

Green Industry in Bangladesh: An Overview

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Abstract

Green industry initiative is a major driver towards sustainable industrial development around the world. Bangladesh economy has been targeting a middle-income status by 2021, and for such development to occur, a sustainable development is required, for which a green industry is one of the major drivers. This paper presents an overview of the current scenario of the initiatives taken for a green industry and tries to examine the social economic and environment benefit. This paper also discusses major prerequisites of green buildings as location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation, regional priority. Apart from these, other opportunities are also discussed in this paper. Bangladesh Government and Bangladesh Bank are also adopting some policies for this development. Finally, some policy suggestions towards an efficient green financing policy for the better nourishment of green

industries are provided in this paper.

Keywords: Green industry, LEED certification, Environmental sustainability, Bangladesh

1. Introduction

Over the past 30 years, environmental degradation has been considered as a major focus in industrial sectors. The increment in the emission of greenhouse gasses through industrial processes and the destruction of natural resources has created a major problem in the environment. In the modern era of globalization and with aspirations of achieving a middle-income status, Bangladesh has been striving towards industrial reform. The rapid growth of these industries have provided benefits to the socioeconomic development in the country, have created many employment opportunities, reduced poverty and increased the quality of life (Zohir, 2001).

As the world faces an environmental crisis that affects in many facets, economic progress is to be done in such a way that environmental considerations must be deliberated. As the world is moving forward towards a greener economy, industries are adopting policies that strive towards this goal. Bangladesh is falling in line with these policies and adopting green principles for different industries, namely the garments sector. One of the main tools towards achieving this goal is by following certain guidelines that aid in the betterment of the industry.

The scarcity of natural resources and environmental pollution in regards to air and water are one of the major constraints towards sustainable future growth. In Bangladesh, some major concerns are ground water depletion, production processes that use finite resources inefficiently, unavailability of natural gas, lack of waste management and occupational health and safety measures (Ahmed and Islam, 2014). If environmental degradation is allowed to be aggregated, cleaning up or controlling any negative ramifications might end up being unfeasible. Indubitably, for the Bangladesh economic growth, this has become one of the major concerns of the government, policy makers, and environmentalists (BELA, 2017).

Consequently, the competitiveness requires special attention for the long-term sustainability because the competition is increasing remarkably within the industry to industry, sector to sector both at national and international levels. There is a rising awareness that current resource (and pollution) intensive business models cannot long continue, creating a negative social and environmental impacts that also creates business risks. The competitiveness of Bangladesh industries is also largely determined by the nature of the resources that are being used and value chain relative to its competitors. To maintain a competitive edge, many factories are adopting green principles (BKMEA, 2016).

Thus, focus on a more corrective measure to mitigate any environmental concerns has been noticed in the past few years. A growing demand for products that are environmentally friendly and have eco-friendly manufacturing processes has been observed. This reduces cost, improves resource efficiency, reduces any risk and causes greenhouse gas emissions to be lowered. The stakeholders of different industries are now inclined towards conducting business with the vision of an environmentally friendly industry. For example, foreign buyers

of the Ready Made Garments (RMG) industry are not only concerned about the product quality but also about the social, ethical and environmental standards (BKMEA, 2016).

Sustainability and environmental consciousness are a buzzword in today's world where business is no longer confined to the traditional concept of business, for example, the garments sector already consists of a number of factories that are concerned about the environment and are striving towards an industry that is environmentally inclusive. Namely, these factories have been actively participating in the betterment of the environment such as running effluent treatment plants (ETPs), using energy efficient technologies and installing renewable energy technologies and creating the business eco-friendly in general.

One of the popular strategies to halt environmental degradation is green building initiatives in Bangladesh. Green buildings have been implemented in Bangladesh as the leading initiative towards environmental sustainability. This paper aims to illustrate an overview of green industries and initiatives that have been taken in Bangladesh towards it.

2. Green Industry

The term 'green industry' comes from a concept 'green economy, a pathway towards sustainability that is followed by organisations such as the World Bank and United Nations Environment Programme (UNEP) (Barbier, 2012). Strategies, policies, and programs give the rise of a green industry that focuses on the development of production. Green industry has been defined by United Nations Industrial Development Organization (UNIDO) as "A pathway of sustainable growth by undertaking green public investments and implementing public policy initiatives that encourage environmentally responsible private investments." (UNIDO, 2011).

A green industry is one which is environmentally friendly in all aspects. This industry is not harmful to the environment as traditional industries. A green industry does not put industrial production above and all at the expense of the natural environment and human health (Hall and Dickson, 2011). A green industry aims to build an industry that intertwines environmental and social consideration with economical considerations.

