UNIVERSITY OF LIVERPOOL

Exploring the role of Environmental Impact Assessment (EIA) system in delivering environmental sustainability within the textile industry of Bangladesh

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Philosophy

By

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I want to dedicate this thesis-

To our son, who had been the most important part of my PhD journey, who made me realize that I can break thousand times and still get up the next day. He made me stronger than ever.

To my husband, who made the maximum sacrifice for this degree of mine; he left everything behind, but never left my side.

To my parents, who are my mentors for life, who always pushed me towards the sky, making me believe that I can accomplish anything I want.

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And,

Want to express my love for the beautiful city of Liverpool, the birthplace of my son.

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Abstract

The textile industry is one of the fastest growing industries around the globe. It occupies a prominent position in the economy of Bangladesh through its significant share of workforce and establishments within the manufacturing sector of the country. Although, for a developing country like Bangladesh, such rapid industrial growth often comes at the price of environmental degradation. A comprehensive research on role of EIA in addressing the environmental sustainability for this key industry in Bangladesh is long due . This study aims in doing so by evaluating the system requirements of EIA for textile industry and its practice at pre and post decision stage. The author has performed extensive literature review on the subject matter for developing the framework of analysis for this research, document analysis on EISs from textile units of the country, face to face interview with the stakeholders and visited case study textile units to understand their post decision performance. The evaluation identified deficiencies within the EIA system requirements for textile industry in Bangladesh. The practice appeared even poorer. Therefore, the major recommendations by author include reforming existing legislation; strengthening administrative arrangements; incorporating sectoral considerations within key components of the EIA system (e.g., guideline on EIA methodology, contents of EIS, EIS review, implementation monitoring); promoting transparency, accountability and quality control by establishing legal status of the stages of EIA and public involvement, measurers promised in EIS and provision of accreditation for EIA consultants, This research can simultaneously contribute to academia, policy making and EIA practice. First, the framework of analysis can be adopted for other comprehensive sectoral EIA studies. Then, the EIS review package can be readily used by Department of Environment (DoE), Bangladesh to review EIA reports from textile industry. Information in this research can also prove helpful to the policy makers while enhancing and reforming the institutional requirements for the EIA system focussing on key sectors like textile. The researcher also understands that there is a scope to extend such study to the informal textile units of this country. However, limited data on that segment of textile industry in Bangladesh might make such research challenging.

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List of Abbreviation and Acronyms

3R-Reduce-Reuse-Recycle

ADB-Asian Development Bank

BAT-Best Available Technique

BBS-Bangladesh Bureau of Statistics

BDT-Bangladeshi Taka

BELA- Bangladesh Environmental Lawyers' Association

BEPI- Business Environmental Performance Initiative

BGMEA- Bangladesh Garment Manufacturers and Exporters Association

BKMEA- Bangladesh Knitwear Manufacturers and Exporters Association

BOD-Biological Oxygen Demand

BSCIC-Bangladesh Small and Cottage Industries Corporation

BUTEX-Bangladesh University of Textile Engineering

CETP-Central Effluent Treatment Plant

CO2- Carbon-di-oxide

CO-Carbon Monoxide

COD-Chemical Oxygen Demand

CS-Case Study

DEFRA-Department for Environment, Food and Rural Affairs

DoE-Department of Environment

DoT-Department of Textile

EA-Environmental Assessment

EAC-Environmental Assessment Committee (Bangladesh)

EAC-Expert Appraisal Committee (India)

ECA-Environmental Conservation Act

ECC-Environmental Clarence Certificate

ECR-Environmental Conservation Rules

EHS-Environment. Health and Safety

EIA-Environmental Impact Assessment

EIS-Environmental Impact Statement

EMAS- Eco-Management and Audit Scheme

EMP-Environmental Management Plan

EMS-Environmental Management System

EPA- Environmental Protection Agency

ESDD- Environmental and Social Due Diligence

ETP-Effluent Treatment Plant

EU-European Union

FD- Forest Department

FY-Financial Year

GHG-Green House Gas

GIZ-Deutsche Gesellschaft für Internationale Zusammenarbeit

HIA-Health Impact Assessment

HSRC- Hazardous Substance Research Center

IAIA-International Association for Impact Assessment

IA-Impact Assessment

IEE-Initial Environmental Examination

IFC-International Finance Corporation

ILO-International Labour Organization

ISO-International Organization for Standardization

IUCN-International Union of Conservation on Nature

MOEFCC-Ministry of Environment, Forest and Climate Change

MoI-Ministry of Industries

MRSL- Manufacturing Restricted Substances List

NEMA- National Environmental Management Authority

NGOs-Non-Governmental Organisations

NOx-Nitrogen Oxides

NPE- NP ethoxylates

OEC- The Observatory of Economic Complexity

OECD- Organisation for Economic Co-operation and Development

PaCT- Partnership for Cleaner textile

PIL-Public Interest Litigations

REA-Rapid Environmental Assessment

RMG-Ready-made Garment

RSL- Restricted List of Substances

SAC-Sustainable Apparel Coalition

SDC-Society of Dyers and Colourists

SEA-Strategic Environmental Assessment

SEHD-Society for Environment and Human Development

SGS-Standard Global Services

SIA-Social Impact Assessment

SME-Small and Medium Enterprise

SOx-Sulphur Di Oxides

ToR-Terms of Reference

TSS- Total Suspended Solids

UK-United Kingdomo

UNEP-United Nations Environment Program

UNIDO- United Nations Industrial Development Organization

USAID-United States Agency for International Development

USD-United States Dollar

USEPA-United States Environmental Protection Agency

US-United States

VIB-Voluntary and Information based

VOC-Volatile Organic Compounds

WDF-Washing-Dyeing-Finishing

WHO-World Health Organization

WITS- World Integrated Trade Solution

WTO-World Trade Organization

WWF- The World Wildlife Fund

ZDHC-Zero Discharge of Hazardous Chemicals

ZLD-Zero Liquid Discharge

Section A: Introduction

Chapter one: Introduction to the research

Chapter one provides preface to the research using six sections. The research problem has been identified in the first section, followed by the background in the second section. The third section presents the aims, objectives, and key research questions. A brief schematic of the research methodology is provided in the fourth section. This is followed by the organization of the thesis in the fifth section. Finally, challenges faced in undertaking this research are presented in the sixth section.

1.1 Problem Identification

Globally, textile and apparel industry has been identified as one of the fastest growing industries (Singh & Khajuria, 2018). In 2020, global market for textiles was estimated at USD 942.8 billion while employing more than 300 million people within its supply chain[1] (ReportLinker, 2020; Turnbull, et al., 2020). However, textile industry is infamously reputed for being the second most polluting industry (Ene, 2021). It imposes significant threats to the environment and human health (Karthik & Gopalakrishnan, 2014; Madhav, et al., 2018). Environmental pollution and impacts from industries are usually managed worldwide through various environmental policy instruments. These instruments are: regulatory instruments (e.g., performance standards, chemical and waste management regulations), market instruments (e.g., incentives, loan, subsidies), voluntary and information-based instruments (e.g., environmental management systems, environmental-health & safety guidelines) (see section 4.1 and 4.2 in chapter four for details). Environmental Impact Assessment (EIA) is one such environmental policy instrument. It has been used in more than 100 countries of the world for regulating textile and apparel industry (Resta & Dotti, 2015). EIA is widely appreciated by experts for its role as both regulatory and management instrument (Komínková, 2016; Sinha, 1998; Yang & Percival, 2009).

Textile and apparel industry of Bangladesh contributes to almost half (49.64%) of the total gross value added from the manufacturing sector within the country (BBS, 2012). However, textile is amidst one of the first few industries of Bangladesh receiving notice from Department of Environment (DoE) to improve their environmental practice as early as 1980s (SEHD, 1998). Being the most important industry in the economy of Bangladesh, environmental considerations for textile industry demand thorough and detailed examination to ensure

[1] See section 3.2.1 in chapter three for definition of supply chain

sustainability in the long run. For textile industry in Bangladesh, environmental regulatory mechanisms like environmental clearance certificate (ECC), compliance to effluent standards, monitoring of environmental performance are related to the existing EIA system. Prior completion of EIA and presenting ECC is even required for participation in voluntary environmental improvement projects with international organizations like IFC, GIZ, The World Bank, as well as for entering into business with international apparel brands (see section 5.3 in chapter five).

EIA exists as a legal requirement in Bangladesh since 1997 with the aim of pollution prevention from development activities, especially industrial units (DoE, 1997b). Therefore, it is the most relevant environmental policy instrument for textile industry in Bangladesh. Hence, this research intends to investigate the performance and gaps of EIA system of Bangladesh focussing primarily on textile industry and provide recommendations to enhance its potential in delivering environmental sustainability within this crucial sector. There is limited research on comprehensive sectoral evaluation of the EIA system around the world (see section 4.4.2 in chapter four). Therefore, the framework and findings of this research can provide insight to the global audience and researchers regarding the significance of such study and lead them to pursuing similar research.

