

RECONCILING INDUSTRIALIZATION AND ENVIRONMENTAL  
PROTECTION FOR SUSTAINABLE DEVELOPMENT IN  
BANGLADESH: THE TEXTILE AND APPAREL INDUSTRY CASE

A Thesis

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by

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## ABSTRACT

The textile and apparel industry in Bangladesh has been the biggest engine for economic growth for the last three decades. Thanks to the growing contribution of the textile and apparel industry, the country has consistently achieved high economic growth, alleviated poverty, and increased per capita income. Because of the comparative advantage of a large pool of cheap labor, easy access to power, and a high potential of creating employment opportunities, the textile and apparel industry received significant importance in the country. In fact, for these reasons, the textile and apparel industry has turned out to be the most prolific and thriving sector for Bangladesh. The recent graduation of Bangladesh from a developing to a lower- middle-income country is largely attributable to the booming textile and apparel industry. Its proven potentials have motivated an increasing number of private sector entrepreneurs to establish more and more textile and apparel factories. Consequently, the country has witnessed an exponential growth of textile firms and enterprises across the country albeit with a huge concentration in the country's capital Dhaka and its adjacent areas.

The pursuit of speedy economic growth has resulted in a large-scale and rapid rise of textile firms and enterprises. However, this growth and expansion have taken place without sufficient attention to the negative social and environmental externalities associated with the industry. A growing number of textile enterprises and their clustering in a few districts in the country are taking a heavy toll on human health, ecosystems, and the overall environment. Untreated wastes such as dyeing materials, liquid effluents, wastewater containing chemicals, and harmful gases released by textile factories are causing irreparable damage to the natural environment and public health. These pollutants are directly contaminating soil, air, and water at an alarming rate in the different regions

of Bangladesh. This puts agri-food systems, human health, and overall environment of the country at risk. As a result, the most productive and profitable industry has turned out to be one of the most polluting industries in the country because of poor spatial distribution and unsustainable operation.

Therefore, it is of paramount importance to address the intensifying threat of environmental degradation in a comprehensive and effective manner that balances sustained textile and apparel industrial growth with reduced human health and natural environment adverse impacts. This capstone project paper will explore the major drivers of poorly planned textile and apparel industry in Bangladesh and their adverse impacts on human health and the environment. The paper will then recommend some short, medium, and long-term solutions that can improve the environmental performance of Bangladesh's textile and apparel industry if adopted timely and efficiently.

## BIOGRAPHICAL SKETCH

Shahadat Hussein worked as an Assistant Project Director at the Planning Commission of Bangladesh before he entered Cornell University's Graduate School in fall, 2019. He graduated from the University of Dhaka with a Bachelor of Arts in English Language and Literature in 2014. After graduation, he taught at a university for one and a half years as a lecturer. In 2016, he joined Bangladesh Civil Service (BCS) after successfully passing the country's most competitive civil service recruitment test and was posted at the Ministry of Planning of Bangladesh. In 2019, he was awarded the 'Prime Minister Fellowship', the most prestigious fellowship from the government of Bangladesh to study abroad. He is currently finishing his Master of Professional Studies (MPS) at Cornell University in Global Development with a major in Development and Environment Policy. After completion of the program, he plans to resume his civil service duties with the planning Commission of Bangladesh.

*To my Parents*

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## LIST OF ABBREVIATIONS

ACC	Anti-Corruption Commission
AQI	Air Quality Index
BER	Bangladesh Economic Review
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BBS	Bangladesh Bureau of Statistics
BI	Business Insider
BOD	Biological Oxygen Demand
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
DIFE	Department of Inspection for Factories and Establishments
DO	Dissolved Oxygen
DoE	Department of Environment
EIA	Environment Impact Assessment
ENRAC	Environment and Resource Analysis Center
ETP	Effluent Treatment Plant
GOB	Government of Bangladesh
GED	General Economic Division
ILO	International Labor Organization
IP	Industrial Policy
IUCN	International Union for Conservation of Nature
IWM	Institute of Water Modelling

MoI	Ministry of Industries
MoE	Ministry of Environment
PC	Planning Commission
NRDC	National Research Defense Corporation
PaCT	Partnership for Cleaner Textile
RMG	Readymade Garments
T&A	Textile and Apparel
TDS	Total Dissolved Solids
TIB	Transparency International Bangladesh
TSS	Total suspended solids
VOC	Volatile Organic Components
WHO	World Health Organization
WTO	World Trade Organization

# **1. Introduction**

## **1.1 Background**

The development journey of Bangladesh has been quite rocky since its birth in 1971. Even after a few years of independence, the country remained a so-called ‘basket case’ wracked by extreme poverty, illiteracy, population explosion, unemployment and a number of other socioeconomic problems. Bangladesh had a very long and rich history of textile products. Although the history of textile production dates back to the British era thanks to the famous ‘Muslin’, it turned into a moribund industry during the Pakistan period because of the poor maintenance of plants and lack of institutional support. Since the mid-1970s the country policies targeted rapid economic growth and the eradication of extreme poverty and unemployment through large-scale industrialization across the country. The industrial policy in 1973 was the first one that attempted to revamp the industrial sector. This led to the shift of greater development focus from agriculture to industrialization, and textile and apparel industry emerged as a promising sector.

In 1979, when ‘Desh Garment’ was first established, the government initially did not recognize the potential and, as a result, the support was inadequate to help the industry to flourish. However, in 1982 the government started providing incentives in the form of duty-free machinery import, loan, and bonded warehouse services to revive the dying textile industry (Quddus & Rashid, 2000; Siddiqi, 2005). By 1990, the textile and apparel (T&A) industry appeared as the most productive industry in Bangladesh. While in 1982, there were only 47 textile factories, the number reached 2900 in 1999 and became the sixth-largest supplier of textile goods to the US market (Banglapedia, 2015). The T&A industry is not only the major driving force of the economy now but also the

largest exporter and foreign exchange earner for Bangladesh. Figure 1.1 illustrates the growing contribution of the textile industry to the economy of Bangladesh between 1995 and 2011.

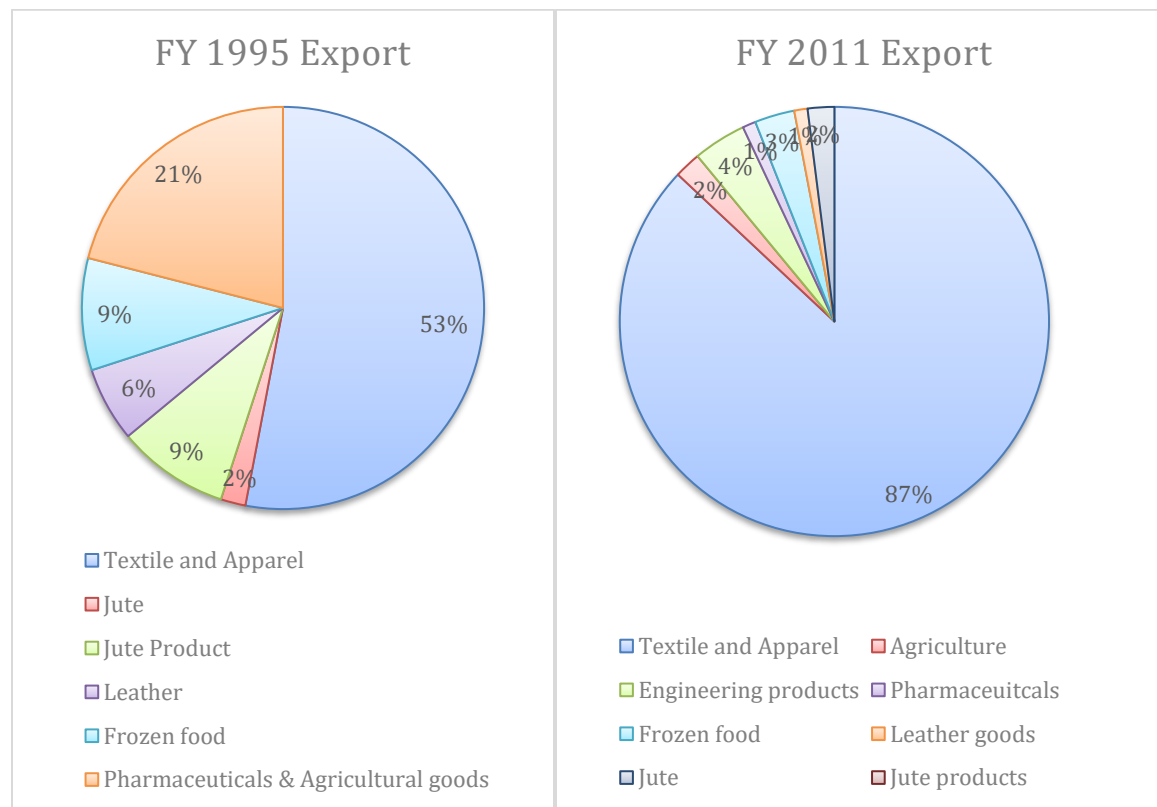


Figure 1.1 Textile and apparel sector contribution (Source: Export Promotion Bureau in the World Bank, 2014)

As it is evident in Figure 1.1, the role of T&A in the economic development of Bangladesh is both consistent and profound. From the very beginning of the industrial phase of Bangladesh, T&A industry has been the prime driver of economic growth for the country. While in 1995, T&A industry constituted 53% of the total export earning, it became a staggering 87% in 2011 and surprisingly this trend is still increasing.

For the last 25 years, this sector has been consistently contributing and shares approximately 80% of the total national exports. The current export output from this sector is US\$29.21 billion from more than 7000 factories, and by 2020 the export volume is expected to reach US\$36 to US\$40 billion (DATABD.CO, 2019). Globally, Bangladesh holds more than 6.4% share of total T&A exports and occupies the second place after China. Cheap labor especially women who were previously jobless, low prices of gas and electricity, better technical skills, and favorable government policies have resulted in the meteoric rise of this sector within a few decades spanning from 1990 to 2015.

However, in many cities including the epicenter Dhaka, urban expansion and rapid industrialization have occurred without appropriate planning (Begum et al. 2011). The government of Bangladesh formulated more than ten industrial policies. The first policy was initiated in 1973. Afterward, there were more than ten policies to guide the country's industrializations. These policies were predominantly focused on restructuring and reviving the sector but paid little attention to environmental sustainability and protection. All these policies and institutional guidelines created a strong manufacturing base for the economy, but the health and environmental issues were ignored. In addition, most of the policies proved to be short-sighted and more focused on immediate economic growth rather than long-term environmental impacts. There was insufficient integration of environmental protection into the country's industrial policies especially the T&A industry. Lack of proper plans and visionary policies for incorporating environmental protection in the establishment and expansion of textile and apparel enterprises has led to severe environmental degradation and risks to public health.



Consequently, flawed policies, the concentration of industries in big urban centers enabled by reliable and cheap energy supply, and lack of enforcement of environmental laws and regulations have led to the unbalanced and lopsided distribution of industries in Bangladesh. This trend is more acute and visible for the T&A industry. A staggering 75% of approximately 7000 textile and apparel factories are concentrated in Dhaka and in adjacent cities (Rana, 2016). The textile and apparel factories have witnessed a sharp increase in Dhaka, Gazipur, Narayanganj, and Chattogram. Unfortunately, this trend is rising alarmingly. As a result, the negative impacts of the textile and apparel industrialization are taking a heavy toll on human health and the environment of highly populated urban centers in particular.

In the most concentrated areas of textile mills and factories like Dhaka, Tongi, Gazipur, and Chattogram, there is an alarming rate of water, air, and soil pollution. For example, industrial pollution accounts for 60% of pollution and the textile industry is the second most polluting industry next to the tannery industry in Bangladesh (NRDC, 2012). There are 719 washing, finishing, and dyeing factories in Dhaka and adjacent areas which generate more than 200 tons of wastewater that seriously threatens the lives of 18 million residents (The World Bank, 2007; PaCT, 2016). The three nearby rivers in Dhaka have already been declared biologically dead by the government due to the severe concentration of pollutants discharged by T&A factories and plants. The Chillai River of Gazipur is dying. Turag, Bangshi, Shitalakkhya, and Balu rivers are suffering from the acute absence of dissolved oxygen (Singh, 2019). The waters of these rivers have become completely unusable due to acute pollution stemming from industrial effluents. In addition, the capital Dhaka has the third most polluted air in the world, and the poorly planned and excessively clustered textiles and apparel factories are one of the major contributors to this problem (AQI

Index, 2019). Due to the detrimental impact it leaves on the environment, the government has categorized T&A as ‘Red industry’ under the Bangladesh Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997.