In a broader sense, a green industry is one that sustainably uses any inputs, where production process requires less use of water, energy, and materials, where solid waste is reused and recycled, any emission of harmful gases are reduced, and production process is free from harmful human toxins. A green industry takes an approach towards any form of growth by reducing its impact on the environment while taking into account of environmental criteria that may or may not directly relate to the development at hand, but to the ecosystem of the world at large. A green industry can help them to reduce costs, fight climate change, re-think long-held business practices and open doors to a myriad of opportunities (Fineman and Clarke, 1996)

According to UNIDO (2011), two main approaches towards creating such industry are by retrofitting new technologies or starting from scratch. For example, greening an industry relates to an industry or a facility that has already been erected and is functional. This focuses the long term environment performances regardless of sector, size or location. This also

includes any internal process that reduces the environmental impacts by using more efficient resources and most effective use of natural resources, renewable energy, by improving the health safety issues and reducing any overall risks. Additionally, creating green industries relates to a new industry or a facility that needs to be established focusing on zero environment pollution. A company should focus on adopting the cutting edge technologies while installing renewable energy and erecting the business in a way that green principles are embedded in the earlier stages of planning (UNIDO, 2011).

3. Literature Review

Chen et al. (2017) showed that a green industry can make big improvements in a country's socio-economic development and provides a favourable condition for a sustainable industrial development. This study assessed the current green industry conditions in China and the results show that about 8% contribution was done to the socio-economic conditions by a green industry. The number is quite small and even big though improvements are being done; there is a substantial scope for improvement (Chen et al., 2017). This paper states that about 45% of the industry has been adopted with green technology followed by service industry 65%, agriculture industry 55%, manufacturing industry 24%. This study also revealed that green industry growth is associated with the national economic development of China, as it increased the annual growth rate of exported green product. This study also revealed that if there was a 1% increase in green product exports, an increased in 0.04% gross domestic product in China (Chen et al., 2017).

Additionally, economic profit is not something that should be an issue when it comes to implementation of a green industry as the future yields are substantial in terms of profit, enhanced environmental performance and in general human wellbeing (Hashim et al., 2015). This can be further seen as a study by Hoque and Clarke in 2013 shows that realizing the potential pollution prevention initiatives in Bangladesh reduces environmental degradation, and in turn, saves cost (Hoque and Clarke, 2013). Bangladesh Bank is already underway facilitating green industries and argues that a better future can be made by changing our mindset about environmental issues in a preventive manner (Ullah, 2013).

Jia et al. (2017) discussed that sustainable development should be ensured through the resource-constrained process of industry. For this purpose, natural resources including water, minerals, fossil fuel, and environmental resources usage should be reduced, thus, environmentally sound product usage and reducing the consumption of resources help towards ensuring long run sustainability. Ali et al. (2016) investigated the understandings and green initiatives in the construction industry in Kota Kinabalu, Malaysia. Their findings included economic development activities which were fostered with the aid of using green technology. It should also be noted that a focus on green technology solely is not sufficient for a sustainable development. To incur effective change and raising awareness, proper education and broad trainings are also required. This will move towards a more sustainable development.

Ito (2016) investigates the association between CO₂ emissions, renewable and non-renewable energy consumption, and economic development of 31 developed countries. They found that

energy consumption policy has a negative impact on the economic growth but renewable energy uses has significantly reduced the carbon emission of those countries. Ge and Zhi (2016) demonstrated that there is a complex relationship between the green economy and employment generation in both developed and developing countries. They found that green economy, in general, has a positive effect on employment generation in both developed and developing countries, but it should be noted that it has negative effects on employment generation in Spain. Hashim et al. (2014) discussed that by green practicing, environmental harmful effects can be reduced and energy saving would be ensured. The authors developed an assignment tool named Green Industrial Performance Scorecard (GIPS) to understand the performance of a green industry. Five essential components namely, energy, water, waste, soil management and air are included in their assignment tool.

Deng and Liu (2011) included seven components as green raw material, green exploitation, green store, green transportation, green sale, green consumption, green return, green recycling and green disposal a green supply chain for the oil industry in China. Negulescu and Doval (2014) explored the managers' position against risk, uncertainty and efficiency within the green industry. The authors found that majority of the companies have implemented and in progressed in environmental standard. Their study also reveals that there are strong correlation between environmental protection investment and company's risk management efficiency.