1.2 Background of the research

1.2.1 Contribution of textile industry in the economy of Bangladesh

The World Economic Forum has identified Bangladesh as one of the top performers in Asia in terms of the annual economic growth (World Economic Forum , 2017). In fiscal year 2017, the economic growth appeared to be 7.3% (IMF, 2018). Fiscal year of 2016 was the first time when the growth stood above 7% mark in the country's history (Focuseconomics, 2019). Most of the growth Bangladesh experienced is attributable to readymade garment (RMG) exports (World Economic Forum , 2017). The contribution of this sector accounts for 80% of the country's export earnings (Masum & Inaba, 2015) .

Textile and RMG[2] industry constitutes about 40% of the total manufacturing establishments while employing around 71% of manufacturing industrial workforce of Bangladesh (BBS, 2012). Gross output of this industry is almost half (47%), while the total gross output from the manufacturing industries of the country is worth 5,394,902 million BDT (BBS, 2012).

[2] Alternatively known as "textile and apparel industry" or "textile and clothing" industry (see chapter five)

According to a study, one unit of dollar investment in the textile units i.e., RMG, dyeing and bleaching, handloom cloth, cloth milling and knitting, yields nine to 11 units of income in the economy (Raihan & Khondker, 2010). Therefore, textile industry is certainly one of the most important industries in the country's economy.

1.2.2 Environmental impact of textile units around the world

Despite all the economic advantages, it cannot be ignored that textile is one of the most polluting industries in the world (Choudhury, 2014; UNCTAD, 2019; Boström & Micheletti, 2016; Madhav, et al., 2018). Textile units can cause serious environmental impacts through emissions to water, air, disposal of toxic waste and consumption of resources like water, energy and harmful chemicals (Choudhury, 2014; Jena, et al., 2015; Resta, et al., 2016). Such pollution affects human health, aquatic life and biodiversity degrading standard environmental parameters (Karthik & Gopalakrishnan, 2014; Radhakrishnan, 2015; Babu, et al., 2007). Especially in developing countries with lack of stringent environmental rules (Maitra, 2011; UNEP, 2019; The World Bank, 2018; Šajn, 2019) and less access to resource, capacity or technology (Mayda, 1985; UNEP, 2019) this industry has been contributing towards major environmental problems (Details can be found in chapter three and five). According to Madhav, et al. (2018; p.01),

> "The textile industry is considered to be one of the biggest threats to the environment".

Global Fashion Agenda and the Boston Consulting Group estimated that global textile and apparel industry alone caused emission of 1715 million tons of Carbon dioxide and disposal of 92 million tons of waste in the year 2015. Kissinger, et al. (2013) identified textile industry as one of the largest producers of Green House gases (GHG). Burning of fossil fuel for energy causes emissions of GHG and particulate matters raising air quality index denoting pollution. Particulates are considered as major air pollutant for textile mills (SEHD, 1998). Emission of Nitrogen and Sulphur oxide from this industry can be responsible for acid rain and smog formation (Choudhury, 2014). Part of the pollutants released by textile units in the air can enter human body through breathing or absorption through skin (Yacout & Hassouna, 2016). Such pollutants can also be potentially carcinogenic (Yacout & Hassouna, 2016). On the other hand, the most hazardous segment of solid waste from textile unit is the sludge from on-site wastewater treatment and spent solutions of textile units (EPA, Ireland, 2008). If not treated properly before disposal, these can leach through ground contaminating soil and water sources (Yacout & Hassouna, 2016).

The stages[3] of textile and apparel manufacturing process consume significant amount of energy, water and chemicals and generates huge amount of waste as a result (Karthik & Gopalakrishnan, 2014; European Union, 2017; Parisi, et al., 2015). Quoting Yaseen & Scolz (2019, p. 119), "The wet process uses a considerable quantity of potable water and releases highly contaminated wastewater." Global production of clothing involves almost 25% of world's produced chemicals (Greenpeace International, 2011). Besides, it is alarming that "nearly 90% of the organic raw material load entering the textile process ends up in the wastewater, the remaining amount being released to air" (Ireland EPA, 2015, p. 10). Evidently the highly polluted wastewater from textile units is largely attributable to the chemicals used in wet processing. The stages of wet processing namely desizing, scouring, bleaching, washing (see section 3.2.1 in chapter three for definition) in textile units use chemicals those are attributable to alkaline wastewater, high BOD[4] and COD[5] level of about 2-5 times higher than BOD (Jena, et al., 2015; Ren, 2000; World Bank, 1998). Specially in dyeing and finishing units, the use of bleaching, washing and dyeing chemicals can be responsible for health issues like skin irritation, itching or blocking nose, sore eyes, sensitizing skin, damaging DNA and can sometimes be highly carcinogenic as well (Islam, 2013; Ahmed, et al., 2004; H&S Executive, 1996; Jena, et al., 2015).

Therefore, textile wastewater is recognized as the most polluting among all the industries due to the volume and composition of the effluent (Huantian & Ian, 2001; Vilaseca, et al., 2010; UNIDO, 2003). Consequently, among all the environmental issues attributable to textile units, effluent discharge is the most important concern (EPA, Ireland, 2008; Islam & Mostafa, 2019; Kumar & Saravanan, 2017). Environmental impacts relevant to stages of textile manufacturing process are discussed in detail in chapter three (section 3.3).

1.2.3 Textile industry in Bangladesh and environmental impacts

According to Planning Commission of Bangladesh (2015; p.07), "Industrial and urban growths are contributing to economic livelihoods but already are serious threats to environmental and human health because of inadequate attention to environment and sustainable development". The World Bank (2018; p.9), has expressed serious concerns that "such environmental degradation can lead into dramatic shift in exposure to environmental health risks of Bangladesh". Therefore,

[3] Production of raw material, spinning, weaving and wet processing of textile components

[4] BOD is Biological Oxygen demand, 'estimates the degree of contamination by measuring the oxygen required for oxidation of organic matter by aerobic micro-organisms (Show, 2008)

[5] COD is chemical oxygen demand, 'is defined as the amount of oxygen equivalents consumed in the chemical oxidation of organic matter by strong oxidant' (Hu & Grasso, 2005).

urbanization and industrial growth can significantly affect Bangladesh's prospects of economic progress by the environmental costs accrued (The World Bank, 2018).

During the 1990s, along with other polluting industries, textile units in Bangladesh were served notice by DoE to improve production process and install treatment facility for waste and effluent. Hardly complying to this notice, the number of polluting industries continued to grow (SEHD, 1998). Although Environmental Conservation Act (ECA) was in place since 1995, the particulars (e.g., acceptable limits of environmental parameters, process of getting ECC) were enforced through a new regulation in 1997. Environment Conservation Rules (ECR) was enforced in 1997, requiring approval of ECC for any new industrial establishments. For heavy polluting new industries, ECC can be acquired only after approval of EIA report (DoE, 1997b). Units like garment and sweater production, powerloom, fabric washing, fabric dyeing within the textile industry are designated as orange B and red category[6] units in the ECR'97 of Bangladesh (see section 6.1.2 in chapter six for more) (DoE, 1997b). Additionally, standard parameters for discharged wastewaters by large textile plant had also been prescribed under the same rule.

Quoting from The World Bank (2014; p.11), "Over 95 percent of Washing, Dyeing and Finishing units are concentrated near rivers, canals, and water bodies in Bangladesh's two major cities, Dhaka and Chittagong". Every day, the textile units dispose large volumes of untreated wastewater due to poor environmental standards and weak enforcement system of the country (World Bank, 2014; The 2030 Water Resources Group, 2015). Specially, these two major cities with the highest density of population and developments, makes the situation even more alarming. According to Asian Development Bank (ADB) (2010), textile industry was one of the highest contributors to the hazardous waste inventory of Bangladesh in terms of solid (113,720 ton/year) and liquid waste ($99.75X10^{3\ m^3}$) in year 2008.

Alongside the large amount of effluent, textile dyeing industries of Bangladesh also dispose untreated sludge and solid waste materials into nearby channel or surface water sources and agricultural fields everyday (Islam, et al., 2011; Islam, 2013). This ends up in the main rivers of the country degrading the water quality parameters and affecting humans, aquatic life and other animals using the water (Islam, et al., 2011; Islam, 2013). Therefore, health of the people of the surrounding area using this water for washing, bathing, irrigation, fish culture is severely threatened (Islam, et al., 2011). Islam et al. (2011)'s study, found alarming levels of water

[6] Indicating pollution potential of units

quality parameters from surrounding river of a dyeing unit. For the workers, the noise level inside the factory is mostly higher than the acceptable level for human adaptation (Islam, 2013), which can cause hearing damage. These adverse impacts often seem to affect vulnerable social groups, who have less access to health care facilities (Birley, 1995) and less knowledge to understand the effects. Incidents of pollution induced diseases like dermatological diseases and asthma are 15 and 19 times higher among the residents living within a kilo meter radius of heavy polluting industrial area, compared to the regular urban area residents of Bangladesh (Hossain, 2016).