There has been plenty of research focusing on engineering issues like the production process, wastewater management, and need for installing of effluent treatment plants (ETP) in the T&A industry. Unfortunately, there is no research highlighting policy issues both from institutional and stakeholder perspectives, which would provide better guidance in integrating environmental issues into the T&A industrial process (Sakamoto et al. 2019). So, a timely revision of the current industrial policy must be made to optimize the socio-economic benefits from the T&A industry while conserving the natural environment.

## 1.2 Objectives of the study

Bangladesh has been achieving steady economic growth for the last two decades. The major route for economic growth is the expansion of large-scale textile and apparel (T&A) industry across the country albeit with a high concentration in the capital. While targeting a dynamic economic growth, environmental protection received inadequate attention since the earlier stage of industrial expansion in Bangladesh. As a result, the adverse effects of poorly planned industrialization have emerged as a growing concern for environment and human health. The main objective of this paper is to assess the correlation between the poorly planned textile industrial development and its impact on human health and the environment in Bangladesh. Consequently, the paper will:

- (i) Identify, analyze, and describe the current status and growth trajectory of the textile and apparel industry in Bangladesh
- (ii) Identify and map the adverse environmental and human health impacts caused by poorly planned textile and apparel industry and evaluate how environmental protection is ignored
- (iii) Identify and analyze policy and regulatory reform areas to improve environmental and human health performance of T&A industry development planning in Bangladesh; and
- (iv) Recommend Bangladesh context specific solutions to minimize and mitigate the escalating environmental degradation

### 1.3 Importance of the study

To date, there has been no careful examination of the nexus between T&A and its impact on the environment and health in Bangladesh. Hence, the findings of this paper will be highly significant for the government, policymakers, entrepreneurs, and manufacturers who are directly or indirectly involved with the textile and apparel industry in Bangladesh. As development and environmental issues are closely entwined, the findings of this paper will lend some groundbreaking insights for government and policymakers to devise a sustainable development pathway. In addition, the potential entrepreneurs who intend to establish textile and apparel factories in the future will gain useful guidelines that can help them plan their enterprises in an environmentally sustainable manner. Furthermore, public and private sectors can derive guidelines from the paper's findings as it primarily deals with a real-life problem and solutions that fit into Bangladesh's context. Also, findings from this project might be applied to a wider population in different parts of the world. In addition, if any knowledge or data gaps that remains unresolved or uncovered during this study, will encourage future research on the same topic. It is undeniable that the textile industry is the prime driver of economic development in Bangladesh, hence the purpose of the paper is not to discourage or villainize the T&A industry but rather provide some specific solutions for sustainable performance of the industry.

This paper is structured as follows: The next section will focus on reviewing literature on the drivers of the T&A pollution. It will then explore the social, economic, and political factors that led to the rise of large-scale textile and apparel enterprises, and its dynamic impact on economic growth. Next, the paper will discuss the hazardous impacts of the poorly planned textile and apparel industry on human health and the environment in Bangladesh. Finally, the paper will recommend several sustainable policy solutions to address the ongoing tension between

Bangladesh's textile and apparel industry and its detrimental impacts on the environment and human health.

## **2. Literature Review**

### **2.1 Textile and apparel industry in Bangladesh and its socio-economic impact**

For many countries, industrialization has been regarded as the overriding principle and prime strategy for rapid economic growth. Kaldor (1967) endorses industrialization as the prime engine of economic growth and believes that industrialization has the strong potential to transform a sluggish economy into a mature one. However, the pattern of comparative advantages determines the nature of industries for any particular country (Balassa, 1979). For example, a large pool of cheap labor was a comparative strength of Bangladesh in the late 1980s and, hence this spurred the country to promote the textile and apparel (T&A) industry which was its most suitable option. For the last two and half decades, the T&A industry has turned out to be the major source of foreign export earnings for Bangladesh, which consistently helps the country achieve a steady GDP growth rate. Looking from a broader perspective, the T&A serves two major roles in the Bangladesh economy. One, by bringing in direct foreign export earnings. Two, by creating employment opportunities across the country. According to the Bangladesh Economic Review (2019), more than 80% of the nation's total export comes from T&A sector. In 2018-19, the total earning was US\$27563 million which was about 83.90% of the total national export.

In terms of employment generation, T&A serves as the most promising and thriving sector. Having more than 7000 factories, the textile and apparel industry employs about five million people in Bangladesh and 80% of them are women (Bangladesh Economic Review, 2019). Women's

empowerment through education and employment opportunities has always been a big challenge for Bangladesh. Thanks to an ever-increasing number of textile and apparel factories and firms, employment opportunities for women and men have become increasingly accessible as one can start working in any textile and apparel factory after getting some basic training. As a result, a growing number of young people who were previously jobless are getting into mainstream economic activities.

Apart from this, the T&A alone constitutes approximately 17% of the total GDP of Bangladesh, which is the highest for any single industry's contribution to the national economy (MacLean & Olderman, 2014). This contribution is increasing every year. Bangladesh is now the second largest textile and apparel goods supplier in the world. Furthermore, it is the second-largest clothing supplier to the European Union (EU) and third largest to the USA. Between 2012-2018, Bangladeshi textile and apparel export grew by more than 60% (Research and Market.com, 2019). Thanks to the T&A sector's robust and consistent contribution, Bangladesh secures an annual growth rate of more than 7% for the last seven years (Macrotrends, 2020). Considering the dynamic growth of this sector, the country has set an ambitious export target of US\$ 50 billion for the 2020-2021 financial year (Ishaque, 2019).

## **2.2 Textile and apparel industry around the globe**

Over the last three decades or so several other countries around the world have attained similar success in the textile and apparel sector. China, Vietnam, Taiwan, Hongkong, Thailand, Indonesia, Sri Lanka, and India have emerged as strong players in the global textile and apparel industry. Among these, China, EU, Bangladesh, and Vietnam unshakably remain the world's largest four exporters with a total market share of 72.3% (Lu, 2019). The total contribution of the top ten

countries in textile and apparel goods was US\$820 billion in 2018 (WTO, 2019). Amidst this skyrocketing success, one very crucial issue that concerns all these major exporting countries is the growing adverse impacts that textile and apparel industry is exerting on the environment and human health in these countries.

Undeniably all industrial production inevitably causes pollution. The textile and apparel industry, which is reported to leverage significant adverse impacts upon the environment, is no exception (Visvanathan et al. 2000). There has been a plethora of literature on global environmental degradation caused by the textile and apparel industry across the world. The major textile goods producing countries like China, Vietnam, Indonesia, Thailand, Pakistan, and Sri Lanka are confronting severe but similar environmental hazards and risks caused by the T&A industry.

After the open-door policy in 1979, China's economy got a major impetus in the form of industrialization, and textile industry became one of the major catalysts of change. From 1990 to 2007, China's textile and apparel production increased six-fold from US\$7.21 billion to US\$48.68 billion within less than two decades (WTO, 2008). The textile and apparel industry was the major contributors to the soaring double-digit growth of China during the 2000s (You, Cheng, & Yan, 2009). However, with more than 50000 textile mills, China is facing severe environmental degradation mainly caused by the massive effluent discharges from these factories (Greer, Keane, & Lin, 2010). For example, the large-scale use of Dichlorodiphenyltrichloroethane commonly known as 'DDT', which is used in the textile production process has profoundly deteriorated the water quality in the Yangtze River and Taihu Lake in Jiangsu (Sheng, 2001). Also, a high level of concentration of nitrogen has been detected in the province's Kuihe River (Wu et al. 2007).

National Bureau of Statistics of China (2006) recognized that textile production has significantly affected the natural environment and ecosystems of several provinces.

The volume of polluted water, gas, and solid waste has doubled worldwide between 1997 and 2006. The textile production takes a heavy toll on air, water, and soil. For example, one-unit weight of goods requires 20-25-unit weights of baths to process, which indicates extensive use of water for textile production (Visvanathan et al. 2000). An average size textile mill uses more than 1.6 million liters of water per day in any country irrespective of location (Kant, 2012). In addition, noise and dust produced from spinning, which is a mixture of traces of organic and inorganic fiber cause severe health hazards for people inside and outside the textile and apparel factories (Kane, 2000).

The wastes and effluents from the T&A industry not only degrade groundwater quality but they are also one of the major factors behind the deterioration of surface waters and hence they are recognized as one of the most polluting of all industrial sectors (Odjegba & Bamboos, 2012). The World Bank (2019) estimates that globally 17% to 20% of industrial water pollution is caused by textile and apparel factories. About 72 harmful chemicals have been identified in the dyeing sector which is a part of the textile goods production and thirty of these chemicals cannot be removed from the water. Many of these stay in the air for a long time causing respiratory illnesses. Life under water is equally affected by the pollutants from T&A factories. The depletion of oxygen in water is the most severe effect caused by the textile and dyeing factories, which poses serious threats to aquatic ecosystem (Kant, 2012). Furthermore, similar degradation of freshwater ecosystems has been substantiated by the evidence from Indonesia, which is facing similar kind of crises.



In pursuit of rapid economic growth, Indonesia emphasized expanding textile and apparel plants in different locations in the country. Although this strategy yielded high economic benefits, it brought significant environmental and public health disasters to the country that are becoming more and more obvious in recent years. Since 1985, the textile industry has become the most polluting industry in Indonesia with a massive biological oxygen demand (BOD) load of 3270 kg/day (Sembiring, 1985). The dyes used for textile factories and their uncontrolled discharge to waterbodies are creating 'Chemical Fukushima' for Indonesia (Sweeny, 2015). The Citarum River in Indonesia is now deemed as one of the most polluted rivers in the world due to the wastes discharged from hundreds of textile factories situated on its shores. According to a Greenpeace report (2013), the untreated effluents discharged by the textile factories located at the upper Citarum River affect five million people and wildlife in the adjacent areas.

The effects on soil on a global scale induced by textile and apparel industry cannot be ignored. A 2017 report from the International Union for Conservation of Nature (IUCN) revealed that 35% of all microplastics directly come from textile industry, and more alarmingly about 85% of the wastes from textiles go into landfill each year (Johnsen, 2019). An Ellen MacArthur Foundation's study (2017) predicted that by 2050 the global carbon emission from the textile industry will reach 26% and microplastic could grow up to 22 million tons annually.

The untreated effluents can be extremely detrimental to aquatic as well as terrestrial life by adversely damaging their natural ecosystems. Microplastics stemming from polyester production in the textile factories constitute 31% of global plastic pollution in the ocean and 10% of global carbon emission (IUCN, 2019). In addition, the report states that the effluent systems in many countries including China, India, Thailand, and Bangladesh allow the toxic effluents and

wastewater to flow into the adjacent fields which ultimately clog the pores of the soil and diminish the productivity and overall health of the soil. The presence of accumulated toxic wastes, inorganic chemicals, fibers, acid, soaps, and heavy metals like copper, arsenic, lead, cobalt, mercury, nickel, and salt harden the surface and texture of the soil preventing the penetration of tree roots.

Textile effluents cause severe human illness globally. Around 40% of globally used colorants comprise organically bound choline known as ‘carcinogen’ and many of these elements evaporate into the air, which causes serious respiratory illness to people especially children (Malik et al. 2014).

India followed the same trajectory that Indonesia and China followed in terms of their textile and apparel industry. Driven by speedy economic growth, the country paid little attention to environmental protection at the early stage of T&A industry expansion. Being one of the top three textile goods producers, India has been facing an acute environmental crisis in some states such as Tamil Nadu, Uttar Pradesh, Haryana, Gujrat and Andhra Pradesh (Deshpande, 2020). In fact, textile industry has been categorized as the most polluting industry by the Ministry of Environment and Forest of India (Garg and Kaushik, 2007).

### 2.3 Effects of textile and apparel industry on environment and health in Bangladesh

Being the second-largest textile and apparel goods exporter, Bangladesh is confronting mounting environmental and health-related challenges. This environmental challenge is further exacerbated due to the clustering of most of the textile and apparel factories in handful of major and high-population density districts of the country. The Department of Inspection for Factories and Establishments (DIEF) (2019), reveals that about 3000 T&A factories are operating in Dhaka alone. Apart from Dhaka, Chattogram is the second most textile-industry-laden city. The rest of

the factories are mostly located in Gazipur and Narayanganj, which are also the neighboring cities of Dhaka. This heavy concentration of T&A factories in few districts is exacerbating severe air, water, and soil pollution in the urban areas, which ultimately leads to an accumulated negative impact on the environment.