Transition of adopting green principles come up with certain advantages that not only benefit the world environmentally but economically and socially as well.

According to the Inter-Governmental Panel on Climate Change (IPCC) in 2014, Bangladesh has been categorized as a high-risk country from climate change due to erratic climate events, which will, in turn, threaten the country's food and livelihood security (Hijioka et al., 2016). Adopting green principles are a definite way to start mitigation methods and ensure that no further damage has been done to the climate.

4. Benefits of Green Industry

While Bangladesh has adopted some green principles in the past, natural resources must be used in a manner that it is environmentally feasible and green practices aid in these beneficial arguments that will be discussed in this section.

4.1 Social

A green industry is especially hospitable in terms of social aspects as it contributes towards alleviating poverty levels due to economic growth and job growth. For example, in Bangladesh, there is a huge job market in the plastic industry in the form of recycling, but it is a form of an informal sector. Formalising this industry in the light of a green industry would cause in income generation which will cause positively improved working conditions and higher productivity (UNIDO, 2011).

In Bangladesh, there has been a rise in solar installation in areas that are not able to access electricity, causing in the development of positive social aspects in low-income families.

Additionally, for the rural areas, this access to clean energy would also mean dependency on oneself to provide for their own family while being monetarily solvent. This also causes positive health impacts, for example, using greener methods to cook food would not emit toxic gases.

4.2 Economic

Economic benefits of a green industry stem from a higher business performance of a company due to adopting green principles. This is because in a green industry consumer needs are placed in such a way that it provides a beneficial outlook, a healthy ecosystem and promotes a sustainable future. This also provides a positive outlook on the global value chain, causing increased access to global markets (UNIDO, 2011). Adopting a greener market also causes jobs to rise, as it can be seen from the energy industry. 3.5 million new jobs have been added to the market by renewable energy usage compared to 2.5 million new jobs from the oil and gas industry (Ferroukhi et al., 2016).

Additionally, improving environmental performance will also cause in the rise of economic benefits in the form of monetary savings. For example, energy efficiency will cause in using less energy, which in turn denotes as a favourable outcome in the overall economics of a company. Saving cost also applies due to any fund that has been saved from remediation reserves. Identifying environmental risks mean that a corrective action can be identified which causes in cost saving.

Studies show that clean technologies typically have relatively short payback periods and lead to lower annual costs (Von Weizsäcker et al., 2009). After an initial cost, these investments help decrease resource use while generating more money through increased productivity. This funding from savings can be used to further cause in the expansion of the business or in job growth, causing further economic growth.

4.3 Environmental

A greener industry has the ability to reduce usage of resources by utilising the potential of nature's capital to its maximum efficiency. This is particularly advantageous because this cancels out any inefficiency in the system and reduces waste.

Improved resource efficiency, i.e. using energy, materials and water more effectively, allows resources to be conserved. By reducing the demand for raw materials by using them more efficiently, impacts associated with extraction and harvesting are decreased (Peck and Chipman, 2007). For instance, the recycling of waste materials back into industrial production reduces requirements for the extraction and processing of virgin natural resources. This also saves resources associated with extraction, for example, in the textile industry, recycling of water causes in savings of water and decreases the need for investments in end-of-line effluent treatment systems.

As this involves shifting from linear systems to more efficient closed loop systems, waste is reduced. Improved product or service design with the aid of renewable or recycled resources can also increase the lifetime of the process while eliminating hazardous substances and

decreasing pollution and waste throughout the entire life cycle.

5. Necessities for a Green Industry in the Bangladeshi Context

Fostering a green economy through a green industry can be done through providing categories that can be used as a framework. It should be mentioned that for large scaled buildings, 40–95% of the anthropogenic greenhouse emissions are caused by operational energy use, and the rest being caused by construction and deconstruction (U.S. Green Building Council, 2017). Many types of rating systems exist for a green building, such as Building Research Establishment's Environmental Assessment Method (BREEAM) in the U.K., Leadership in Energy and Environmental Design (LEED) rating system in the U.S. Green Building Initiative (GBI) established in Canada (Vierra, 2016). Nearly 600 green product certifications exist in the world that take different approach to credits allocated for factors related to a green industry (Vierra, 2016).