1.2.4 Role of EIA as a policy instrument in the Global South

The World Wildlife Fund (WWF) (1999; p.3), suggests, "Resource and pollution intensive industries do have a locational preference for areas of low environmental standards". Textile industry is a resource and pollution intensive industry (European Union, 2017; Parisi, et al., 2015; Karthik & Gopalakrishnan, 2014) and developing countries are the production hub of renowned fashion brands (Boström & Micheletti, 2016). Prioritized economic development over environment and lack of stringency in environmental regulations have attracted foreign investments in developing countries, supporting the pollution haven hypothesis[7] (Maitra, 2011; Boström & Micheletti, 2016; Anguelov, 2017). Even after existence of environmental regulations, compliance is still a challenge in developing countries (Ostrovskaya & Leentvaar, 2011). While growth of textile industry brings in economic benefit, the drawbacks should be adequately addressed to protect the environment and people from the pollution induced by this industry.

As mentioned in section 1.1, impacts of environmental pollution from industries can be managed though diverse environmental policy instruments. These measures are not mutually exclusive and therefore can co-exist (OECD, 2001). EIA is recognized as one of the most widely practiced environmental policy instrument across more than 187 countries (UNEP, 2019). Textile and apparel industry is regulated by mandatory EIA requirement in more than 100 countries and development organizations (i.e., United Nations Environment Programme, World Bank) (Resta & Dotti, 2015). Other environmental policy instruments like pollution tax, green finance, ecolabelling, environmental management system (EMS), self-assessment indices are practiced within textile industry around the world (see section 4.2 in chapter four

[7] "The pollution haven hypothesis argues that firms will seek to avoid the cost of stringent environmental regulations (and high energy prices) by locating production in countries where environmental norms are laxer" (OECD, 2017). Studies exploring truth on pollution haven hypothesis can be found from Cai et al. (2018) and Anguelov (2017).

for definition and applicability). While EIA is a piece of puzzle in delivering sustainability, it has significant potential in contributing and drawing from these instruments in this pursuit (Lawrance, 1997) (see section 4.4.1 in chapter four for details).

EIA has been adopted as a mandatory regulatory instrument in majority of developing countries since mid-1990s (Wood, 2003; Glasson, et al., 2005). Experts suggest, absence of clear legislation or minimal penalty can result in general avoidance or abuse of legislation (Briffett, 1999). Dedicated EIA law or regulation exists in developing countries like China, Pakistan, Ghana, Kenya since early 2000 (Environmental Law Alliance Worldwide, 2015). In fact, Malaysia formulated dedicated EIA regulation as early as 1987 (Environmental Law Alliance Worldwide, 2015). In addition to legislation, strong control mechanism is required for effective implementation of EIA (Ortolano, et al., 1987; Ortolano, 1993; Ebisemiju, 1993; Hijri & Ortolano, 1991). Although separate environmental agency exists in almost every developing nation, they are often criticized for lacking administrative capacity impacting EIA implementation and follow-up (e.g. Iran, Pakistan, India) (Khosravi, et al., 2019a; Nadeem & Hamid, 2008; Paliwal & Srivastava, 2011). Public participation is established by regulation in countries of Indonesia, Vietnam, China, Philippine, Pakistan and India (Nadeem, et al., 2014; ILO, 2021). There are also provisions of public hearing and public display of EIA report in these countries. However, these developing nations are often criticized for not being able to implement public participation process in adequate manner (Nadeem, et al., 2014). On the other hand, research on quality of environmental impact statement (EIS)s in developing countries is still very limited. However, factors like inadequacy of baseline data, lack of consultants' independence, absence of legal provisions for quality control, inadequacy of best practice guidelines for EIS are deemed responsible for poor quality EISs in developing countries (Kabir & Momtaz, 2012; Nadeem & Hameed, 2008). Some of the developing countries have tailored specific EIA methodological guideline for large scale development projects (e.g., transport, irrigation, industry in Nepal) and key manufacturing sectors (e.g., petrochemical, waste treatment, thermal power in Malaysia) (Bhatt & Khanal, 2010; Yusoff & Hashim, 1996). However, sector specific guideline on EIA methodology rarely exists for an important industry like textile (see section 8.3.2 in chapter eight for details).

1.2.4 Relevance of EIA in textile industry of Bangladesh and way forward

The World Bank (2014) argues that the concern for industrial pollution has not been adequately addressed in Bangladesh yet, although legislative and regulatory environmental management framework might appear acceptable. Therefore, even after being the most important industry in the economy, Bangladesh does not have any dedicated environmental management policy or regulation for textile industry. The key policies frequently refer to ECR 1997 or EIA process for integrating environmental consideration within industrial units. For example: National Environmental policy 2013 of Bangladesh has emphasized on controlling pollution strictly in industries through the use of EIA, establishment of Effluent Treatment Plant (ETP), clean development mechanism and environmental auditing (GoB, 2013). ECR'97 incorporated designation of standards for textile effluents and established EIA as requirement for approval of heavy polluting units (which includes textile units). In the same year, a guideline for EIA process including contents of EIS (DoE, 1997a) and a sector-specific industrial guideline for textile industry was also published (DoE, 1997c).

Therefore, for polluting textile units in Bangladesh, regulatory requirement of ECC is fulfilled by completion of EIA and submitting its report to DoE for approval. DoE team visits the units for monitoring conformity to ECC condition and effluent parameters after the units start operation. Report from this visit influences decision on renewal of ECC. In addition to this, the only industrial guideline addressing environmental considerations within textile industry in Bangladesh is produced as a support document for the EIA practitioners, academicians, and industrialists (DoE, 1997c). Thus, the most appropriate environmental policy instrument relevant to textile industry in Bangladesh appears to be EIA. Being already in the system for more than 20 years, the research explores the role of EIA in effectively protecting the environment from the impacts of the textile sector. EIA has the potential to address and manage negative environmental impacts of the textile and clothing sector through supporting policy, plan and projects (Resta & Dotti, 2015) (see section 4.4. in chapter four).

However, following a generic methodology with the assumption that "all the businesses are facing a similar environmental problem" is rarely appropriate for EIA practice (Resta & Dotti, 2015, p. 151). Therefore, whether EIA system has been able to deliver sustainability to the challenges faced in this sector, need investigation. Hence, exploring the role of EIA system in addressing environmental sustainability in the context of the textile industry can provide intriguing insight.

1.2.5 Research gap, scope and aim of the study

The relevant previous studies in Bangladesh focussed on environmental degradation caused by textile units, environmental assessment and environmental management for dyeing units, manufacturing sustainable textile products and occupational safety (Islam, et al., 2011; Khan, 2016; H.R.Textile Mills Ltd. and Jahangir Nagar University, 2008; Islam, 2013; Asif, 2017).

There are other studies regarding advancement of textile industry of Bangladesh in the world economy (Center for Policy Dialogue, 1999).

On the other hand, in past 22 years, few studies could be identified on EIA system of Bangladesh, the last one being in 2016 (Ahmed & Ferdausi, 2016). Key studies focussed on evaluation of EIA system, its critical review; procedure and practice; quality of EIS; challenge and future direction of EIA in Bangladesh (Ahammed & Harvey, 2004; Ahmed & Ferdausi, 2016; Momtaz, 2002; Kabir & Momtaz, 2013; Kabir & Momtaz, 2018; Shakil & Ananya, 2015).

Very recently International Labour Organization (ILO) has published a document on effectiveness of EIA for textile and apparel sector in four developing countries, including Bangladesh (see 6.3 in chapter six) (ILO, 2021). Prior to this, there is very little evidence of similar studies investigating the performance of EIA system for the textile sector within Bangladesh or internationally. However, the study by ILO (2021) is predominantly based on previous literature and focussed on legislative & administrative arrangement of overall EIA system (ILO, 2021). On the other hand, no visible effort could be seen to amend the existing EIA system for last 25 years. Infact, the EIA guideline was amended recently (2021), after 24 years. Since there have been at least some studies regarding the EIA system of Bangladesh in general, sector specific focus can add value in this area of research.

Bangladesh's ready-made garment industry aspires to be a sustainable industry by 2021 (Hassan, 2015), which constitutes a significant part of textile industry (see chapter five). In the background paper of Seventh Five-year plan[8], Planning commission of Bangladesh Government (2015) recognized green investments coupled with policy reforms can help addressing environmental challenges and simultaneously bring sustainable pathways to economic development and prosperity. Consequently, with growing demand in global market and increased environmental awareness of global population, textile industry of Bangladesh needs to be vigilant about its impact on environment for economic competitiveness in global market.

Therefore, this research aims:

[8] "The 7th Five Year Plan (2016-2020) aims to develop strategies, policies and institutions that will allow Bangladesh to further accelerate job creation and reduce poverty as well as comply with new commitments to meet Sustainable Development Goal (SDG) targets" - (Bjornestad, et al., 2016)

To explore the role of existing Environmental impact Assessment (EIA) system in delivering environmental sustainability within the textile industry of Bangladesh.

1.3 Objectives and research questions

Following objectives have been identified to attain the aim of this study-

1. To review environmental policy instruments for addressing the impacts of the textile industry and understanding the role of EIA amidst them.

2. To develop a framework of analysis based on good practice examples of EIA system with specific focus on textile industry.

3. To evaluate the requirements of the EIA system for textile industry in Bangladesh.

4. To evaluate the EIA practice for textile industry in Bangladesh.

5. To develop recommendation for improvement of EIA system for textile industry in Bangladesh.

The key research questions relevant to the objectives are shown in Table 1.1.