In Bangladesh's textile industry, due to the inefficiency of the dyeing process, 2000000 tons of dyes are turned into effluent during the dyeing, printing, and finishing process (Mia et al. 2019). This massive amount of effluents either go into the water or mixes with the soil in nearby areas while a significant portion of it turns into dust and mixes with air. More than 200 rivers are directly or indirectly affected by untreated effluents from industries and most of these are T&A enterprises (Mathews, 2018). Wastewater from the T&A industry in 2016 was about 217 million m<sup>3</sup> in Bangladesh and it is estimated that this volume will grow to 349 million m<sup>3</sup> by 2021 if the factories continue using the same production process especially the dyeing method for fabric (DIFE, 2019). The nearest rivers, canals, and small waterbodies in Dhaka, Gazipur, and Savar are highly polluted with visible and invisible wastes and chemicals. The water in these areas is extremely contaminated by heavy metals like lead, copper, molybdenum, zinc, and, iron which pose serious health hazards to the people of these regions as the polluted water is used for irrigation as well as for daily household uses. A study done by the WHO has recognized Bangladesh as one of the countries with the highest level of antibiotic river pollution with 300 times more concentration of metronidazole than the normal limit (Singh, 2019).

Crops and vegetables collected from these areas show the presence of harmful chemicals used in dyeing in the textile factories (Islam et al. 2013). Absorption of heavy metals through foods has been shown to exert serious effects on health and productivity of people, which ultimately impacts

economic development in the long run. The incidence of illness among people living in Hazaribagh, Savar, Keranigonj, Tongi, Ashulia, and other areas where industries like textile and tannery are concentrated (Figure 2.1) is 16% higher than the other areas of Bangladesh (Nishat et al. 2001).

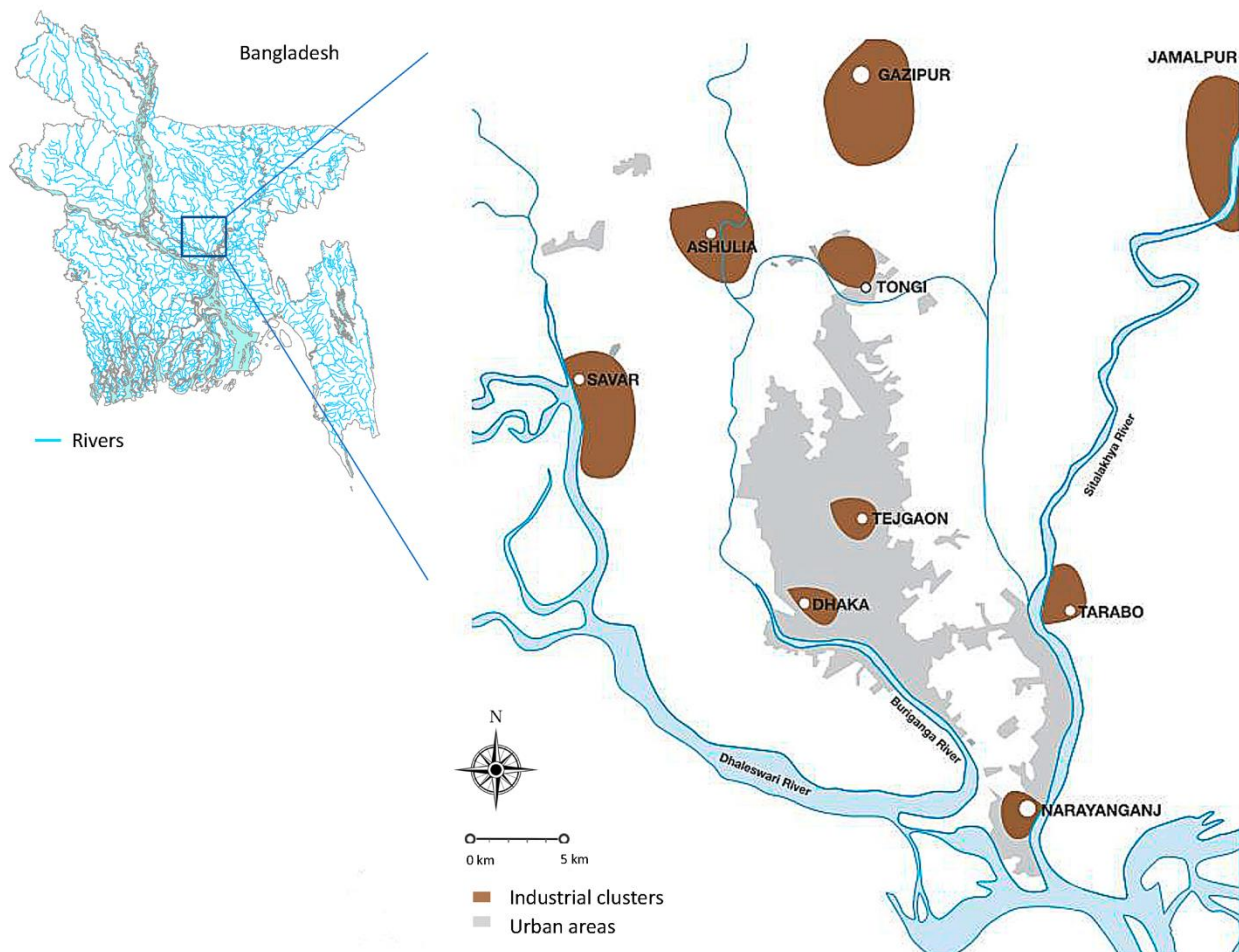


Figure 2.1 Textile industry-clustered areas in Dhaka and nearby cities. (Source: Bangladesh Delta Plan 2100 Formulation Project)

The contaminated water causes a number of diseases including dysentery, diarrhea, skin diseases, food poisoning, and other gastrointestinal problems. Living in the toxic air in the adjacent areas causes serious respiratory problems (General Economic Division, 2019). However, the accumulated impact of these health hazards cannot be limited to a certain area because the pollution can spread through vegetables and other food that grows in these areas and consumed by people living in other parts of the country. Therefore, it is almost impossible to measure the total impact of pollution.

Apart from the water pollution caused by T&A industry, air and soil pollution are also escalating at an alarming rate owing to the outdated and inefficient production process. Most of the T&A enterprises in Bangladesh, like China and India, are powered by coal which is the dirtiest kind of energy in terms of carbon emissions. During winter seasons, the weather becomes drier in Bangladesh and the PM<sub>2.5</sub> increases more than twice triggering asthma and other respiratory diseases (Gurley et al. 2013).

Although there are some partial fixes to mitigate and reduce T&A industry pollution, none of these is complete or comprehensive in nature. The Environmental Conservation Act of 1995 requires T&A firms and factories to install effluent treatment plants (ETPs) but in reality, very few of the textile and apparel factories do so (Sakamoto et al. 2019). There has been a great emphasis on decentralizing the industry outside residential areas over the last two decades on the part of the government and civil society, yet there is hardly any tangible change in this regard. Textile and apparel factories are still clustering in the residential urban areas albeit with some exceptions. This mainly happens due to the availability of power and connectivity with the main cities including the capital. Because of the limited support and facilities (e.g. water, gas, and power), other districts

get little attention for investment. Consequently, entrepreneurs prefer to establish factories in Dhaka or nearby cities for these obvious benefits. Apart from that, the enforcement of the current environmental laws and regulations is pretty lax with plenty of loopholes. The lack of political will, political corruption, and inadequate coordination among agencies are instrumental factors behind the clustering of T&A factories in Dhaka (Belal, Khan, & Cooper, 2015).

Unfortunately, the availability of data at firms, enterprise or factory level and from stakeholders is contained by a number of reasons. The Department of Environment (DoE) very often does not share the necessary and precise data they have, and stakeholders are reluctant to provide any data either due to bureaucratic complexity or personal interest (Sakamoto et al. 2019). As a result, devising solutions and formulating guidelines based on empirical data is really difficult and limited to a great extent.

In an exploratory approach, Haque (2017) collected 290 records regarding the penalties for water pollution from different newspapers in Bangladesh published from 2011 to 2016. About 255 of the samples were related to T&A industry, which showed that the cost of installing ETPs is higher than each fine given to the factory owner. So, it is economically beneficial for the owners not to install ETPs and simply pay fines when they occur. Besides, inadequate enforcement, outdated laws and regulations, little or no attention to environmental and health issues, lack of incentives for relocation of the factories, poor spatial distribution, and an absence of up-to date industrial policy have exacerbated the current state of environmental degradation in Dhaka and adjacent districts. Addressing this myriad of problems surrounding the unsustainable textile and apparel industry entails multi-scale efforts and approaches from a number of sectors, departments, and stakeholders from both public and private spheres. Given the rising tension between environment

and economic development, it is thus imperative to find a sustainable trajectory for T&A in a concerted manner.

### **3. Research Methods**

In light of the objectives stated above, this capstone project has been designed to examine and critically evaluate some major aspects relevant to the T&A industry in Bangladesh and its impacts on environment and human health in Bangladesh. It will be an exploratory study using qualitative and quantitative research approaches. The study will use secondary data collected from a number of sources such as relevant journal articles, books, relevant research works, studies conducted by development partners and donors, websites of different ministries of Bangladesh, published reports from Bangladesh Bureau of Statistics (BBS), Annual Economic Review, Annual Development Program, Seventh Five Year Plan, Bangladesh Bank, and reports published by Planning Commission of Bangladesh. Apart from these, reports published by international organizations like the World Bank, WTO, UNDP, UNEP, UNFCCC, and Green Peace will be used. To gain insight into the current status of T&A industry in Bangladesh and its relation to environmental degradation, national and international newspapers reports, and updates will be consulted. The collected data will then be analyzed, processed and tabulated to present the findings in a logical and objective manner. Broadly, the work has been divided into three major sections. (1) a trend analysis of industrialization with special focus on the textile and apparel industry, and its role on the economy of Bangladesh, (2) the impact analysis of poorly planned textile and apparel industry on environment and health, and (3) formulation of recommendations based on the findings to reconcile industrialization and environmental protection in Bangladesh. Furthermore, in a bid to devise pragmatic solutions to the ongoing crisis, experts from relevant sectors will be consulted.

## 4. Results and Discussion

### 4.1. Industrial policies with little or no emphasis on environmental protection:

To expedite economic development, reduce poverty, and create employment opportunities, the government of Bangladesh formulated its first industrial policy in 1973. Since then almost a dozen industrial policies have been promulgated. Unfortunately, most of the industrial policies except the last one was predominantly motivated by speedy economic growth with no or limited attention to environmental issues. Table 4.1 illustrates the major highlights of the past industrial policies of Bangladesh.