From a Bangladeshi context, commonly used framework for a green industry is done on a focus on green buildings and credits regarding this rating. Additionally, LEED is the only recognized body by Bangladesh Bank when it comes to a formal certification for green industry in Bangladesh (Nabi et al., 2016)

5.1 Implementation of Green Industry in Bangladesh

To promote healthy, durable, affordable and environmentally sound practices in industrial sites and commercial building design and construction, any new construction and major renovations must fulfil some minimum program requirements for achieving the status of green. In this case, environmental laws and regulations are inevitable to implement. Commonly used green building rating and certification systems around the world are known as Energy Star, Leadership in Energy and Environmental Design (LEED), Green Globes, Living Building Challenge, NZEB, Passive House Institute US, SITES, WELL Building Standard, and much more. According to the instruction of Bangladesh Bank, Bangladesh is currently following the Leadership in Energy and Environmental Design (LEED) green building rating system developed by the U.S. Green Building Council (USGBC) (U.S. Green Building Council, 2009). According to LEED instruction, construction must have a complete, permanent building space using a reasonable site boundary. This structure must include a minimum of 1,000 square feet (93 square meters) of gross floor area to comply with minimum floor area requirements. Moreover, construction must be committed to share whole-building energy and water usage data as well as ensure minimum occupancy rates. To mention, the gross floor area must be no less than 2% of the gross land area to comply with a minimum building area to site area ratio.

5.2 LEED Certification

After the formation of U.S. Green Building Council (USGBC) in 1993, the organisation formed a system to define and measure ‘green buildings’ for the sustainability in the building industry which is known as LEED green building rating system. This rating system works with subsisting and vindicated technology and is illustrated in table 1. The rating systems provide a definitive standard for the design, construction, and operation of a green building.

The overall rating systems are consensus-based, voluntary and driven by market demand (U.S. Green Building Council, 2009).

Table1. USGBC rating system for green Certification Level

Version	Certification Level	Required Points
v2008, v2009 and , v4	LEED Certified	40-49 points
	LEED Silver	50-59 points
	LEED Gold	60-79 points
	LEED Platinum	80 points and above

Source: (U.S. Green Building Council, 2017)

In USGBC guide, LEED certification involves four main steps: register, verify, review and certify. There are four levels in LEED certificate process namely; LEED Certified, LEED Silver, LEED Gold, and LEED Platinum, whose levels are based on 100 points rating system. A rating between 40 to 49 points is marked as LEED certified, whereas LEED Silver and LEED Gold certificate are provided for 50-59 points and 60-79 points respectively, and this can be seen in table 1. The highest level of green certification name is LEED Platinum which can be attained with 80 points and above (U.S. Green Building Council, 2017).

5.3 Overview of LEED Green Building Rating System

To develop hygienic, viable, affordable, and environmentally sound practices in building design and construction this rating system is being used widely. The intention of this rating system is to standardise and certify commercial or institutional buildings and high -rise residential buildings of all sizes which are both private and public. Different criteria have been allocated to award credit for the certification process for different arenas under LEED certification .Those are stated as below:

5.3.1 Location and Transportation (LT)

The first priority that needs to be considered while implementing a new development is the strategic location which provides connectivity of the said premise to amenities that are convenient. These amenities include the availability of well-constructed roads, access to efficient transportation methods, and connections to utilities such as gas, water, electricity and sewage. This is also a priority as emissions must be reduced through the usage of transportation to the site, it is preferred that the site is nearby public transport and contains proper parking and cycling routes for ease of transportation.

5.3.2 Sustainable Sites (SS)

A sustainable site is one that doesn't hinder any pre-existing development or compromise any habitats nearby. This entails prioritising development on a previously developed site rather than one that requires deforestation or ecological change. This must also contain managing any runoff from storm water, and placing lights in a way that light pollution does not occur is a prerequisite. Additionally, planting landscapes that are native to the region to reduce water usage and soil erosion are a priority. Finally, usage of strategic materials for construction (to

reduce heat island effect) so that build-up of heat does not inconvenience users are required (U.S. Green Building Council, 2017).

5.3.3 Water Efficiency (WE)

Large volumes of water causes a strain on resources thus one of the conditions is to use water in an efficient manner. This means monitoring the performance of water systems by metering and efficiently integrating water management. This also includes reducing potable water consumption by using alternative water sources for non-potable water applications. Lowering potable water usage for showerheads, fixtures and machinery and systems that do not require a high purity of water is of the utmost importance. Additionally, this reduces energy costs because less amount of water is required to be processed and conserved (U.S. Green Building Council, 2017)

5.3.4 Energy and Atmosphere (EA)

Energy and atmosphere are one of the most important receptors when it comes to a green industry, and these are addressed in a way that energy efficiency ties with atmospheric conditions. This highlights energy performance of a site including orientation, materials, and in general how the site uses any energy. Emphasis on energy performance must be given so that energy management is done efficiently while ensuring elimination toxic gas discharge to the atmosphere such as chlorofluorocarbons (CFCs). Finally, usage of renewable energy finds a priority in this section as on-site renewable energy systems are given priority. This creates a low carbon system that contributes to positive environmental consequences (U.S. Green Building Council, 2017).