Table 1.1 Objectives and research questions

Objectives	Key research questions
1. To review environmental policy instruments for addressing the impacts of the textile industry and understanding the role of EIA amidst them	Which manufacturing units compose the textile industry and what environmental impacts are resulting from their processes?
	What are the environmental policy instruments practiced around the world to address this concern? What is the role of EIA amongst them?
	What are the components of textile industry in Bangladesh and what are their environmental impacts? What environmental policy instruments are relevant to this industry in Bangladesh and how does EIA connect them?
	What are the components of EIA system of Bangladesh? Who are the relevant stakeholders for EIA and textile industry of Bangladesh?
2. To develop a framework of analysis based on good practice examples of EIA system with specific focus on textile industry.	What are the good practice examples to evaluate theoretical and empirical dimensions within the EIA system with particular attention to textile industry?
3. To evaluate the requirements of the	Is the legal framework for EIA system in Bangladesh adequate and satisfactory?

Objectives	Key research questions
EIA system for textile industry in Bangladesh.	Is the administrative arrangement for EIA system in Bangladesh adequate and satisfactory?
	Is the procedural framework to conduct EIA adequate and satisfactory?
4. To evaluate the EIA practice for textile industry in Bangladesh.	What is the quality of EISs prepared for textile industry in Bangladesh?
	How the key stakeholders (i.e., EIA consultants, regulators, and project proponents) are playing their role to ensure the practice of EIA?
	How are the textile industrial units performing in terms of mitigating and managing environmental impacts from their units?
	Why is EIA underperforming for textile industry in Bangladesh?
5. To develop recommendations for improvement of EIA system for textile industry in Bangladesh.	In the light of the findings what rectifications can we suggest for the EIA system, so it can efficiently deliver environmental sustainability for textile industry in Bangladesh?

Source: Prepared by author for this research

1.4 Research Methodology

The reality of this research problem is relative since it depends on the interpretation of the information gathered from interviews and literature rather than by laboratory-based experiments or other quantitative measures (See section 2.1, chapter two). Therefore, the outcome of the research would draw a subjective view, rather than objective (Guba, 1990; Eriksson & Kovalainen, 2016; Kawulich, et al., 2012). Thus, this study is exploratory and qualitative in nature. For data collection, the research has utilized qualitative data collection methods like literature review, document analysis, face-to-face interviews, case study analysis. Use of these methods according to the stages of the research and objectives is shown in figure 1.1. Research strategy and adopted research methods are discussed in detail in chapter two (Section 2.2 and 2.4).

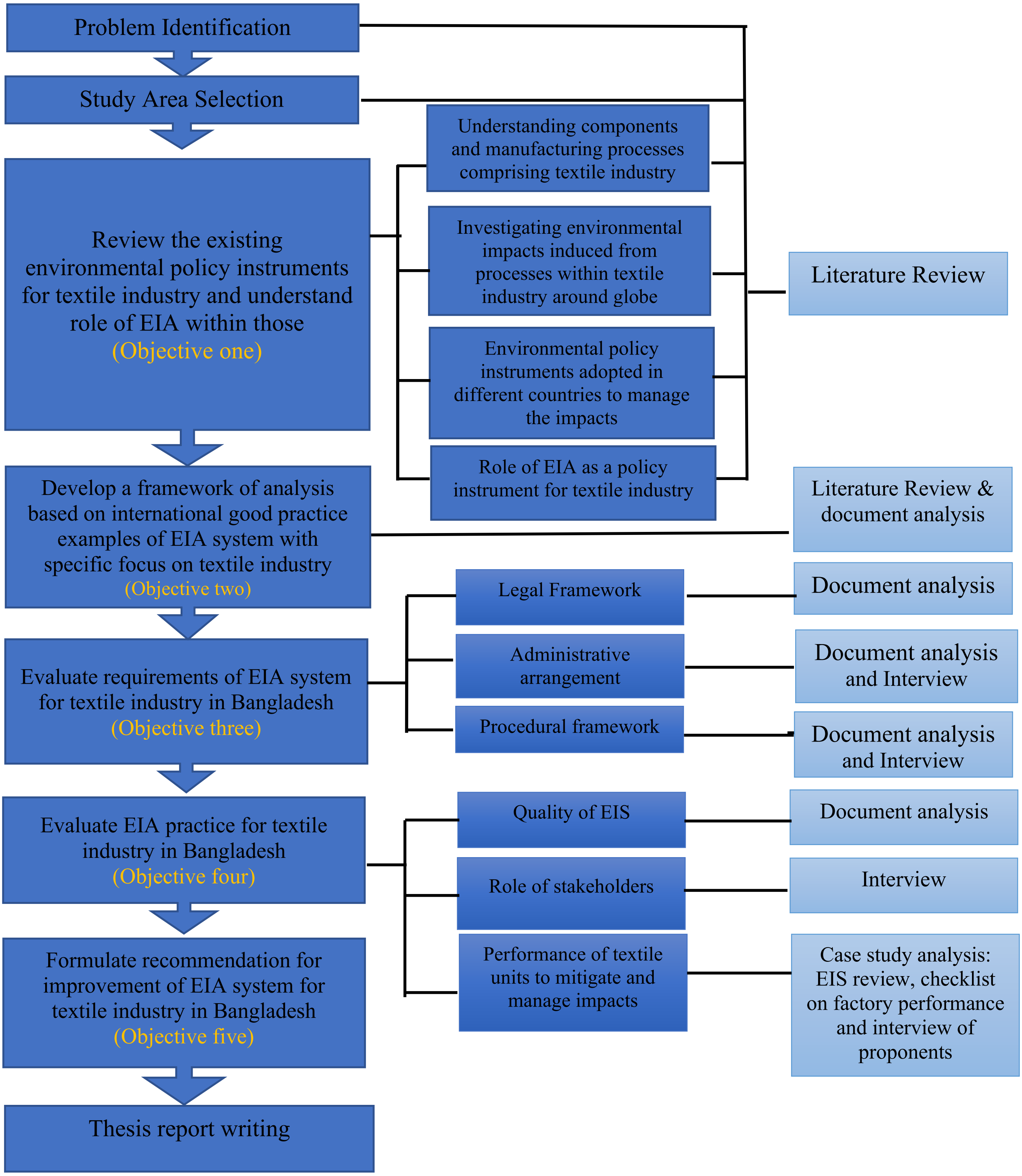

Figure 1.1 Flow diagram depicting the stages of research including the research methods relevant to objectives

Source: Prepared and used by author for this study

1.5 Organization of thesis

The arrangement of the contents within the thesis in relation with the objectives is described below in Table 1.2 -

Table 1.2 Chapter summary for the thesis

Sections	**Chapters in the thesis**	**Objectives discussed**
A: Introduction	Chapter one: Introduction to the research	----------
	Chapter two: Methodology of the research	----------
B: Understanding textile industry, its impact on environment and relevant environmental policy instruments	Chapter three: Understanding the global concept of textile industry and its impact on environment	Objective one
	Chapter four: Environmental policy instruments adopted globally for textile industry	
	Chapter five: Textile industry in Bangladesh: its environmental impacts and relevant environmental policy instruments	
	Chapter six: Environmental Impact Assessment (EIA) in Bangladesh: EIA system for textile industry, previous literature, and relevant stakeholders	
C: Evaluating the requirement of EIA system and its practice for textile industry in Bangladesh	Chapter seven: Role of EIA in delivering environmental sustainability for textile industry: Developing framework of analysis	Objective two
	Chapter eight: Evaluation of the requirements of EIA system for textile industry in Bangladesh	Objective three
	Chapter nine: Evaluation of the pre-decision EIA practice for textile industry in Bangladesh	Objective four
	Chapter ten: Evaluation of the post-decision EIA practice for textile industry in Bangladesh	
D: Recommendation and conclusion	Chapter eleven: Recommendation & conclusion	Objective five

The thesis is divided into four major sections the contents of which are briefly described below-

Section A: Introduction

Section A has two chapters.

Chapter one introduces the research by discussing the background context and presents aim, objectives, research questions and brief methodology.

Chapter two discusses the methodology of the research in detail. This chapter includes the research philosophy, methodology and conceptual framework, detailed methods of data collection and sampling.

Section B: Understanding textile industry, its impact on environment and identifying relevant environmental policy instruments.

This section attains the first objective using three chapters.

Chapter three begins with the definition and importance of textile industry in the world economy. It discusses the components of the textile industry including the manufacturing processes and environmental impacts resulting from those.

Chapter four describes environmental policy instruments adopted in different countries relevant to the textile industry. Following on, it focuses on the definition and purpose of EIA, its suitability in connecting the policy instruments and its potential role in controlling and managing environmental impacts resulting from this industry.

Chapter five illustrates the importance of the textile industry in the economy of Bangladesh, manufacturing units comprising the industry and its environmental impacts. Followed by this, there is discussion on relevant environmental policy instruments to realise the role of EIA within this sector.

Chapter six provides in depth understanding on EIA system including the legislative and administrative arrangements. Alongside it also provides insight into the EIA process and practice. Furthermore, role of the relevant stakeholders for EIA and environmental concerns for textile industry in Bangladesh was discussed. This chapter also provides brief information on previous literature regarding EIA system and textile industry in Bangladesh. However, the findings were discussed in chapter eight, nine and ten.