Industry Policies	Year	Key Focus	Environmental Focus
Industrial Investment Policy	1973	<ul style="list-style-type: none"><li>• Nationalization of medium and large-scale industries and attracting investment</li><li>• Private investment encouraged</li></ul>	<ul style="list-style-type: none"><li>• No special attention for environmental protection</li></ul>
New Industrial Investment Policy	1974	<ul style="list-style-type: none"><li>• Encouraging private sectors in manufacturing and mass-production system</li></ul>	<ul style="list-style-type: none"><li>• No specific clause or article for environmental protection</li></ul>
Revised Investment Policy	1975	<ul style="list-style-type: none"><li>• Private sector-led growth emphasized, and industrial</li></ul>	<ul style="list-style-type: none"><li>• No specific clause or article for</li></ul>



		enterprises were denationalized	environmental protection
New Industrial Policy (NIP)	1982	<ul style="list-style-type: none"> <li>• Industrial expansion and development stimulated through massive privatization</li> <li>• Creating conducive environment for investment was highlighted</li> <li>• Denationalization continued</li> </ul>	<ul style="list-style-type: none"> <li>• No specific clause or article for environmental protection</li> </ul>
Revised Industrial Policy	1986	<ul style="list-style-type: none"> <li>• Government divided the whole country into three regions for balanced development in terms of infrastructural status namely developed, less developed and least developed</li> <li>• Reducing regional development gap was emphasized</li> </ul>	<ul style="list-style-type: none"> <li>• No specific clause or article for environmental protection</li> </ul>
Industrial Policy	1991	<ul style="list-style-type: none"> <li>• Market-based competitive economic policy was incorporated in the</li> </ul>	<ul style="list-style-type: none"> <li>• No specific clause or article for</li> </ul>

		mainstream investment and industrial policy	environmental protection
Industrial Policy	1999	<ul style="list-style-type: none"> <li>• First industrial policy to have a clear goal and true vision</li> <li>• Major objective included the attainment of at least 25% of GDP in the decade and ensuring 20% of workforce in industrial activities</li> <li>• Struggling but profitable industries were rehabilitated</li> </ul>	<ul style="list-style-type: none"> <li>• No specific clause or article for environmental protection</li> </ul>
Industrial Policy (IP)	2005	<ul style="list-style-type: none"> <li>• The policy targeted 30-35% of GDP from manufacturing sector within the following decade and 30% of employed workforce in industries</li> <li>• SMEs got attention</li> </ul>	<ul style="list-style-type: none"> <li>• No specific clause or article for environmental protection</li> </ul>
Industrial Policy	2009	<ul style="list-style-type: none"> <li>• Government's commitment to support private sector-led industrialization strategy was reflected</li> <li>• Privatization became major driver of industrial expansion</li> </ul>	<ul style="list-style-type: none"> <li>• Some generic discussion about sustainable development</li> </ul>

Industrial Policy	2010	<ul style="list-style-type: none"> <li>• To reduce hunger by 50% through dynamic economic growth within 2017 was targeted</li> <li>• Medium and long-term programs were undertaken to lead vibrant industrial activities across the country and support private-sectors' growth</li> </ul>	<ul style="list-style-type: none"> <li>• Some generic discussion about sustainable development yet no special focus was given to environmental conservation</li> </ul>
Industrial Policy	2016	<ul style="list-style-type: none"> <li>• Creating employment through industrialization</li> <li>• Increasing industry sector contribution from 29 to 35%</li> <li>• Attainment of inclusive growth</li> </ul>	<ul style="list-style-type: none"> <li>• Environment-friendly industrialization was mentioned</li> <li>• Sustainable growth and development were emphasized</li> </ul>

Table 4.1 Industrial Policies of Bangladesh (Sources: Banna, 2014; Roy, 2018; The Ministry of Industries, 2016)

Table 4.1 illustrates that in general, the industrial policies were most growth-driven in a bid to eradicate poverty and expedite the expansion of industries. After analysis the industrial policies of Bangladesh, few major trends and characteristics become obvious, which include-fast economic growth, increased focus on privatization, increasing efficiency of production, attracting foreign

direct investment (FDI), building more export processing zone (EPZ), and making manufacturing sector as the prime engine of growth. While chasing these economic goals, environmental issues have been largely overlooked in most of the policies. In addition, there were no special policy and plan for the sustainable operation of T&A factories in spite of its being the most important industry in the country.

From Grossman and Krueger's (1991) analysis of Kuznets environmental curve (EKC) hypothesis, we know that at earlier stages of development, environmental degradation continues in developing countries due to intensive and extensive economic activities, until average per capita income reaches a certain level and environmental consciousness comes into the forefront. This hypothesis rings true to a considerable degree for a developing country like Bangladesh where the post-independence fragile economy motivated the government to adopt large-scale industrialization with little or no focus on the environment. As Schwarzer (2013) points out, traditional industrial policies predominantly emphasized credit concession, loan facilities, government interventions, privatizations, import licensing, etc. So, environmental conservation is generally neglected in traditional industrial policies in developing countries. In fact, the government engaged stimulation mechanisms to increase productivity and expand industries to maximize the return from labor and capital (Altenburg et al. 2017). Rapid industrialization started in Bangladesh in 1990 although the environmental awareness came to the forefront quite recently, specifically after 2005 due to a number of international conventions that Bangladesh ratified and the development of guiding principles for environmental protection (Sarkar, 2005). In fact, continued global and local environmental degradation and climate change patterns have raised concern, which stirred the government of Bangladesh to redefine and revisit the traditional industrial policy in 2016, although no explicitly stated clauses are mentioned for integrating environmental protection to industrial

expansion (Roy, 2016). The Industrial Policy of 2016 simply stated a ‘sustainable and inclusive industrial growth’, which is limited considering the spiraling environmental degradation in the country (Bangladesh Economic Review, 2017). However, in contrast to the industrial policy of 2010, the industrial policy 2016 holds some promises for green growth and sustainability although it is inadequate and incomplete in terms of execution and implementation perspective. For example, it is quite challenging to work on vague and generic principle like ‘sustainability and eco-friendly’ because there are no specific clauses or sections that clearly dictates as to how and who will ensure environmental protection. So, the prospect of ensuring the green industry through this policy stands little chance due to lack of proper directions for adopting proper mechanism and building coordination among relevant departments (Roy, 2016).

#### 4.2. Poor spatial distribution of textile and apparel factories

Lack of visionary planning and policies affected the imbalanced spatial distribution of T&A in Bangladesh. Having no clear policies, guidelines, and binding rules regarding their establishment and operation, T&A factories and firms densely clustered in Dhaka city (capital) and its adjacent districts because of greater access and availability of water supply, labor, and energy (Figure 4.2). The facility of ‘one -stop-service’ which stands for providing all essential facilities for industries from one office is one of the instrumental factors behind the mushrooming of so many textile factories in Dhaka in a haphazard manner. A study by Stern Centre for Business and Human Rights (2016) shows that there are more than 7000 T&A factories in Bangladesh and more than 90% of these are located in Dhaka, Narayanganj, Gazipur, and Chattogram (former Chittagong).

Although there has been a shift of T&A factories from Dhaka to surrounding cities and districts, Dhaka still remains heavily overburdened by the number of T&A factories. Another study by Khan

# Bangladesh

Textile and Apparel Industry Location

**Legend**

- International Boundary
- District Boundary
- Coast Line / River
- Number of Textile and Apparel Industries

District	Number of Textile and Apparel Industries
Panchagar	0
Thakurgaon	0
Nilphamari	0
Lalmonirhat	0
Kurigram	0
Dinajpur	0
Rangpur	1
Gaibandha	0
Jaipurhat	0
Naogaon	0
Bohagaj	1
Rajshahi	0
Nator	0
Sirajganj	0
Pabna	4
Kushtia	0
Meherpur	0
Chuadanga	0
Jhenaidah	0
Magura	2
Faridpur	0
Rajbari	4
Manikganj	4
Munshiganj	2
Shariatpur	0
Madaripur	0
Gopalganj	0
Barisal	0
Pirapur	0
Jhalakati	0
Bagerhat	0
Satkhira	0
Khulna	0
Jessore	0
Narail	0
Chandpur	1
Lakshmipur	0
Noakhali	2
Feni	3
Khagrachhari	0
Rangamati	0
Chittagong	668
Bandarban	0
Cox's Bazar	0
Bhola	0
Patuakhali	0
Borguna	0
Dhaka	729
Narayanganj	0
Gazipur	1294
Tangail	12
Myensingh	43
Netrokona	0
Sunamganj	0
Sylhet	0
Moulvibazar	0
Habiganj	0
Kishoreganj	0
Narsingdi	17
Brahmanbaria	0

(Source: Khan et al. 2016)

In addition, many of these factories in Dhaka are located within the residential areas which affect public health due to the air and sound pollution. Some of the factories continue operation till night. Furthermore, the number of workers in T&A factories has dramatically increased from one million workers in 1993 to four million workers presently, and more than 80% of them live in Dhaka and adjacent satellite cities like Savar, Tongi, and Ashulia (Anker & Khan, 2016). A World Bank (2005) report identified apparel industry as the main reason for migration of workers to Dhaka and nearby cities from other districts. Consequently, the high concentration of T&A in Dhaka city has created undue pressure on land, transport, environment which ultimately affects not only the employees of textile and apparel factories but also the people in general. For example, a study conducted by Ali et al. (2008) revealed that approximately 98.9% of T&A industry employees face transportation problems followed by 87.8% facing housing problems in Dhaka and in nearby satellite cities where textile factories have clustered. Overall, the hasty and uncontrolled clustering of T&A factories have led to adverse environmental consequences in the most alarming way (Alam, 2018; Sultan et al. 2013).

#### 4.3. Inadequate effluent treatment plants (ETP)

According to the Environmental Conservation Rules, (1997), industries are categorized into three main types based on the potential environmental risks and health hazards. The Green category industry is the safest, the Orange category is slightly harmful, and the Red ones are very risky for human health and environment. The T&A industry falls under the Red category, which is one of the three most polluting industries in Bangladesh. Considering the potential risks and hazards on humans and the environment, the Act and Environmental Rules (1997) made it mandatory to install

effluent treatment plants (ETP) for T&A factories to treat the wastes before they are discharged into a safe place.

However, the number of factories with ETPs is quite unsatisfactory. In fact, the number of estimated factories in Bangladesh with an ETP varies from 40% to 80% with small textile factories mostly having no ETPs (Haque, 2017). In addition, only 29% of wet processing units fully comply with all necessary regulations (Park, 2011). The Department of Environment (DoE) of Bangladesh claims that there are approximately 1350 ETPs in different T&A factories in Bangladesh against about 7000 small, medium, and large factories. In addition, against the rising volume of production, the efficiency of the already installed ETPs has not increased, and many of them do not function properly.

What makes ETP installation a must in T&A factories in Bangladesh is the inefficient production process and the subsequent massive load of wastewater and chemicals (Figure 4.3). The textile industry is the most energy-intensive, specifically the dyeing and finishing processes entail an extensive generation of hot water and steam (Rupp, 2008). In addition, the processing systems in Bangladeshi textile factories are shockingly inefficient. For example, it takes 50-70 lit/kg water in the dyeing and finishing process in other countries whereas Bangladeshi textile factories need 200-300 lit/kg water for the same purpose (Haque, 2017).





Figure 4.3 A typical textile wastewater discharge in Bangladesh. (Source: ENRAC, 2017)

This massive amount of water usage leads to a staggeringly high volume of wastewater that requires effluent treatment before it is released into nature. However, most of the untreated wastewater and other toxic chemicals are released indiscriminately by the factories causing profound damage to waterbodies and agricultural land. On average, 20% of freshwater pollution is caused by the textile and apparel industry sector due to the absence of ETPs in the particular districts where T&A factories have densely clustered (Fibre2Fashion.com, 2012).

#### 4.4. Poor enforcement of environmental laws and regulatory problems

Poor enforcement of laws and regulations is a perennial problem in Bangladesh. Although there is a good number of environmental laws and guidelines to safeguard water resources from industrial effluents, lack of strict enforcement brought hardly any tangible change in curbing pollution (Karn & Harada, 2001). A study by Browne et al. (2014) on enforcement and stringency demonstrates the institutional weakness of Bangladesh.

Table 4.4 shows that Bangladesh performs very poorly in enforcing environmental laws. Bangladesh stands at the second to last position before Vietnam whereas the other rival countries

like Malaysia, Thailand, Cambodia, and Indonesia have much better enforcement performances. A World Bank (2018) report attributes the environmental pollution caused by industries in Bangladesh to the poor policy framework and lack of an enforcement regime.

Country	Stringency Ranking (Out of 113 countries)	Enforcement Ranking (Out of 113 countries)
Japan	6	5
Malaysia	24	19
Republic of Korea	46	39
Philippines	47	46
Indonesia	55	51
Thailand	81	70
Cambodia	95	91
Bangladesh	97	98
Vietnam	101	87

Table 4.4 Stringency and Enforcement Ranking for selected countries, 2015 (Source: Browne et al. 2014)

Unwanted interference by political and influential individuals is also a stumbling block to strict enforcement. Reluctance of the factory owners is also responsible for lack of ETP installations in textile factories. In fact, more than half of the T&A firms or factories are reluctant to set up ETPs or adopt any green policy in their production systems owing to the high installation cost at the start up stage. Factory owners find adopting a green policy or ETPs unprofitable (Karp & Stevenson,

2012). But it is the duty of the Department of Environment (DoE) to strictly execute the environmental laws. However, the lack of regular monitoring, strong vigilance, and high punitive measures have paved the way for violations of the laws. In fact, irresponsible commercial practices persist due to weak and ineffective institutional and regulatory regimes (Belal, Cooper & Khan, 2015). In addition, environmental impact assessments (EIA) are not strictly performed, and very often the EIA system has many loopholes that are abused by opportunistic textile industry owners (Haque, 2017). A study supported by Transparency International of Bangladesh (TIB) and conducted by the Environment and Resource Analysis Center (ENRAC) (2017) on T&A owners and staff reveals that it is easy to bypass the environmental regulations because the fines imposed by the government are less than the cost of installing an ETP.