5.3.5 Materials & Resources (MR)

Usage of materials and resources are an important parameter when it comes to the development of an operation. Maintaining resources in a planned way so that it reduces waste of resources and materials are given a priority. This includes waste management hierarchies, a careful consideration of life cycle, reuse and recycling. This also focuses on cleaner production, a preventive approach that focuses on reducing waste at its source (U.S. Green Building Council, 2017).

5.3.6 Indoor Environmental Quality (EQ)

Indoor environmental quality directly relates to a giant portion of human interactions on the site, hence this category is a very important part when the environment is concerned. High quality indoor environmental quality aspires for this category with the usage of structural improvements. This can be done by improving ventilation, managing air contaminations such as restricting tobacco smoke, carbon dioxide, particulate matter, specifying harmful materials. Daylight lighting will decrease energy consumption, and providing a view will act as a pleasant experience for occupants. Additionally, occupants must have the access to control desired settings for convenience (U.S. Green Building Council, 2017).

5.3.7 Innovation (IN)

Implementation of innovative technologies in a green industry is one of the main factors in development, and this category emphasizes on implementing new methods that provide a significant improvement to the site in question (U.S. Green Building Council, 2017).

5.3.8 Regional Priority (RP)

Some environmental issues are area specific and can only be assessed upon in-depth deliberations. The noticeable effects of an area that cannot be ignored such should be taken as a priority in areas of naturally occurring particulars. These include drawbacks such as water shortages, polluted watersheds or advantages such as abundant sunlight, landscapes that are conducive to rainwater harvesting, etc. The main aim is to address any critical environmental issues that may possess due to the development of said project (U.S. Green Building Council, 2017).

6. Present Scenario of Green Industry in Bangladesh

Some initiatives have been taken towards a green industry in Bangladesh, but the most predominant initiative towards a green industry is through green buildings. Bangladesh started her journey towards implementing green buildings in 2011 by the first LEED certified project named as CIPL which was located in Savar, Dhaka. After that, Bangladesh started a revolutionary change in industrial development with special considerations towards environment issues. Bangladesh follows the USGBC guide to construct green buildings.

Recently seventy-eight LEED projects of Bangladesh have achieved certified, silver, gold and platinum certification level as seen in table 2.

Table 2. LEED certification of Bangladesh

Certification Level	Number	Version	Rating system
LEED Certified	8	v2008,v2009	Existing Buildings, New Construction
LEED Silver	34	v2009, v4	Existing Buildings, New Construction
LEED Gold	22	v2009	Existing Buildings, New Construction, Core and Shell
LEED Platinum	14	v2009	Existing Buildings, New Construction, Core and Shell
ALL	78		

Source: U.S. Green Building Council (2017)

In Bangladesh, only 8 projects are recognized as LEED certified. Moreover, 34 and 22 projects are recognized as LEED silver and LEED gold respectively. What is more noticeable is that, 14 projects have already achieved LEED platinum status (which is the highest certification level according to USGBC) as illustrated in table 2.

7. Major Industries in Bangladesh

7.1 Brick Industry

The brick -making sector of Bangladesh is one of the significant sectors contributing about one percent in overall GDP. This sector employs between one and two million people, most of them are pauper migrants. According to Bangladesh's Ministry of Environment and Forests, there were total 6,791 numbers of kilns in Bangladesh in September 2014 (Katsigris, 2014). This sector is considered as one of the most threatening sectors for environmental degradation in Bangladesh as the primary source of air pollution and deforestation. Moreover, by damaging soil fertility and animal health this sector is acting as the critical threat for agriculture sector of Bangladesh (Katsigris, 2014). The urban air quality is also deteriorating for the use of traditional kilns. During the brick- making seasons, the brick kilns are

responsible for almost 40 percent of fine particulate emissions across Dhaka city (Begum et al., 2010). Although this sector is playing the key role for urbanization and infrastructural development of Bangladesh, thorough monitoring and green technologies should be applied in this sector for the reduction of environment degeneration.

7.2 Cement Industry

The uplifting urban development of Bangladesh raises this sector as one of the fast growing sectors. The cement industry of Bangladesh is recognized as the 40th largest market in the world. In 2015, about 125 companies have generated an internal market of more than 18 million metric tons a year. (Royal Capital Limited RCL, 2015).

