability in textile manufacturing industry.

- The conventional cotton production requires a huge amount of pesticides. Therefore, organic cotton production should be encouraged and use of natural pesticides. Focus should go to recycle cotton, reprocessing and reuse.
- In preference to using synthetic compounds or chemicals, natural dyes can be utilized. In that case, toxic mordants should be avoided such as chromium based mordants.
- 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.
- Industries should take necessary steps regarding construction of ETPs and operate them regularly to treat effluent.
- 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.
- Industry can introduce LCA approach for the manufactured product in order to address Green House Gas (GHG) 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.

7. Conclusions

The apparel manufacturing industry of Bangladesh is the lifeline of the country's economy. Since late 1970s, the garment industry has become the single dominant exporting sector in Bangladesh and it covers around 80% of total export products in terms of foreign currency earning. About three million workers are involved in this large industrial sector in which about 80% workers are women. The garment industries are expanding rapidly, creating lot of job opportunities for skilled or unskilled men and women. This industrial sector also plays a great role to reduce poverty by providing job opportunities. The economic growth of the country has been surprisingly steady during the last decade in which garment product exporting has a great role. At present, Bangladesh is the third largest garment manufacturer and exporter country after China and The European Union.

It is needless to say that, there is a competition among all fashion related people, celebrities, the brands; those are working with the fashion related organizations. The term "Sustainability" is not merely for the consideration for apparel manufacturing industry but also its continuation and further development of the new concept amongst all the people for the sustainability of the environment to check global warming, ecological balance, reduce natural calamities, conservation of vegetation, conservation of wildlife, etc. Most of the world famous brands have already become famous for the sustainability of fashion by its environmental and ecological conservation policy. Fashion concern consumers are searching sweat free labor, energy efficient process in the fashion in a sustainable, ethical ground whereas, all the brands are very much conscious for the same in the western world.

Garment manufacturing industry is one of the major key elements of the economic growth of Bangladesh, the workers' rights and standard wage levels should be revised and reconsidered. No workers should suffer from their poor working environments. The government along with factory owners should authenticate the workers personal benefit, health and safety issues. The government, private organizations and the factory owners must have to take responsible initiatives and to work for the better working atmosphere in order to enrich a satisfactory position in terms of sustainability.

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