Section C: Evaluating the requirement of EIA system and its practice for textile industry in Bangladesh

This section discusses the outcome of objectives two, three and four in three different chapters.

Chapter seven discusses the development of the framework of analysis, which is the second objective of the study. This chapter contains discussion on the key components, criteria and sub-criteria selected on the basis of global good practice example for evaluation of the EIA system with specific focus on textile industry.

Chapter eight contains discussion on third objective. It includes evaluation of institutional framework, i.e., the requirement of EIA system in Bangladesh with specific focus on the textile industry. This part evaluates the legal and administrative arrangements, procedure and guidelines for EIA system. Analytical framework developed in chapter seven is used for this evaluation. Furthermore, it develops a discussion around the findings comparing with the international scenario.

Chapter nine contains discussion on the fourth objective. It evaluates the performance of the key stakeholders (e.g., EIA consultants. project proponents and regulators) and quality of EIS in pre-decision stage of EIA practice using the framework of analysis. The findings are further compared with international practice.

Chapter ten forms discussion on performance of the stakeholders (e.g., project proponents and regulator) in post decision stage of EIA practice in Bangladesh in light of the international scenario. Following on, performance of the case study textile units in observing the mitigation measures and environmental management plan are also evaluated using the framework of analysis and discussed in detail against international backdrop.

Section D: Findings and recommendation

This final section contains one chapter drawing conclusion to the study.

Chapter eleven provides an overview of the findings from the research and accordingly formulates recommendations for enhancing the role of EIA in delivering environmental sustainability within the textile sector in Bangladesh. Finally, it provides a conclusion to the thesis.

1.6 Limitations of the research

The researcher encountered number of challenges during the data collection period. Firstly, sufficient information is not available online regarding role of relevant government agencies. Hence, the researcher needed to visit several agencies to gather information.

Additionally, pandemic and country-wide lockdown in Bangladesh hindered inclusion of at least three participants. Involvement of few more participants would have been greatly helpful for the study. Lockdown also hampered additional site visits, which could have helped in drawing a better picture of existing condition of the informal textile units. However, amongst the interviewees, two participants were interviewed via telephone (interviewee #3) and internet (interviewee #5) during countrywide lockdown. However, those interviews were completed after repeated attempts. Covid-19 situation also impacted duration of this study. Restriction on international flights caused four months delay to the researcher while returning to UK from the study area. Also, the researcher was infected enroute and suffered from post covid issues. Due to this reason around the study was further delayed.

Gathering EIA report for this study appeared to be a great challenge. Even after several efforts, researcher was not able to gather more than five reports. The reasons behind this are - i) inability of EIA consulting firms to provide or display such report due to consultant-client privilege, ii) unavailability of EIA reports in DoE library or website possibly due to lack of storage area and lack of the practice of digitalisation, iii) unwillingness or lack of practice of the textile units to upload EIA reports on their official website. Infact, EISs in Bangladesh have been deemed as widely unavailable to public or even to the environmental activists as there is no regulation for public disclosure of the final EIA reports (Ahmed & Ferdausi, 2016; Ahammed & Harvey, 2004; Dhaka Tribune, 2021).

Apart from these, tracking the availability of policy and guideline documents had also been a difficult task. For example: textile policy 2017, the action plan of industrial policy 2016 and the sector specific industrial guideline for textile are not available online. In fact, information on existence of these key documents was ambiguous. Hence, author had to visit the relevant government offices physically to collect these key documents.

Chapter summary

Textile is a significant industry in the economy of the Bangladesh experiencing a rapid growth. Despite all the economic advantages, it has been identified as one of the most polluting industries around the world, including Bangladesh. The environmental impacts of this industry extend from consumption of resources to threatening the health of living beings. EIA is one of the key regulatory instruments existing in the country for last 25 years. EIA can potentially address the impacts from this industry. However, for this purpose, the EIA system including the practice is required to be evaluated with special attention to textile industry. However, evidence on no such comprehensive studies could be found for Bangladesh, while they are also rare in global scale. Therefore, this research selects five objectives to accomplish the aim of exploring the role of existing Environmental impact Assessment (EIA) system in delivering environmental sustainability within the textile industry of Bangladesh. Being exploratory in nature, methods like face-to-face interview, document analysis, literature review and case study analysis have been used in this study. Main challenges encountered in this study are caused due to limitation of information and Covid-19 induced lockdown.

Chapter Two: Methodology of the research

Chapter two describes the methodology of the research using four sections. The first section discusses the philosophy of this research. The second section presents the research strategy starting from problem identification to formulation of recommendation. Following on, conceptual framework for the research is provided in third section. The fourth section describes research methods including the methods of data collection & sampling, validation of data and data analysis supported by research specific examples.

2.1 Research philosophy

> "The term research philosophy refers to a system of beliefs and assumptions about the development of knowledge". - Saunders, et al. (2009, p.124).

Part of research philosophy leading the approach of investigation based on researcher's belief and the views gathered from the world is known as research paradigm (Schwandt, 2001; Kawulich, et al., 2012).

Research paradigm

Research paradigm is composed of three things: belief (i.e., Ontology), approach to acquire the knowledge on that belief (i.e., Epistemology), truth about that belief through value system (i.e., Axiology) (Saunders, et al., 2009). Research paradigm sets orientation of a research, followed by formulation of research questions, selection of research methodology and finally identification of methods (Kawulich, et al., 2012).

A brief discussion on the contents of research paradigm and their relevance to this research is discussed below-

Ontology is concerned about reality. Ontology for this research questions environmental sustainability of textile industry and how it can be delivered by environmental policy instruments. Philosophical alignments of ontology are realism and relativism. While realism refers to real feature of the world, relativism is open to multiple interpretation leading to multiple implications (Guba, 1990; Schwandt, 2001). Ontological orientation of this research is relativist as there can be several interpretations.

Epistemology is concerned with the way of earning knowledge. This research earns knowledge on textile industry, its environmental impacts, relevant environmental policy instruments, role of EIA among the existing policy instruments for environmental control & management of textile industry (see section 2.3 within this chapter). Following on, it evaluates the existing system and practice of EIA for textile industry. Not being observable material things, knowledge in this research is available only through social actors (Eriksson & Kovalainen, 2016, p. 16). It used literature review, document analysis, interviews, and case study analysis for gathering knowledge. Information gathered from these sources are influenced by views of the experts and participants. While in “positivist” orientation of epistemology the researcher is not influenced by subject while experimenting with material things (Creswell, 1994). Researcher interacting with subject indicates the orientation of epistemology in this research as “interpretivist” (Creswell, 1994). Therefore, in interpretivist epistemology, interpretation varies from actor to actor and is relative in nature.

Axiology in research philosophy is the value system or ethics that the researcher applies while conducting the research (Guba, 1990; Saunders, et al., 2009). Axiology in this research is “subjective” since it is value laden, biased (Rust, et al., 1999) and relative by the views of participants and previous research. “Objective” axiology is value free or unbiased resulting from the direct and clear observation of reality (Saunders, 2016; Rust, et al., 1999), which is not the case of this study.

Table 2.1 Research philosophy and paradigm of this research

Components of Research paradigm	**Concerns of this research**	**Decision about philosophy of this research**
Ontology (reality)	Role of environmental policy instrument in delivering environmental sustainability within textile industry	Relativist as there can be several interpretations
Epistemology (source of knowledge)	Literature review, document analysis, interviews, and case study analysis regarding structure of textile industry, its environmental impacts, role of EIA system and its practice for textile industry.	Interpretivist as it requires to interact with social actors and gather their view through interview or literature
Axiology (value system)	EIA theoretical requirements and practice for textile industry needs studying to understand whether those are sufficiently utilized	Subjective as the information sources (previous researchers, participant in this research) have a value laden view on it

Source: Prepared by author for this research, from discussion in this section

Summing up the discussion, it can be said that the realist ontology directs towards positivist epistemology and objective axiology. Research methodology followed in such philosophy is quantitative using experimental methods of data collection and analysis. Relativist ontology is oriented towards interpretivist epistemology and subjective axiology (table 2.1). It follows philosophy follows qualitative research strategy utilising exploratory methods (figure 2.1).