With 33-35 million metric tons per year installed capacity and 25-27 million metric tons per year effective capacity, this sector is emerging significantly though Bangladesh stands in lowest per capita cement consumption in world perspective (Royal Capital Limited RCL, 2015).

This sector is considered as one of the major sources of particulate emissions, noise and odours in Bangladesh (Stajanča and Eštoková, 2012). The major emissions from cement plants are dust, nitrogen oxides (NO_x), sulphur dioxide (SO₂) and most importantly carbon dioxide (CO₂). Global warming, as well as respiratory and pollution health risks are the major consequences of pollution caused by cement manufacturing process. Some of the sources of solution for cement manufacturing process can be found by using alternative fuels, solar cells and wind turbines, amongst others to generate electricity, while also focusing on waste heat recovery system (Mamun and Biswas, 2012)

7.3 Ceramics Industry

The ceramics industry of Bangladesh, considering as one of the growing manufacturing sectors started its journey during the late 1950s (Islam, 2015). The major products of this sector are sanitary ware, table ware, and tiles. According to Bangladesh Ceramic Ware Manufacturers Association (BCWMA), this sector having more than 54 ceramic industries and employing about 500,000 people throughout Bangladesh (Islam, 2015). Moreover, at present the overall investment of this sector is counted as about BDT 53 billion (Hussain, 2016). This sector generates various types of environment pollution, mostly air and water pollution. The major air pollutants are considered as dust (particulate matter), gaseous emissions, Sulphur dioxide and other sulphur compounds, Oxides of nitrogen and other nitrogen compounds, Carbon monoxide (and carbon dioxide), Volatile organic compounds (VOCs), Metals and their compounds, Chlorine and its compounds, Fluorine and its compounds etc. Water is another important raw material in the ceramic manufacturing process. Suspended solids (clays, frits, insoluble silicates), suspended and dissolved heavy metals (lead and zinc), dissolved anions (sulphates), boron, screen printing vehicles and glues used in glazing operations etc are the major water pollutants generated by cement industries. As a consequence, Workers of ceramic industries are inclined to various health hazards. Among them silicosis leading to tuberculosis is most common which is related to breathable dust content and free silica content (Tiwari et al., 2007).

7.4 Glass Industry

Glass manufacturing sector is another thriving sector of Bangladesh which is currently competent to meet more than 90% of total domestic demand (Alauddin, 2005). The glassware industries are run by energy intensive process consuming electricity, fuel oil and natural gas. Silica and gas are considered as primary raw materials whereas dolomite, feldspar and limestone are reckoned as secondary raw materials. These industries emit fewer amounts of pollutants in comparison with other industries (Alauddin, 2005). The raw materials which are used in this sector are environmentally safe; as a result waste levels are low. While this sector causes insignificant water pollution problems, air pollution is the major concern of glassware industries. Suspended and breathable particulate matter, nitrogen oxides (NO_x), Sulphur dioxide (SO₂), Carbon monoxide (CO), volatile organic compounds (VOC) and greenhouse gases (GHG) are major air pollutants of glass industries of Bangladesh. Thus, eco manufacturing should be applied in this sector considering health, environment and safety issues.

7.5 Ready Made Garments (RMG) Industry

The garments industry of Bangladesh is the largest manufacturing and export sector in Bangladesh with a 6.04% contribution to the Gross Domestic Product (GDP). This sector employs around 4.4 million workers of whom 80% are women. Due to the enormous nature of the industry, environmental aspects are highly looked at in this industry, mainly resource consumption and environmental degradation. The WDF (washing/dyeing, finishing) process uses a bulk amount of water, as much as 300 L/kg of fabric produced. Energy loss related to water consumption is also a major area of concern. Resource consumption is a major aspect as resource efficiency in terms of energy and water must be looked after, and the entire process must use resources in such a way that overuse is not done (BKMEA, 2016).

Secondly, environmental degradation is a big aspect as proper disposal of solid and liquid waste are not done as some garments expel wastewater in nearby water bodies. The WDF facilities require usage of an effluent treatment plant, of which some are not in use and the water is expelled untested. Machinery contributes to negative air quality with the aid of greenhouse gases and volatile organic chemicals, which cause degradation to the air. Due to the size of the sector and its contribution to environmental degradation, this sector must look after its environmental aspects if the sustainability of the country is to be maintained.