#### 4.5. Impacts on environment and natural ecosystems

There are approximately 200 environmental regulations and clauses for environmental protection and ecosystem conservation in Bangladesh including natural resources like water. (Khan, 2000). The National Environmental Policy (1992), National Environmental Action Plan (1992), Forest Policy (1994), Environmental Conservation ACT(1995), National Conservation Strategy (1997), Environmental Conservation Rules (1997), Bangladesh Environment Conservation (Amendment) Act (2000), and Environmental Court Amendment Act (2002) are major conservation and regulatory Acts in Bangladesh (Reazuddin & Hoque, 2002).

Revised and redefined from time to time, these acts and regulations were designed to curb environmental pollution and help sustainable development activities. However, poor enforcement standards carried out by the Ministry of Environment (MoE) and Department of Environment (DoE) have not met with optimum success. Thanks to enforcement inefficiency, bureaucratic and

political corruption, and lack of political will have led to the breach of these regulations routinely, which ultimately results in severe environmental pollution mostly in Dhaka and nearby cities where textile factories are excessively clustered (Mohammad, 2011; Bala & Roberts, 2010).

The People's Report on the Bangladesh Environment reveals that all three components of the environment namely air, water, and soil are facing severe degradation due to the poorly planned industrial expansion (Rahman & Chowdhury, 2001). Textile and apparel being the most prominent and most productive industry in the country is contributing to the mounting pollution. The dumping of untreated industrial effluents like wastewater and toxic chemicals in different parts of the country especially in the capital and its outskirts is responsible for the degradation of air, water, and soil quality (Bala & Yusuf, 2003; Quader, 2000; Bashar & Reazuddin, 1990). In Dhaka and adjacent districts where textile and apparel factories are densely clustered have witnessed an alarming environmental crisis in recent years due to poor management of industrial waste.

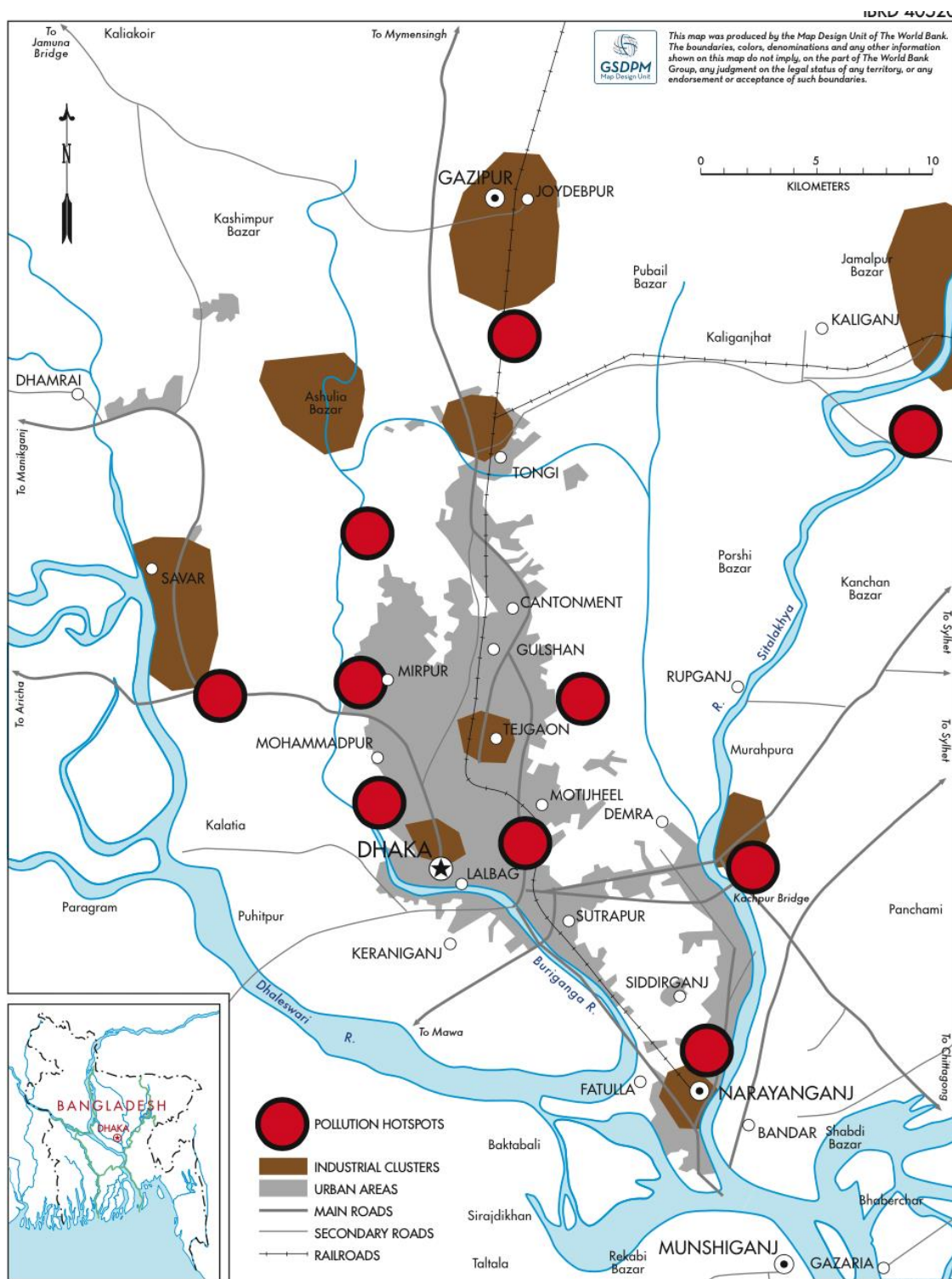
Toxic wastes from nearby textile and dyeing factories have destroyed the croplands in vast areas in Savar, Tongi, and Ashulia near the capital (Bhuiyan et al. 2011). A recent study conducted by Hoque, Mohiuddin and Su (2018) on the textile and apparel factories located in Dhaka and its outskirts reveal hazardous findings about the adverse environmental and socio-economic impacts on the environment and public health caused by the untreated effluents from these factories. Table 4.5. shows that surface water is extremely polluted by effluents released from T&A factories. This further leads to the depletion of aquatic species because the wastes create oxygen deficiency in water. The solid and liquid wastes almost equally affect the soil quality, which ultimately reduces productivity and gets into the food chain.

Environmental Factors	Risks Score (out of 5)
Effect of toxicity	2.6
BOD load	2.5
COD load	2.0
Salinity of water	1.2
Soil erosion and quality degradation	1.1
Depletion of aquatic life	2.6
Decreased fertility of agricultural land	2.1
Underground water pollution	1.2
Surface water pollution	3.1
Productivity of land	2.0
Livestock	1.3
Livelihood	1.7
Forest resources	1.0
Water resources	2.8
Quality of life standard	2.3
Grazing land	1.5
Greenhouse gas effects	1.5

Table 4.5 The impacts of inefficiently operated textile and apparel industry in Bangladesh (Source Hoque, Mohiuddin & Su, 2018):

The surface water is the main victim of growing volume of industrial wastes released from T&A factories located in Dhaka and its outskirt cities. The water bodies are heavily polluted with industrial effluents that result in the lack of sufficient oxygen in water that is the primary cause of gradual depletion of aquatic biodiversity (Alom, 2016). The Turag, Buriganga, and Balu rivers have already lost the minimum level of oxygen required for living creatures and thereby most of the fishes and other aquatic species have disappeared (Reza & Yousuf, 2016). The textile and dyeing effluents normally black and gray in color contain high total dissolved solids (TDS), BODs, acid, high levels of suspended solids, and excessive pHs that affect the natural ecosystems and biodiversity cycle. Most alarmingly, more than 90% of WDF (washing, dyeing, and finishing) units are located near water bodies like rivers and canals in Dhaka, and Narayanganj as these locations provides easier access to water and easy dumping and discharge facility (Sultana et al. 2013; ADSL Baseline Survey, 2009). Consequently, the rivers have become the hotspot of water pollution in Dhaka and nearby districts, and the condition becomes worse in the dry seasons due to the increased concentration of the pollutants (Haque, 2018). The following map (Figure 4.5) prepared by the World Bank (2014) amply illustrates the industrial clusters and consequent water pollution hotspots in the few districts where textile factories have clustered.

As it is evident from Figure 4.5, the industrial clusters are located near rivers in Gazipur, Narayanganj, and Dhaka. In addition, the boundary between industrial clusters and residential areas has almost disappeared. That means there is no separating demarcation between residential urban areas and industrial sites. To harness the easy water supplies, the textile and dyeing factories have been established in the close proximity to water bodies in Savar, Keraniganj, Ashulia, Dhamrai, Narayanganj, Tejgaon, Joydebpur, Kaliganj, and Konabari. This closeness has led to severe surface water pollution in the cited areas creating a huge water safety crisis.



Like surface water, the groundwater is also adversely affected by untreated wastes from heavily clustered textile and apparel factories in the Dhaka, Gazipur, Narayanganj, Munshiganj, and Chattogram. For example, due to the excessive extraction and consumption, the groundwater level in Dhaka has dropped to almost 61.2 meters below the surface level making it difficult for general people to collect water for drinking purposes (Roy, 2015). By the end of 2020, the groundwater level is estimated to be 90 meters below the surface level and the rate of decline is 3 meters per year (Hoque & Bala, 2004). This trend simply indicates the impact of extensive water use in the Dhaka district by industries especially textile and apparel.

In terms of the water quality and its standard, the industrial effluents have also posed extremely severe threats. A study by Islam et al. (2011) on the textile and dyeing factories in Dhaka, Narayanganj, Gazipur, and Chattogram shows that untreated effluents have degraded the water quality to such an extent that aquatic species are facing the extreme risk of extinction. The study reveals that the level of physiochemical concentration in water is much higher than the reference value set by DoE. A comparative illustration can make it easy to understand the gap between reference value and the existing value of different physiochemical elements in water.

Table 4.6 illustrates that most of the parameters have crossed the reference values set by DoE for the textile and dyeing factories in all the major districts of Bangladesh. The total suspended solids (TSS), turbidity, biological oxygen demand (BOD), and chemical oxygen demand (COD) level are dangerously higher than the reference values. Excessive pH is harmful to both soil and water. However, against the reference pH range of 6.5-9, all the districts mentioned in the table have



much higher level. In addition, textile factories use strong chemical agents like NaOH and H<sub>2</sub>O<sub>2</sub> to bleach raw materials that affect the water and soil quality.

Region/Districts	Temp	pH	TDS (mg/l)	COD (mg/l)	BOD (mg/l)	EC (us/cm)	Sources
Dhaka	37-65	8.7-10	460-5981	508	90-460	250-7950	Kamal et al. (2016) Mahfuz (2011) Begum & Ahmmed (2010)
Narayanganj	50	6.8-11	152-1011	268-1275	60-450	592-1696	Sultana et al. (2013) Islam et al. (2011)
Gazipur	34.7-48.8	8.9-10	531-1006	-	560-965	0.88-1701	Hannan et al. (2011) Sultana et al. (2013)
Chattogram	25-55	8.9-11	685-1338	487-1120	140-420	1108-1907	Sultana et al. (2013)
Reference: Value	50	6.5-9	2100	200	50	1200	DoE (2008)

Table 4.6 Physiochemical parameters of the effluent samples in different districts of Bangladesh

As many of these factories lack properly functioning ETPs, the wastes and effluents find their way to nearby canals, ponds, and rivers creating severe threats to aquatic life and biodiversity. During the dry seasons the rivers become overly polluted with industrial effluents from nearby textile factories, and the water crisis reaches at peak. The alarmingly degraded water quality in the Buriganga, Shitalakshya, and Turag rivers shows how polluted they are in the sites where textile and apparel factories are densely clustered (Restiani, 2016). As the Dhaka Water Supply Authority (WASA) largely relies on surface water treatment for its water supply, they are expected to obtain water from the Padma and the Meghna River to meet the demand, which will incur an investment cost of US\$430 million and US\$285 million respectively (IWM, 2007). By 2021, the amount of

wastewater discharged from the textile and dyeing industry is estimated to reach 349 million m<sup>3</sup> (Hossain, Sarker, & Khan, 2018).