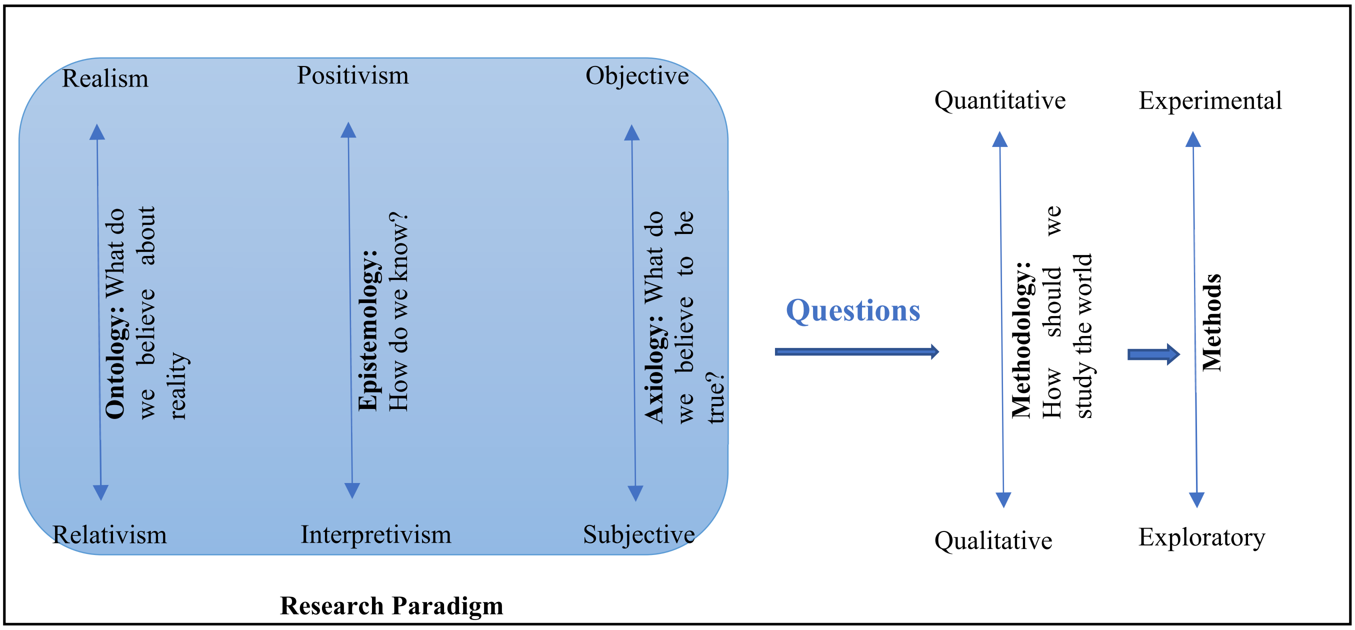

Figure 2.1 Research paradigm and its relationship with research methodology and methods
Source: Adapted from Kawulich, et al. (2012); Patton (2002); Creswell (1994); Saunders, et al. (2009)

2.2 Research Strategy

Saunders et al (2009, p. 600) defined research strategy as

> "The general plan of how the researcher will go about answering the research questions"

The aim of this research is **to explore the role of existing EIA system in delivering environmental sustainability within the textile industry of Bangladesh**. For this purpose, five objectives and detailed research questions have been formulated (see section 1.3 in chapter one). The research strategy to attain these objectives is described in the following sub-sections.

2.2.1 Identification of problem

The research problem is identified through literature review of several journal papers, reports, books and theses. This research apprehends that despite being one of the fastest growing industries in the world, the negative environmental impacts of textile units are concerning (Singh & Khajuria, 2018). Considering the demand of this industry throughout the world, ensuring its environmental sustainability should be a priority in policy making. Therefore, environmental policy instruments for textile industry can serve as key to address this issue.

2.2.2 Selection of study area

To study and understand the environmental policy instruments in practice, a geographic area needs to the selected. While textile industry is the key concern, study area should preferably be a country with significant contribution of textile industry to its' economy. This research selects Bangladesh as the study area because of textile industry's significant contribution in country's export earnings (80%), share of manufacturing workforce (71%) and share of gross output (47%) among the industries within the country (BBS, 2012). Additionally, the lack of stringency in environmental regulation as a developing country (Maitra, 2011; The World Bank, 2018) raises the question on quality of pollution minimization for such economically important industry. With prioritized economic development, enforcement of environmental regulation appears as a general weakness in developing countries (Lee & George, 2000). Environmental Conservation Rules (ECR)'97 in Bangladesh, sets the criteria for industrial units requiring EIA (see 6.1.2 in chapter six). Upon submission and review of the EIA report, the environmental clearance certificate (ECC)[9] is approved for polluting textile units in Bangladesh. Thus, the role of EIA in delivering the environmental sustainability within textile industry in Bangladesh is expected to yield interesting insights.

2.2.3 Selection of objectives

Five objectives are selected by author for this study based on the key research problem. See section 1.3 in chapter one for their details.

2.2.4 Sequential stages to attain objectives

The five objectives to this research can be achieved in six sequential stages. The first objective is established in stages one and two. Objectives two to five are established in stages three to six (figure 2.3).

i) Stage one (Objective 1): Developing an understanding of the textile industry and its impacts on the environment

First objective of this research is to review the environmental policy instruments for addressing the impacts of the textile industry and understanding the role played by EIA.

[9] Environmental permit is named ECC in Bangladesh

The structure of the textile industry is established based on identification of the manufacturing processes and components it includes. Global environmental impacts resulting from these processes are also investigated. This stage is based on reviewing national and international literature.

ii) Stage two (Objective 1): Exploring existing environmental policy instruments for textile industry used globally and the role of EIA amidst them

This stage focuses on the environmental policy instruments relevant to the textile industry. Accordingly, international and national policy documents, reports and journal articles are reviewed. Following on, an in-depth understanding of EIA system of Bangladesh is established. Due to limited availability of publications within the sector, the literature review is further complemented with face-to-face interviews.

iii) Stage three (Objective 2): Developing framework of analysis from international good practice examples of EIA system with specific focus on textile industry

Stage three assists in establishing the key components (i.e., institutional framework, pre-decision stage of EIA practice, post-decision stage of EIA practice) and criteria of good practices of EIA system based on literature review. This further helps in developing the framework of analysis to evaluate the EIA system for textile industry in Bangladesh. Document analysis helps in elaborating the framework by adding sub-criteria, adapting it for the specific context of the textile industry (figure 2.2). Development of the framework of analysis is the second objective of this research. This framework is used in evaluating both theoretical and empirical dimensions of the EIA system in Bangladesh. Detail description of the framework of analysis is provided in chapter seven.

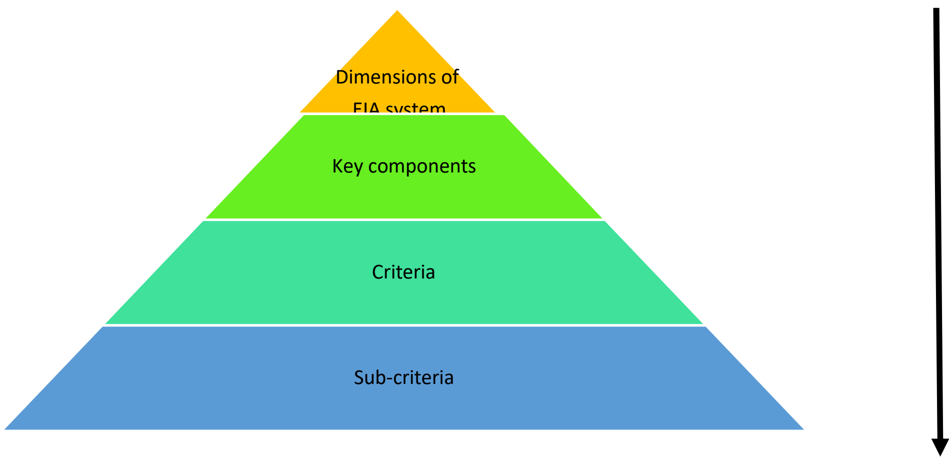

Figure 2.2 Hierarchy in framework of analysis developed for the research
Source: Developed by author

iv) Stage four (Objective three): Evaluating requirement of EIA system for the textile industry in Bangladesh

Using the framework of analysis, the third objective evaluates the requirements of EIA system relevant to the textile industry in Bangladesh. For this purpose, relevant information for evaluation is gathered based on three criteria. These are– i) legal framework, ii) administrative arrangement and iii) procedural framework for EIA. Information on these is primarily gathered from policy documents. However, face-to-face interview of the stakeholders also plays an important role in establishing an in-depth understanding. This is especially true in the case of administrative arrangement. The data collected in this stage is evaluated using the framework of analysis. The literature review and document analysis have provided support in critical analysis of the findings at this stage.

v) Stage five (Objective four): Evaluating EIA practice for textile industry of Bangladesh.

The fourth objective is achieved in this stage. The objective evaluates the practice of EIA for textile industry in Bangladesh using two components i) pre and ii) post decision stages of EIA. Three criteria are evaluated within this objective. Firstly, the role of stakeholders (i.e., regulators, EIA consultants and project proponents) is evaluated against the framework of analysis. Here, face-to-face interviews of the stakeholders assist in the understanding of the current practice. In addition to this, secondary resources are reviewed for verification (i.e., data triangulation) of the responses where appropriate. Secondly, the Environmental Impact Statements (EISs) of five textile units are evaluated against Lee-Colley's EIS review package using document analysis. The EISs of the two case studies are also reviewed here. Finally, performance of three textile units, serving as case studies are investigated. Their performance is evaluated against checklist prepared from national guidelines and good practice examples. Therefore, the case study incorporates i) filling in of the checklist ii) document analysis of the EISs (using review package) from the cases and iii) interviews of project proponents. Key methods of data collection in this step are face-to-face interview, case study analysis and document analysis of EISs of textile units.

vi) Stage six (Objective five): Formulating recommendations for improvement of EIA process for textile industry in Bangladesh.

Outcome of the previous objectives helps formulating the recommendations as fifth and the final objective of this research. The recommendations discuss about improvements in existing EIA system to deliver environmental sustainability within textile industry of Bangladesh.

The key stages in this research along with data collection methods are shown in figure 2.3.