7.6 Leather Industry

One of the most polluting industries in Bangladesh is the leather, footwear and tannery industry as this industry has been under a lot of scrutiny for expelling toxic waste products, untreated. In the fiscal year 2015-2016, Bangladesh exported USD 1.13 billion of leather and leather goods, making this industry the second highest exporter after RMG. Tanneries are known to not use effluent treatment plants and can generate 20,000 m³ effluent and up to 232 tonnes of waste a day (Paul et al., 2013). Heavy metals such as chromium get discharged in the effluent and this causes major disastrous human health impacts. A study by Ahmed and Chowdhury (2016) states that this industry has a serious impact on eutrophication to water

bodies nearby and on aquatic ecotoxicity, which causes damage to flora and fauna. Similar to the RMG sector, certain effort must be taken so that the environmental damage is to be lowered significantly by this industry.

8. Opportunity in Bangladesh to Set Up Green Industry

Considering the global competitiveness scenario, Bangladesh is paying a notable emphasis on green initiatives, especially for marketing reasons. A company can reduce electricity, water and consumption of other resources by taking green building initiative. Settings up green factories are still too expensive in Bangladesh for the larger dependency of raw materials on external sources. But green initiatives can save money in the long run by abating cost of utility services such as power and water, as elucidated in earlier sections.

8.1 The role of Bangladesh Bank

Bangladesh Bank the central of Bangladesh has launched green financing as a part of green banking which can make a great contribution to the transition to resource-efficient and low-carbon industries. Bangladesh bank is providing facilities to establish green industry and green economy in Bangladesh (Nabi et al. 2016).

8.1.1 Green Banking

Green banking is a component of the global initiative by a group of stakeholders to safeguard the environment. The Bangladesh Bank issued policy guidelines for Green Banking in February 2011. The guidelines provide instruction to all operating banks and financial institutions for taking feasible measures to operate environment-friendly banking activities in the country. According to the guideline, all the commercial banks and financial institutions are compelled to submit a quarterly report of their green banking activities in BB common reporting format. Green Banking Initiatives of the Bangladesh Bank (BB) have two aspects: in-house green activities and non-in-house operations.

From table 3, it can be seen that the sector wise disbursement of Bangladesh Bank (BB) totals 2,649,099,596.00 Amount in Bangladeshi Taka (BDT) (million) for green financing. Under green banking scheme BB has enlarged the product line from 6 to 47 and differentiates these products into 10 categories which are:

(a) Solid Waste Management, (b) Energy Efficiency, (c) Fire Burnt Brick, (d) Non-Fire Block Brick, (e) Liquid Waste Management, (f) Alternative Energy, (g) Recycling & Recyclable Product, (h) Renewable Energy, (i) Green Industry (j) Miscellaneous (Nabi et al. 2016)

Table 3. Sector wise Disbursement (February, 2016)

Sector	Cumulative amount in BDT (Million)
Solar Home System	327,507,199
Solar Irrigation Pumping Station	68,270,000
Solar PV module assembly plant	569,287,647
Solar Mini Grid	10,000,000
Bio-gas plant	627,954,600
Effluent treatment plant (ETP)	110,365,200
Hybrid Hoffman Kiln/equivalent technology in Brick Field	467,189,950
Vermicompost	2,645,000
Safety Working Environment	45,680,000
Green Industry	400,000,000
Paper Waste Recycling	20,000,000
Organic Manure	200,000
Total	2,649,099,596

Source: Rizwanul, (2016)

Bangladesh bank follows the UNEP Inquiry Performance Framework for green financing which consists of five major elements:

8.1.2 Capital Requirement

This is the capital that is required to provide a sustainable development by prioritizing financial needs towards it.

8.1.3 Financial Flows

This is the assessment for the levels of financial need for a company that focuses on investment against pollution.

8.1.3 Effectiveness

This measures the degree to which market prices are set by sustainability factors in assets. This is done by factoring in market pricing and taking in externalities in full cost.

8.1.4 Efficiency

This measures how cost effective a part of system is for raising the finance for a sustainable development.

8.1.5 Resilience

This accounts the implications of any shocks on the financial system by any future unsustainable development. (Designing a Sustainable Financial System in Bangladesh, 2015)

Major export-earning sectors of Bangladesh such as brick industry; cement industry; ceramics industry; glass industry; leather, footwear and tannery industry; RMG industry; steel industry and textile industry are included in green banking refinance scheme to ensure

compatible and secure working environment. According to the guideline, no institutions are able to apply for a loan more than 2 billion taka at 9% interest rate.