A comparative study has found shocking indications about the future water pollution crisis in rivers of Dhaka and nearby districts. Figure 4.6 shows an alarming trend of water pollution by different sectors. The graph illustrates that the pollution of rivers caused by textile industry is much higher than that of the leather. As a comparison, the polluting effluents released from textile factories will spike at a dangerous level by 2030 if ‘business as usual’ continues and no preventive measures are implemented. No doubt, the low level of oxygen and high toxicity of the textile and dyeing wastes will leverage a devastating impact on all rivers in Dhaka, Narayangonj, and Gazipur.

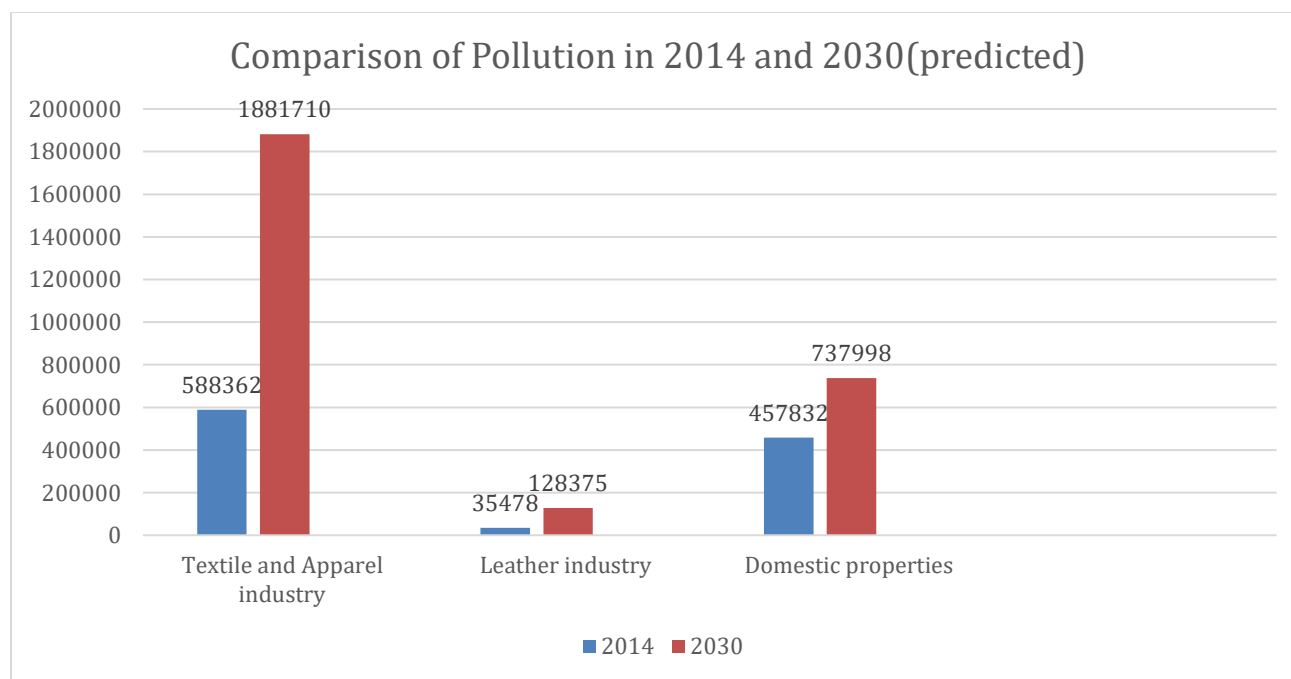


Figure 4.6 Pollution caused by different sectors (Source: Sagris & Abbott, 2015)

In addition, different social aspects including standard of living have degraded in the highly industrialized areas due to detrimental impacts of industrial wastes. As shown in Table 4.5, the textile effluents have negatively affected soil quality, leading to erosion of soil, and the rise of

of organic and inorganic particulate matters. This process of soil erosion and release of small particulate matters degrade air quality and poses threats for human health. Consequently, an increasing number of people are suffering from respiratory diseases in Dhaka.

From Table 4.7, one can see that the number of days with ‘very unhealthy’ and ‘extremely unhealthy’ air quality has been steadily increasing in Dhaka and nearby districts. A study by Mia et al. (2019) found that about 10% to 25% of the dye is lost in textile industry while processing, which is one of the major factors behind air pollution in the northern zone of Dhaka where textile, dyeing mills, and apparel factories are densely clustered. Gases like CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>2</sub> are major culprits for air pollution (Vallero, 2014). Sakamoto et al. (2019) show in their study that the chemical dyes used in the T&A factories stay for a long time in the environment thanks to their high thermal and photostability, which cause a number of respiratory and skin diseases.

<b>AQI Level</b>	<b>Category</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
00-50	Very Good	22	25	63	18	15
51-100	Good	86	101	94	113	74
101-151	Caution	62	66	68	89	76
151-200	Unhealthy	57	54	30	52	50
201-300	Very Unhealthy	22	53	53	44	80
301+	Extremely Unhealthy /Hazardous	86	66	46	49	67
>15	Number of days	165	173	129	145	197

Table 4.7 The rising problem of air pollution in Dhaka and nearby areas. (Number of days per year) (Source: CASE project, 2018)

The World Bank's (2006) report on 'Bangladesh Country Environmental Analysis' states that environmental pollution accounts for as much as 22% of the burden of disease mainly in the form of respiratory infections and diarrheal diseases. The report also added that reduced exposure to environmental degradation especially air and water pollution could result in economic savings equivalent to approximately 3.5% of the annual GDP.

Another recent report by the World Bank (2018) conducted on the impact of air pollution in urban areas of Bangladesh found that air pollution in Greater Dhaka (Dhaka and adjacent few districts) causes an approximately 0.50% loss in annual GDP, and in total, this makes up about 2.50% considering all urban areas of Bangladesh. The GDP loss occurs due to the rising medical costs as well as the potential labor losses owing to air pollution-related illnesses. For example, when workers cannot work due to illness, it means a significant productivity loss for a firm and its owner. Besides, both families and public agencies have to incur heavy losses. Non-mortality costs due to environmental degradation especially air pollution is about US\$370 million per year (Narain & Sall, 2016).

#### 4.6. Impacts on human health

Alongside environmental degradation, textile and apparel effluents have equally disastrous impacts on human health. From skin diseases to respiratory illnesses, the improperly operated and heavily clustered T&A factories cause a number of health hazards not only for the people working in the factories but also for people living nearby. A study by Hoque, Mohiuddin & Su (2018) reveals some groundbreaking findings about the consequences that T&A factories cause in Dhaka and other surrounding districts, where the factories are haphazardly established with no or poorly

functioning ETPs. Table 4.8 illustrates most common diseases caused by textile effluents and their risk scores.

Human Health Factors	Risk Score (out of 5)
Skin diseases	3.8
Respiratory illness	3.4
Brain and nervous system problems	2.5
Children's respiratory diseases	1.7
Diarrhea and stomach disorder	1.1
Water borne diseases	1.0
Bad odor and public nuisance	1.3
Poisonous gas effects	1.2
Toxicity impacts	2.1

Table 4.8 T&A industry health risks score (out of 5). (Source: Hoque, Mohiuddin, & Su, 2018)

As Table 4.8 indicates skin diseases are the most common and widespread illnesses in highly populated areas with high densities of textile factories. The study records that most of the respondents suffer from skin diseases that scores 3.6 (out of total 5) followed by respiratory illnesses with a 3.4 risk score. Another household survey revealed that the incidences of diseases including jaundice, diarrhea, and skin diseases are twice as high in villages and peri-urban areas, where the textile factories are heavily clustered (Ullah et al. 2006). Children in highly industrialized areas in Dhaka and Gazipur are more vulnerable to these diseases. Employees

directly involved in processing dyeing materials using alkali and bleaching agents suffer from both immediate and long-term health hazards including eye problems, skin diseases, respiratory disorders, and gastroenterological illnesses.

Environmental degradation and human health hazards are the direct and indirect effects caused by the highly concentrated T&A factories in Dhaka and surrounding districts. Because of the poor and haphazard setting of the factories, workers most often live in unhealthy conditions since already densely populated urban areas cannot comfortably accommodate more than four million T&A industry workers. A study by Khatun et al. (2013), found that due to inadequate access to water, sanitation facilities, health services, and accommodations, the textile employees living in the slums of Tongi, Gazipur, and Mirpur are more vulnerable to a number of diseases and illnesses like anemia, malnutrition, tuberculosis, jaundice, dysentery, and weight loss than those of living in less industrialized areas. The study also reveals that women are the worst sufferers. So, there is a robust correlation between the poorly planned, established, and operated T&A factories and their negative consequences on its workers' health as densely clustered textile factories draw an increasing number of workers in a comparatively small place, who are compelled to lead a miserable life. In fact, these overly clustered factories do harm in both ways- affecting the workers working in these factories and general people living in the areas by taxing social and health facilities as well as releasing massive load of wastes into a limited area.

A field survey conducted by Ali et al. (2008), reveals that about 36.7% of T&A industry workers suffer from some kind of poor health (Figure 4.7). According to this field survey, about 70% of employees suffer from headaches. Due to the acute shortage of pure drinking water in Tongi,

Mirpur, Tongi, Konabari, Ashulia, and Savar, Jaundice and Typhoid fever frequently break out. Unfortunately, the frequency of these diseases is increasing at an alarming rate.

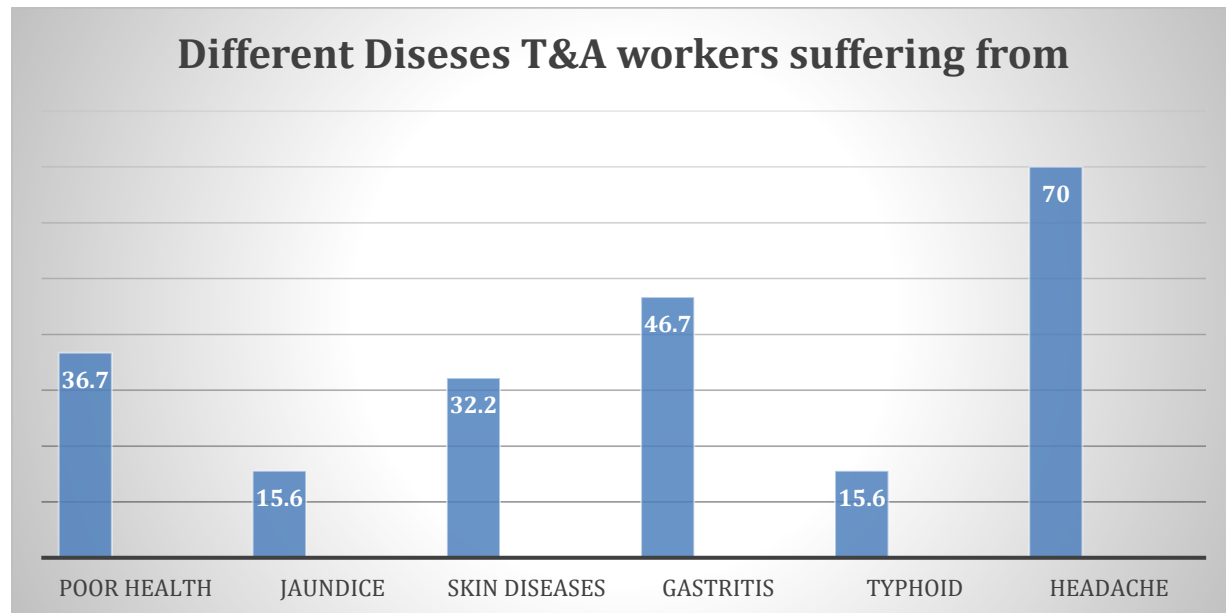


Figure 4.7 Field survey of diseases workers suffering from in the textile and apparel industry (Source: Ali et al. 2008)

Figure 4.8 shows an upward trend of diseases in the most populated and textile factory-intensive areas in Dhaka and adjacent districts (Halder & Islam, 2015). As an increasing number of people head towards Dhaka, Gazipur, Narayanganj and Chattogram for better livelihoods, the crisis for basic services like pure drinking water, good accommodation facilities, health care services, and overall healthy natural environment becomes worse day by day. Due to limited amenities and health care services, people easily fall victims to diseases and various health problems.