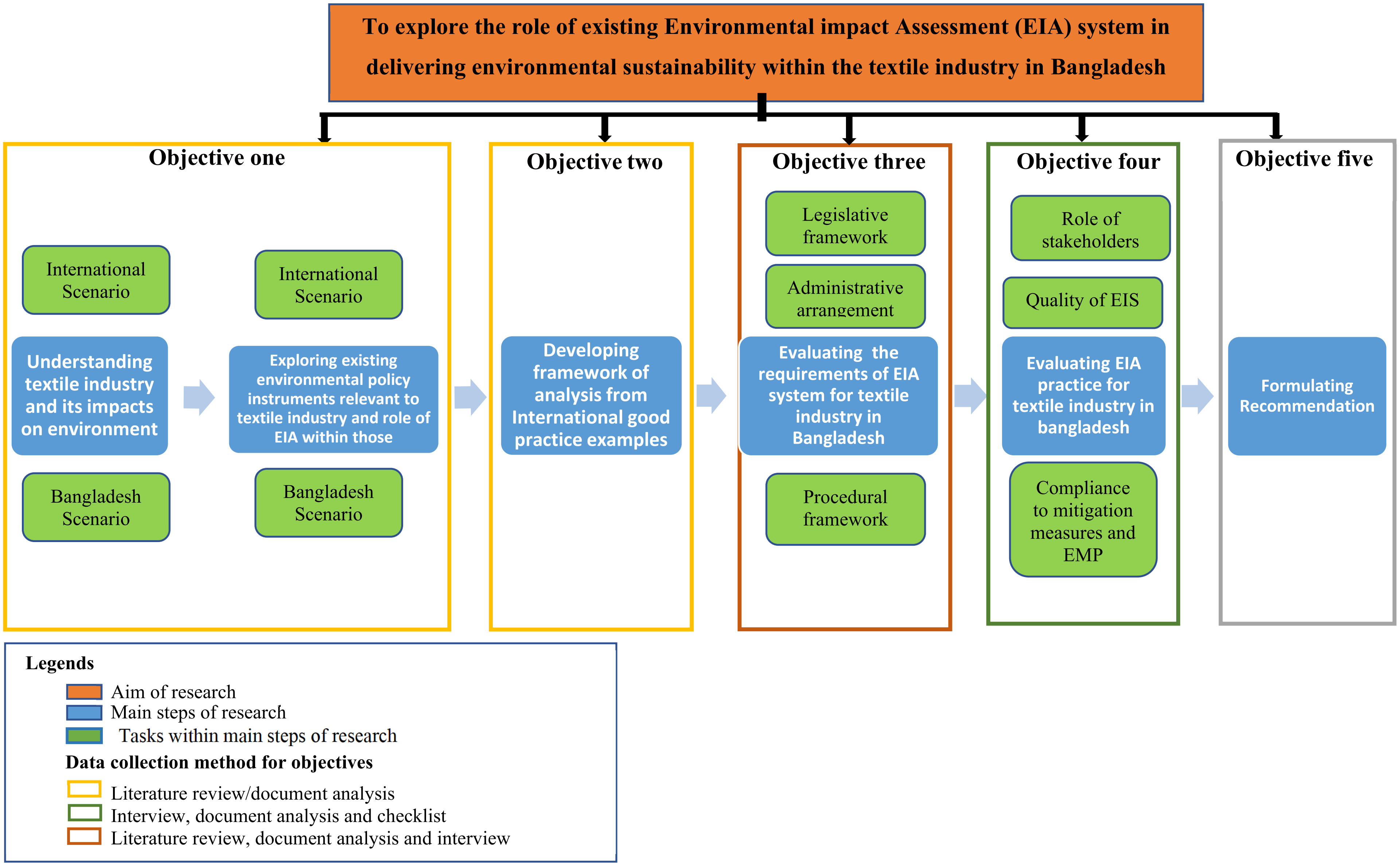

Figure 2.3 Flow diagram depicting objectives, main stages and data collection methods in this research

Source: Prepared by author for this research

2.3 Conceptual framework

Jabareen (2009) defines conceptual framework as a network of interlinking concepts to deliver a comprehensive understanding on a phenomenon.

> "Conceptual framework as a visual or written product, one that explains, either graphically or in narrative form, the main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them" - (Miles & Huberman, 1994, p. 18).

The key issues pertinent to this research are impacts of textile industry on environment due to its diverse manufacturing processes and environmental policy instruments to minimize those impacts. The need for impact assessment (IA) instruments to combat the negative environmental impacts of the textile and clothing sector have been recognized worldwide and EIA emerged as one of the most successful and widely practiced instruments for this purpose (Resta & Dotti, 2015). Lee & George (2000) emphasized that, EIA fits as an effective environmental policy instrument aiming for sustainability in combination of command-and-control approach, economic approach and planning tool all at the same time. Hence it can also influence the effectiveness of a country's overall environmental regulatory system (Lee & George, 2000).

Lee & George (2000) suggested that countries in the Asia-Pacific region mostly have umbrella legislation and environmental policy to cover most types of environmental pollution. This is the case in Bangladesh too, as it does not have any dedicated environmental regulation for textile industry. For polluting textile industrial units, issuance of ECC is dependent on EIA system (see chapter six for details). EIA also plays significant role as a prerequisite to take loan from the banks and begin business with international apparel brands (interviewee #10). EIA was legally mandated in Bangladesh since 1997 through Environmental Conservation Rules (ECR)'97. As the most relevant and widely practiced policy instrument for textile industry in Bangladesh, this research intends to focus on EIA's role for delivering environmental sustainability within it.

EIA system can have two sides: one is the theoretical side "designed to operate on certain principles", another is the practice of "how it operates" (Emmelin, 1998, p. 132). Exploration of both these sides for evaluating the EIA system can provide a holistic view. On the other hand, performance of EIA can be assessed through two broad approaches: aggregate analysis and disaggregate analysis. Aggregate analysis involves assessing benefit cost resulting from the whole process, while disaggregate analysis uses indicators to assess different stages of EIA process (Lee & George, 2000). This research evaluates the role of EIA through both dimensions: theoretical and empirical and uses the disaggregate analysis process. The conceptual framework for this research is shown in figure 2.4.

Belonging to the dimensions, the components, criteria and sub-criteria for performing evaluation are selected through established literature and thus framework of analysis for this research was developed (see chapter seven).

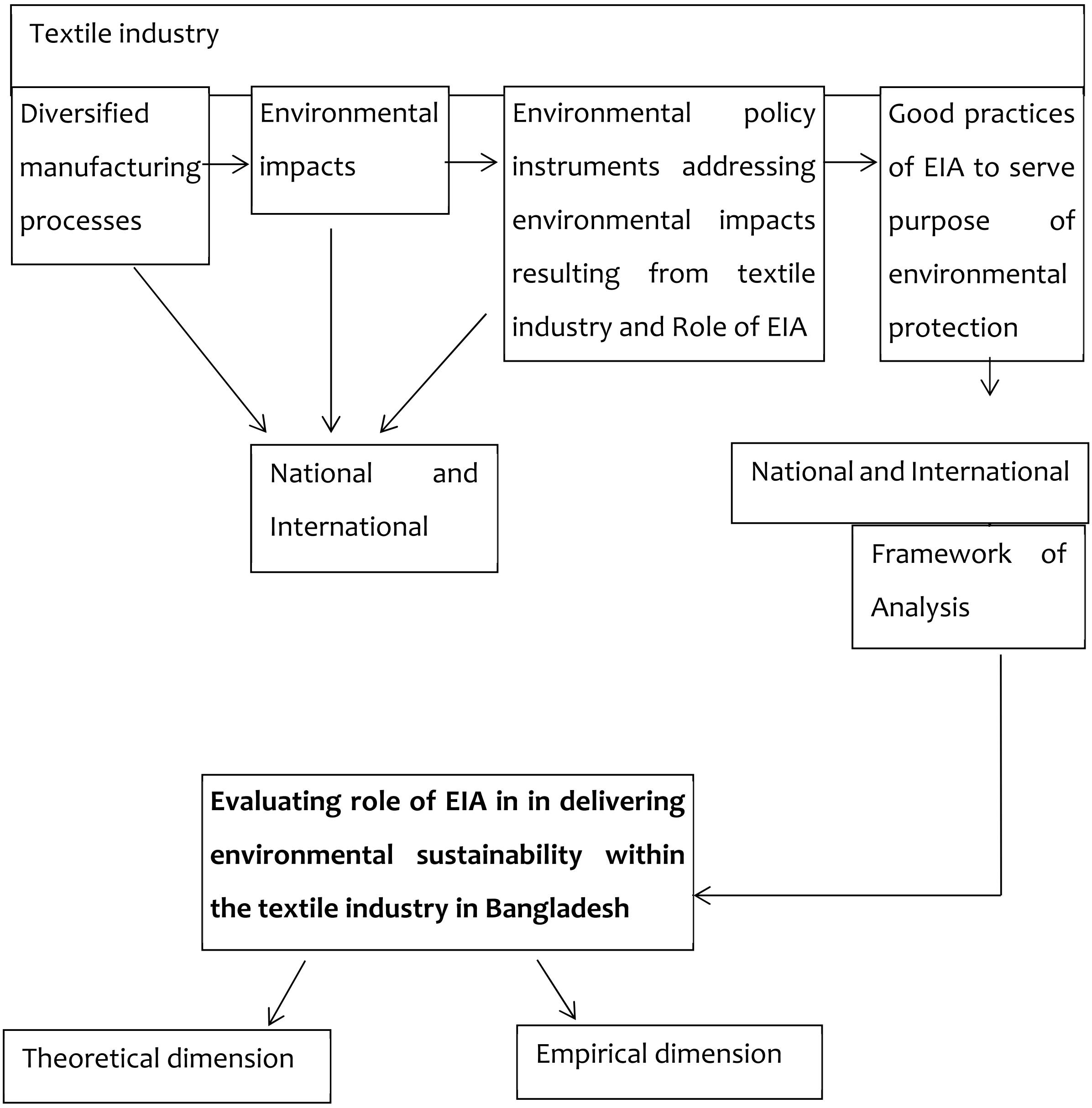

Figure 2.4 Schematic diagram of conceptual framework
Source: Prepared by author for this research