Bangladesh Bank has been advised to commercial banks to finance in Solar Energy, Biogas, ETP and Hybrid Hoffman Kiln (HHK) in the brick field under their finance program. A comprehensive guideline on Corporate Social Responsibility (CSR) has been issued by green banking & CSR department of Bangladesh bank for undertaking eco-friendly and socially responsible practices. According to the CSR guideline, all institutions have to follow green office guide in internal management as well as eco-friendly business activities, industries have been instructed to get privilege in financing. Bank and Financial Institutions (FIs) have policy for green banking, and they are instructed by Bangladesh bank to allocate a 10% to their Corporate Social Responsibility budget for Climate Risk Fund for green banking. Banks and FIs have been instructed to form a “Climate Risk Fund” according to the above mentioned policy guidelines for green banking. E-commerce has been introduced in all financial institutions to initiate online banking for paying utility bills, money transfer etc.

Moreover, Bangladesh Bank has set the policy to provide two hundred million dollars green fund for textile and leather markets from the foreign currency reserve which is known as “Green Transformation Fund”. Along with these two giant exports oriented industries, other emerging export oriented industries can also benefit from low-cost loans from this fund. The loan will be provided for water conservation and management, waste management, renewable energy and energy efficiency & resources efficiency and recycling. Table 4 illustrates the major green banking activities in the time span of three months in 2016.

Table 4. Major Green Banking Activities at a Glance in July-September, 2016

Issue	Bank	FI
Number of banks/FIs having Green banking unit	56	32
Number of environmental risk rated projects	18,981	658
Number of environmental risk rated projects and financed	16,653	678
Amount disbursed against rated projects (in million Taka)	435,416.21	25,274.60
Online branches (as % of total branches)	69.54%	N/A
Amount disbursed as green finance (in million Taka)	109,231.80	3,086.20
Direct green finance as % of total funded loan disbursement	0.40%	1.37%
Amount utilized from climate risk fund (in million Taka)	255.60	0.50
Amount utilized for green marketing, training and development(in million Taka)	8.08	0.82

Source: Bangladesh Bank (2016).

9. Recommendations

- An effective and efficient green financing policy should be initialized. Higher interest rate against bank loan is a major impediment to set up green industry in Bangladesh which is highest 9% at present (conventional bank rate is 5% at present +highest 4%). To foster the growth of green factories, reduction of interest rate against bank loan is needed urgently.

- The cost price regarding the implementation of green initiatives is expensive in Bangladesh. The government could potentially initiate duty-free import of diverse machinery and equipment for setting up export-oriented green factories which can facilitate medium and small industries effectively. Tax abatement facilities could also be provided to entrepreneurs of the green industry.
- If the government provides lands and utility services through economic zones or eco-friendly industrial zone, it would help to increase the number of green factories across the country and facilitate an eco-industrial park.
- Development of central effluent treatment plants in special economic zones should be developed in factories to a larger extent considering the environmental safety.
- Government and financial sector should provide incentive and rigidity of rules and regulations for the implementation and development of green initiatives in Bangladesh.
- A unified standard for green industry needs to be formulated in a policy based structure so that the industry flourishes nationally through national guidelines.

10. Conclusion

This paper discussed the benefits of a green industry in a worldwide context before focusing on a Bangladeshi perspective. The consensus is that the Bangladeshi green industry framework is adopted from principles of green building due to the incentives that are in place by Bangladesh Bank. The green building principles that are widely accepted in this region are mainly the LEED certification by USGBC, and the factors that grant this certification mainly dictate the terms of the current green industry. It should be noted that these incentives are not enough to cause a fruitful green industrial development as the sector of this growth is very small. The major export industries in Bangladesh face major challenges of environmental sustainability because of water depletion, resource inefficient production processes, unavailability of natural gas, lack of waste management.

However, the small changes that are already in place towards greening the industry is on the assumption that this pollution incentive business model cannot continue for a long time. Green industry increases material and energy efficiency as well reduces waste outputs and pollution. At the same time, it improves energy and water efficiency systems and develops a recycling process to reduce pollution of air, land and water. It also reduces the carbon emissions, uses renewable energy in the production process and ensures that the final products are environmentally friendly. This increases the productivity of workers by providing a healthy place for the workers.

This study reflects on the need for a unified code for national requirements for a green industry. Further studies could include sector specific achievements for a green industry in Bangladesh with projections for this implementation. This should be seen as an opportunity rather than a gruelling challenge as green industry has benefits of the tripartite aspects of sustainability, and at the same time, it enhances a good image of a factory or a company.

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