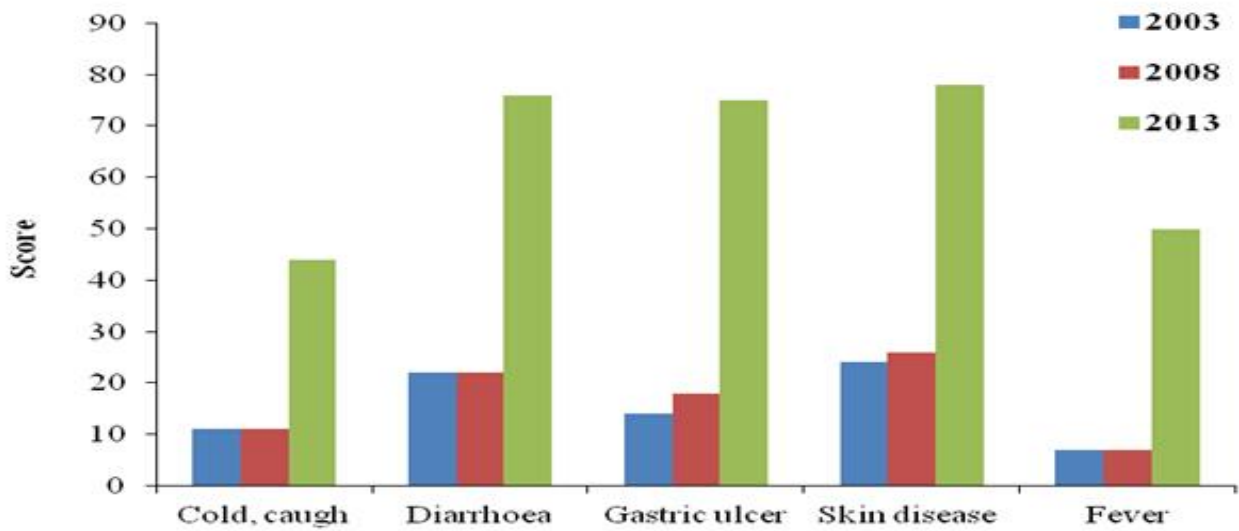


Figure 4.8. Rising trend of diseases (Source: Halder, & Islam, 2015)

Compared to 2003, the number of people facing different diseases has markedly increased as the environmental degradation exacerbated (Figure 4.8). As no noteworthy preventive measures were initiated to ameliorate the current environmental status, the situation steadily worsened over the years. Qualitative data suggests that there is a connection between poor health and degraded environment. Although Dhaka city has a very unhealthy environment due to uncontrolled industrial expansion in urban areas, conditions are even poorer in most densely areas where textile and garments factories are heavily clustered. The number of people suffering from respiratory diseases like asthma and cough is higher in Tongi, Mirpur, Narayanganj, Savar, and Konabari where clusters of textile and apparel factories dominate. Interviewing doctors and health workers in the relevant areas, Halder and Islam (2015), found that the rising trend of diseases occurs mostly due to the unsafe water and air pollution. Exposure to a high amount of sulphur dioxide, chlorine, copper, and lead in both air and drinking water is a major reason behind chronic skin diseases, asthma, diarrhea, eyesore, and long-term poor health. Another field survey conducted with textile workers in different regions of Dhaka has shown that due to the haphazard and dense setting of



T&A factories in Dhaka, Gazipur, and Narayanganj, workers are deprived of proper facilities, which include sufficient living space, clean air, potable water, sanitation, and space for privacy (Bhuiyan, 2012).

Paul and Majumder (2003) attribute the unhealthy physical setting and location of textile factories to the psychological stress and self-reported poor mental health of its workers. The sub-human conditions in the slums of Dhaka and Gazipur pose long-term health hazards and mental illnesses for its residents. A cross-sectional epidemiological study conducted by Steinisch et al. (2013), finds that the dense setting of the T&A factories within a limited space has both long and short-term negative health effects on its employees. Clustering so many factories within a small area thus leads to a myriad of problems associated with its employees' living standards and health. Unfortunately, once established, almost none of those factories are relocated to spacious areas that would relieve the pressure on the environment and its residents.

## 5. Recommendations

Given the overwhelming socio-economic cost of the poorly planned development and operation of the textile and apparel industry, it is both a necessity and opportunity for Bangladesh to adopt green growth policies that benefit both the industry and the environment in the long run. However, a paradigm shift in policy intervention and physical decentralization of the industry is not an easy task. It is quite an uphill endeavor to relocate, redefine, and transform the whole T&A industry into a green growth trajectory. This grand transition entails broad, strategic, and multi-stakeholder collaboration from the government, private sector, civil society, and the investors. To bring a holistic change from policy formulation to public awareness, a myriad of tools and strategies has to be applied. Based on the context, time, and application, some recommendations have been proposed, which have been categorized as ‘Specific’ and ‘General’. Overall, it is the government that has to act as a key player in the change-making process by leading from the front and making coordination among relevant stakeholders and departments.

### 5.1. Specific Recommendation:

There are some key areas and issues in T&A industry policy planning and operation, which have to be addressed within a set timeframe with specific plans and targets. Thereby, a set of specific recommendations with possible outcomes and timeline are provided in Table 5.1 for result-oriented execution and implementation. To make it more defined and focus-orientated, the recommendations and timeline are divided into three major categories- short, medium, and long. The Short-term goals will be achieved in fewer than two years. The medium-term goals may need two to five years, whereas long-term goals will require five to seven years to achieve. It is envisaged that these specific recommendations will be delivered as a part of a multi-stakeholder

platform approach, which will precipitate the achievement of the set target within the given timeline.

Recommendations	Responsible Sectors/Stakeholders	Timeline	Possible Outcomes
<ul style="list-style-type: none"> <li>• <b>Updating Industrial Policy:</b> The present industrial policy does not fully address the emerging challenges of environmental pollution related to the textile and apparel industry, which is the biggest industry of the country. Since T&amp;A is the biggest and most profitable sector for earning foreign currency, this sector needs to be operated in a sustainable fashion to reduce the stress on environment. In a bid to make this sector moving forward in a sustainable and environment-friendly way, the current industrial policy has to be redefined with clear action plans and visionary goals. The policy and guidelines should address relevant environment pollution related policy, regulatory gaps, and flaws so that no loophole is abused by the factory owners.</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment</li> <li>• Department of Environment</li> <li>• Ministry of Industries</li> <li>• Planning Commission</li> <li>• Leading Private sectors</li> </ul>	Medium and Long	A policy platform for protecting the environment will be recognized, which will reduce the environmental cost and make production processes more efficiently and environment friendly.
<ul style="list-style-type: none"> <li>• <b>Strict Enforcement of Existing Environmental Laws and Penalties:</b></li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment</li> </ul>	Short	Once fine and penalty for violating environmental laws and

<p>Environmental laws in Bangladesh are not rigidly enforced, which acts as an encouragement for breaching laws. The current penalty system does not provide an effective deterrence and it requires an overhaul. For example, the DoE applies ‘polluter pays principle’ mentioned in section 7 of the 1995 ECA (Amendment, 2010), which makes any polluter ‘to compensate’ an injury to the ecosystem. Despite this fact, the extent of pollution is drastically increasing. This indicates that the environmental laws are not strictly enforced. Apart from the lax enforcement, very low financial penalties are responsible. So, the strict enforcement and high financial penalties must be applied to bring a noteworthy change.</p>	<ul style="list-style-type: none"> <li>• Department of Environment</li> <li>• Judiciary</li> <li>• Environment Courts</li> <li>• Anti-corruption Commission</li> <li>• Special environment tribunal</li> </ul>		<p>regulations are strictly applied, factory owners and general public will be more alert and avoid potential punishment. This will ultimately help protect environment.</p>
<ul style="list-style-type: none"> <li>• <b>Making Research Data Available:</b></li> </ul> <p>One very critical problem with the industries and the relevant departments is insufficient amount of data and information. T &amp; A factory owners try to avoid keeping records by adopting illegal means. They are also very reluctant to share their production process and its</p>	<ul style="list-style-type: none"> <li>• Bangladesh Garment Manufacturers and Exporters Association (BGMEA)</li> <li>• Textile and Apparel factory owners</li> <li>• Department of Environment</li> </ul>	<p>Short, Medium, and Long</p>	<p>Making relevant information and data available will render the production and operation system transparent. Owners will avoid illegal and harmful means of the production process for fear of prosecution.</p>

associated information with government and individual researchers. This further creates stumbling block to assess the real impact the inefficient production system leverages on environment and human health.	<ul style="list-style-type: none"> <li>Ministry of environment</li> <li>Ministry of Industries</li> </ul>		
<ul style="list-style-type: none"> <li><b>Relocation of Textile and Apparel industries:</b></li> </ul> <p>A complete decentralization of the textile industries is a demand of time given the fact that more than 70% T&amp;A factories are clustered in Dhaka, Gazipur, Narayanganj, and Chattogram. Having such a large number of factories in a few districts is environmentally, socially, and economically detrimental. So, the government must introduce policies to make factory owners shift and relocate their industries to other district where the industrial density is lower. Government can provide some incentives like ‘one stop services’, ‘tax rebates’, and ‘tax holidays’ for the owners so that they get interested.</p>	<ul style="list-style-type: none"> <li>Private T&amp;A owners</li> <li>Government industries</li> <li>Ministry of Finance</li> <li>Ministry of Planning</li> <li>Ministry of Environment</li> <li>Department of Environment</li> <li>BGMEA</li> </ul>	Long	The stress on environment in highly clustered areas within Dhaka and nearby districts will be reduced. It will positively impact public health by reducing environmental pollution. This will also help balancing the distribution of economic benefits for people of other districts. For example, people of other less developed districts will get employment opportunities. In addition, social infrastructures will be developed which will increase connectivity among districts. A gradual decentralization of development will occur in the long run.
<ul style="list-style-type: none"> <li><b>Strengthening Monitoring and Evaluation:</b></li> </ul> <p>The monitoring and evaluation structure in Bangladesh are weak and inadequate due to insufficient</p>	<ul style="list-style-type: none"> <li>Department of Environment</li> <li>Environmental Courts</li> <li>Anti-corruption commission (ACC)</li> </ul>	Medium	Proper and timely monitoring will reduce number of violations, which will result in healthy industrial operation. It will also help update the

<p>number of workforce and corruption. Consequently, the environmental laws are not fully put into action and dishonest industry owners try to bypass the laws by adopting unfair means. To bring change in this aspect, the number of inspection officers has to be increased as well as their inspection has to be cross-checked so that the officers do not make illegal deals with factory owners. In addition, the environmental courts have to be made more active and their number should be increased for better outcomes.</p>	<ul style="list-style-type: none"> <li>• Ministry of Environment</li> <li>• Ministry of Industries</li> </ul>		<p>government database regarding different issues concerning factories.</p>
<ul style="list-style-type: none"> <li>• <b>Environmental Policy Integration:</b></li> </ul> <p>The environment is a cross-sectoral issue and thereby it entails multi-scale efforts from a number of sectors like fisheries, agriculture, water resources, industry, and the Ministry of Environment, Forest and Climate Change. The earlier industrial policies were mostly growth-centric, which put little attention to safeguard environment. Time has come to critically revise and redefine the industry policies from an environmental perspective. Mere one or two vague and unspecific clause in environmental or industrial</p>	<ul style="list-style-type: none"> <li>• Ministry of Environment</li> <li>• Planning Commission</li> <li>• Department of Environment</li> <li>• Ministry of Industries</li> </ul>	<p>Long</p>	<p>It will initiate a clear guideline and roadmap for setting up new industries. In addition, existing industries will be guided to retrofit the poorly and inefficiently functioning textile and apparel factories.</p>

<p>policies regarding sustainable industrialization is not enough. Rather a comprehensive, well-defined, and up to date policy with clear action plan must be formulated to protect environment and navigate industrial operation.</p>			
<ul style="list-style-type: none"> <li>• <b>Make Environmental Impact Assessment (EIA) Effective:</b></li> </ul> <p>In Bangladesh, it is required to have a feasibility study and environmental impact assessment if the project falls under ‘Red’ category. However, these prerequisite steps are not strictly followed. As a result, the number of ‘Red’ category projects is increasing. As the textile and apparel industry is highly polluting industry and it falls under Red category, the environment impact assessment step must be rigorously maintained before a clearance certificate is issued.</p>	<ul style="list-style-type: none"> <li>• Ministry of Environment</li> <li>• Planning Commission</li> <li>• Department of Environment</li> <li>• Ministry of Industries</li> <li>• Project director</li> <li>• Industry owner</li> </ul>	Medium	<p>Making environmental impact assessment (EIA) mandatory and effective will reduce the number of harmful industries. In addition, it will ensure safeguard policies for approved projects and industries on the part of the factory owners or project directors, which will benefit environment. Besides, clustering of industries in one particular region will stop.</p>
<ul style="list-style-type: none"> <li>• <b>Requiring Effluent Treatment Plants</b></li> </ul> <p>Each and every T&amp;A factory must install an effluent treatment plant (ETP) irrespective of location or physical conditions. Lack of ETPs and their inefficient functioning are the main</p>	<ul style="list-style-type: none"> <li>• Department of Environment</li> <li>• Local public administration</li> <li>• Mobile courts</li> <li>• Ministry of Environment</li> <li>• Ministry of Industry</li> </ul>	Short	<p>The detrimental impact of effluents on environment and human health will be reduced. Water, soil, and, air will be far better in quality, which will have positive impacts on public health and aquatic species. The</p>

drivers behind the massive load of untreated effluents that cause irreparable damage to environment and human health. So, there should be no alternative to an ETP for a factory. In addition, a third-party monitoring team should be introduced to randomly investigate whether the ETPs are properly functioning.	<ul style="list-style-type: none"> <li>• Local authorities</li> <li>• BGMEA</li> <li>• Water authorities</li> <li>• CETP operators</li> </ul>		social and economic costs due to environmental pollution will significantly decline.
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<ul style="list-style-type: none"> <li>• <b>Making ‘Green Fund’ disbursement transparent and effective:</b></li> </ul> <p>Although Bangladesh Bank and some other financial institutions have ‘Green Banking Units’ to encourage green energy use and operating system in factories, few of these institutions have the capacity to implement and monitor the performance of the industries that have benefitted from this facility. The monitoring capacity and performance evaluation have to be strengthened to ensure the best use of green fund. In addition, the ‘Green Financing’ should be made more available for small and medium-size T&amp;A factories so that installing ETPs and adopting energy- efficient technologies become affordable for them. Overall, dissemination, capacity building in disbursement, and investors’ awareness of the ‘green finance’ facility should be increased.</p>	<ul style="list-style-type: none"> <li>• Bangladesh Bank</li> <li>• Ministry of Finance</li> <li>• Planning Commission</li> <li>• BGMEA</li> <li>• Ministry of Commerce</li> <li>• Ministry of Industries</li> <li>• Private Banks</li> </ul>	Short and Medium	Industries will be motivated to use green energy and green technology (energy-efficient technology) as they can avail of the financial facility at a low interest. A ‘green awareness’ will positively impact the complete production system in factories, which would ultimately result in environmental and energy conservation.
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Table 5.1 Specific recommendations

## 5.2. General Recommendations

Apart from the specific recommendations, there are some supporting and indirect policies that need to be explored further to facilitate overall sustainable growth and management of the T&A industry. These strategies are mostly indirectly related to clean and environment-friendly operation of T&A and conservation of natural resources. If properly adopted, these strategies can help strike a healthy balance between industrial expansion and environmental protection in Bangladesh. The following supplementary strategies can be adopted to achieve the overall goal.

1. Rainwater harvesting to reduce stress on surface water: To reduce stress from the surface water, the textile and apparel sector must focus on harvesting rainwater. As stated earlier, T&A is the most water-intensive industry in Bangladesh. Currently, this industry uses a massive 4027 MLD water per day, which is estimated to increase to 6788 MLD by 2030 (Sagris & Abbott, 2015). Given the vast quantity of water needed for operation, the industry must find an alternative source of water to reduce surface water usage, and rainwater can be a very potent and environment-friendly source. In Bangladesh, the average rainfall per year is 2000 mm (Banglapedia, 2015). This large amount of rainwater can be harvested using inexpensive equipment and affordable tools. The government should make it mandatory to use rainwater for the T&A factories, which will help to conserve surface water resource.
2. Promote sustainable water management: Apart from rainwater harvesting, sustainable water management is equally important. By adopting recycling technique, water can be used repeatedly. Recycling and reuse strategies must be strongly emphasized in T&A industry as this can literally save million liters of water every day. In addition, optimizing water use is critical. It has already been mentioned that due to the inefficient systems, a typical Bangladeshi textile factory uses at least five times more water than that used in Vietnam, China, and

Cambodia. Efficient and smart technologies must be adopted to optimize water use in T&A factories.

3. Civil society engagement and public awareness: Civil society has been playing some commendable roles in raising awareness about the need for environmental protection. The Bangladesh Poribeshbadi Andolon (BAPA) and Bangladesh Environmental Lawyers Association (BELA) have been active in the environment sector. These association and other civil society groups must play dynamic role for public welfare in the coming days voicing concern for environmental protection.
4. Green certificates and financial incentives: On the basis of green energy use and sustainable production system, the Department of Environment and the Ministry of Environment, Forest and Climate Change must launch the ‘Green Certificate (Mark) Scheme’, which has already gained immense popularity in some developed countries like Singapore, Romania, Norway, and Belgium where governments strongly encourage green constructions and green energy adoption in both residential and commercial spheres through incentives and technical support (Building and Construction Authority, 2016). The ‘Green Certificate’ can be given if a factory complies with all environmental regulations. In addition, government should provide proper financial incentives to those factories to boost the progress and expansion of the system.
5. Research and development: Industries themselves acknowledge that there is a substantial gap in their capacity to train, experiment, and conduct research on innovative techniques to modernize and increase the efficiency of their production processes. This is very much pertinent to the textile and apparel industry as this gap prevents the efficiency and sustainable management of natural resources like power, water, soil, and gas. Despite being the country’s most important industry, there is no specialized research and development unit for T&A in

Bangladesh. Increasing technological efficiency through continuous research and innovations is the most warranted factor for the T&A industry in Bangladesh as this can significantly reduce the harm on the natural environment and human health. The Bangladesh Garment Manufacturers and Exporters Association (BGMEA) and its associate institutions should come forward to establish research center that will focus on up to-date research, modernization, and overall development of T&A industry.

6. The separation between monitoring and enforcement staff and environmental clearance staff:

To maximize the positive impact of environmental laws and enforcement, the monitoring and enforcement staff should be separated from environmental clearance staff. As corruption is rampant in the industry sector, and especially in the textile and apparel industry, this separation will enhance accountability, transparency, and efficiency (Asadullah & Chakravorty, 2019; Doing Business Report, 2017). It will also free the factory owners from undue bureaucratic harassment at the hands of corrupt officials.

7. Making Environment Courts more active: The new Environment Court was established in 2010 to speed up the trial of environmental offenses. However, these specialized courts have been failing to perform as per expectation due to a shortage in judges (Miah, 2015). So, it is imperative to increase the number of judges to make the courts more active and dynamic.

8. Strengthening institutional capacity: The institutional capacity of the Bangladesh government in implementing and enforcing environmental laws is low (World Bank, 2018). Not only is the number of officials in the Department of Environment, the Ministry of Environment, Forest and Climate Change, and the Ministry of Industries limited, but they also lack the required expertise and funds (Momtaz, 2002). For example, most of the officials do not know how to detect whether an effluent treatment plant efficiently functions or not. Many of them just

investigate if there is a plant in the factory disregarding whether it is working or not. So, specialized training must be imparted to the inspectors alongside increasing their number. In addition, the government must enhance logistical support for conducting smooth inspections.

9. Redefine the polluter pays principles: The current ‘polluter pays principle’ is defective and very light in terms of financial impact. The Department of Environment assesses the ‘polluter pays principle’ on the basis of a calculation of the cost for treatment per cubic meter of wastewater times the volume of wastewater released. This system has been found to be arbitrary in nature by different newspaper reports as it does not distinguish various levels of violations (World Bank, 2014). In addition, it does not clearly indicate the level of penalty for repeating the same offense as well as it is too low to deter polluting activities. These ambiguities must be resolved in very precise terms to evade future confusion. Besides, the penalty should be increased based on the degree of severity.
10. Political will and commitment: All the previous governments have failed to address the industrial management in a visionary way. Most often the political commitment was not strong. As a result, in spite of knowing the importance of finding a permanent solution they just put a temporary ‘bandage’ on the problem. For example, no government has wanted to relocate textile and tannery industries outside Dhaka due to pressure from industry owners and vested interests of political leaders. In addition, many business leaders from ruling governments manage their clearance certificates in illegal ways. So, the execution of the plans and policies will only bear fruits if there is strong political commitment and will on the part of the government. To make this happen, ‘political will’ must be anchored by ‘political leadership’ in Bangladesh (Quah, 2003).

## 6. Conclusion

The evolution and expansion of the T&A industry in Bangladesh suffers from poor planning and lack of vision. By chasing a fast and growth-driven development track, Bangladesh did not address potential environmental issues with due seriousness at the early stage. This was not just because it was obsessed with rapid growth but also because it could not afford to do so given the large population and the fragile economy it inherited from the British and Pakistan regimes. Thereby the social and economic circumstances strongly influenced the growth trajectory of the country. Being a developing country, Bangladesh had to strive hard to accelerate economic growth, eradicate poverty, and resolve unemployment while simultaneously attaining its development goals. Placed under such a predicament, the country exploited the textile and apparel industry, which proved surprisingly successful in its context within a short time due to the comparative advantages like cheap human resources and available power supplies. For more than thirty years, T&A has consistently been the most reliable and biggest export-earning source for the country contributing more than 87% to GDP. Thanks to the productivity and success, this sector is still flourishing albeit in a poorly planned and unsustainable fashion.

However, unidimensional focus on economic growth has led to many social and environment ramifications that have accumulated for many years. Spiraling environmental degradation is one of the most obvious problems that has posed one of the biggest challenges for the country in recent years. Alongside the tremendous role of T&A industry in attaining economic development, the environmental issues relevant to it have emerged as a major threat for natural ecosystems and the environment. As the epicenter of T&A industry, Dhaka has been identified as the third least livable city in the world due to severe environmental pollution. The production of textiles is one of the most polluting industrial activities in Bangladesh contaminating not just water unlike the tannery

industry but also air and soil. However, given the massive contribution from the T&A industry, the country cannot afford to cease its progress; it would not be a wise step as well. Rather, turning them into a sustainable and eco-friendly mode of operation is the most profitable solution that harms neither the industry nor the environment and public health. So now is the time to critically evaluate the whole system from top to bottom. In this regard, reformation of current policies, relocation of the highly clustered factories to other districts, and transformation of their mode of operation to adopt green energy are the key priorities to be addressed with a definite timeline and action plan.

Mainstreaming an environmental agenda across various issues and plans of government through a national development plan, climate change strategies, and framework for pollution control has already started in Bangladesh although the progress and implementation have been slow. The government must expediate the process through establishing a broad coalition of stakeholders. Some industries have already been moved outside the capital. Recently, the tannery industry has been relocated outside Dhaka city, which is a ray of hope for decentralization of other such industries like T&A. However, for textile and apparel industry, mere relocation is not enough rather a paradigm shift in their energy usage, effluent treatment, water use, and above all, their entire production process has to be fully addressed. Against such a backdrop, the government of Bangladesh must endeavor to achieve the dual goal of attaining economic development and simultaneously protecting the environment and jobs and health of T&A industry workers as well as the surrounding population. This conundrum of balancing economic prosperity and enterprise profitability on one hand with human health and welfare on the other is a worldwide challenge. To keep this vision in the forefront and apply in real life, the government of Bangladesh must engineer visionary and realistic plans to tackle not just the ongoing challenges but also the foreseeable

challenges in the coming decades. In fact, achieving the ‘Vision-2041’ (target of high-income country status) largely hinges on cleaner production process and resilient growth of the T&A industry by addressing environmental protection sustainably. It is strongly hoped that this capstone project will provide some guidance and insights for policymakers, stakeholders, relevant government departments, and the private sectors in Bangladesh to initiate a convergent effort to navigate the T&A industry in a greener, cleaner and safer way to join the worldwide quest for sustainable development and ensure green growth for itself in the coming decades.



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