2.4 Research methods

Techniques and tools for data collection in research are known as research methods (Bullock, 2016). Mackenzie & knipe (2006, p.06) and Makombe (2017, p.3375) expand this definition and suggest, 'Method refers to the way or how data are collected, analysed and the type of generalisation or representations derived from the data'. The choice of a method depends on number of things including nature of the research problem, research paradigm specific to the research, methodology of research (figure 2.5) and finally, training and resources available to the researcher (Okesina, 2020). Being exploratory in nature, this research uses qualitative research methods for attaining the aim.

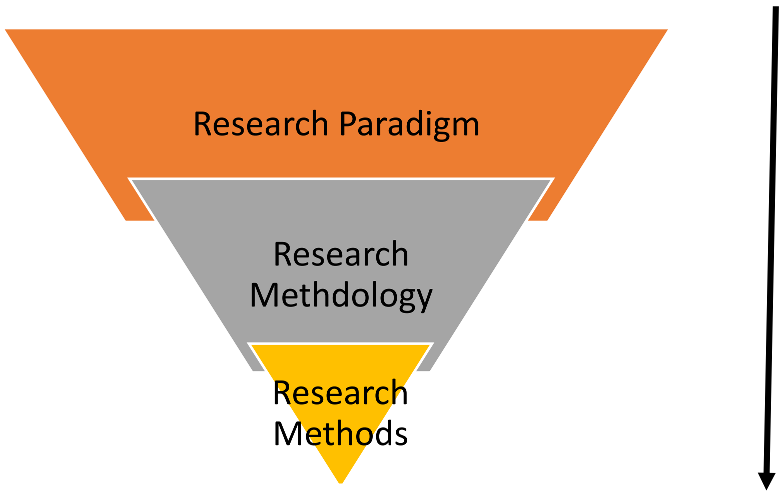

Figure 2.5 Research hierarchy
Source: Adapted from Dervin (1999) and Pickard (2007)

2.4.1 Methods of Data collection and sampling

According to Bolderston (2012, p.67),

> "Most qualitative research projects involve the collection of participants' views, which are transcribed and analysed to reveal a story or conceptual framework that represents the meaning of the experience under investigation."

Among the qualitative methods of data collection, this research uses literature review, document analysis, face-to-face interview and case study analysis. Currently, no comprehensive database exists in Bangladesh regarding discharged effluent parameters of the industrial units or surrounding environmental quality or environmental monitoring performed by DoE or the units. Therefore, secondary data analysis cannot be performed in this study. Case specific limited data on effluent parameters was available on-site. Those data are tallied against the maximum allowable limit prescribed in ECR'97 to understand the compliance level of the case studies (see section 10.3 in chapter ten).

Table 2.2 summarizes the methods used for data collection in different stages of this research. Literature review has been predominantly used throughout the research, so is document analysis. Outcomes from face-to- face interview contributed significantly to achieving objectives three and four. For case study analysis in fourth objective, diverse research tools like checklist, consultation and document analysis are used.

Table 2.2 Summary of the data collection methods by objectives

Objectives of the research	Data collection method
1. To review environmental policy instruments for addressing the impacts of the textile industry internationally and understand the role of EIA amidst them.	Literature review
2. To develop a framework of analysis based on international literature on EIA and textile related environmental good practice examples.	Literature review and document analysis
3. To evaluate the theoretical requirements of the EIA system for textile industry in Bangladesh.	Document analysis and face-to-face interview
4. To evaluate the EIA practice for textile industry in Bangladesh.	Face-to-face interview, case study analysis (site visit for filling up checklist and consultation; document analysis of the EISs of case studies), document analysis
5. To develop recommendation for improvement of EIA process for textile industry in Bangladesh.	Based on all of the above

Source: Prepared by author for this research

i) Literature review

Literature review is used as "means of collecting a body of information pertinent to a topic of interest involving choosing from an array of strategies and procedures for identifying, recording, understanding, meaning-making, and transmitting information" (Onwuegbuzie & Frels, 2016, p. 49). In fact, literature review ensures the potential of research on the intended topic and therefore is mostly involved from very beginning of research (Hart, 2018).

In this research, reputed journals and books are reviewed in stages of problem identification; study area selection; and establishing context of textile, its impacts, relevant environmental policy instruments & EIA. For the latter, both international and national scenario has been explored (see chapter three to six).

Table 2.3 Use of literature review in stages of this research

Objectives	**Tasks**	**Sub-tasks**
-	Problem Identification	-
-	Study Area selection	-
One	Setting context of research	Understanding Textile industry & environmental impacts of it.
		Understanding relevant environmental policy instruments and role of EIA within policy instruments.
		Understanding EIA system of Bangladesh
Two	Formulation of framework of analysis	Identifying key components (e.g., 'institutional framework' for theoretical dimension; 'pre and post decision stages of EIA practice' for empirical dimension) for framework of analysis
		Identifying criteria of evaluation (e.g., 'legal', 'administrative', 'procedural' framework of EIA system within institutional framework; 'role of stakeholders', 'quality of EIA', 'performance of textile units' within EIA practice) for framework of analysis
Three	Discussion on findings	Comparison of findings of the evaluation of institutional framework with international scenario
Four		Comparison of findings of the evaluation of EIA practice with international scenario
Five	Formulation of recommendations	-

Source: Prepared by author for this research

Afterwards, groundwork for formulating analytical framework is also supported by literature review. Once the key components and criteria within those are established by literature review, document analysis helps moving forward in building the framework in detail (discussed in chapter seven). For formulating the framework of analysis, journal articles and books from globally recognized experts (e.g. Sadler (1994), Wood (2003), Lee and George (2000), Lee & Colley (1992) among many others), policy documents and publication from international organizations (IFC, World Bank, IPCC, European commission, EPA among others) are reviewed and analysed (see chapter seven for more). Furthermore, extensive literature review is performed to present discussion on findings and formulate recommendation (Table 2.3).

ii) *Document analysis*

> "Document analysis is a form of qualitative research that uses a systematic procedure to analyze documentary evidence and answer specific research questions"- (Frey, 2018, p. 544)

Qualitative research has been using organizational and institutional documents as a major source of data for many years now (Bowen, 2009). Documents can be either primary or secondary. While primary document consists of raw information without interpretation, secondary documents are developed as interpretation from primary documents (Frey, 2018). In this research, document analysis is used in objectives two and four (Table 2.4).

Document analysis is used in second objective while developing the framework of analysis for this research. Initially literature review sorts out the key components and criteria for EIA evaluation. Following on, documents are analysed regarding good practices of institutional framework and pre & post decision stage of EIA practice; and framework is expanded accordingly. Specially this tool has helped in enhancing the sub-criteria of the framework based on sectoral (i.e., textile industry) perspective. As mentioned in the literature review section, relevant documents by globally renowned experts and organizations on evaluating EIA system, policy documents (e.g., rules, guidelines) on environmental management of textile industry are selected for documentary analysis. The framework provides further support in preparing interview schedules, checklists for site visit and finalizing the review package for EIS. Specific sources of documents analysed for preparing the framework and their outcome is discussed in detail in chapter seven.

Table 2.4 Document analysis used in stages of this research

Objectives	Tasks	Sub-tasks
Two	Developing framework of analysis	Identifying criteria and sub-criteria with specific focus on textile industry
		Amending Lee-Colley EIS review package for this study
Four	Reviewing EIS based on amended Lee-Colley package	Reviewing Five sample EISs from Red category textile units of Bangladesh

Source: Prepared by author for this research

The second phase of document analysis in this research involves analysing EISs of five textile units (including two case study units). Four of these EISs are from knit composite unit, one is from a sweater dyeing unit. One of these reports are available on internet, two were collected through personal connection and two belong to the case studies. This stage of document analysis helps to understand the practice of EIA progress and intention of environmental protection measures for textile industry. The evaluation is performed against enhanced review package primarily generated from Lee & Colley (1993) (see chapter seven for details). The findings from the site visits are validated with the contents of EIS where possible.

iii) Face-to-face interview

Face-to-face interview is very popular data collection method in both qualitative and quantitative research (Doody & Noonan, 2013; Myers & Newman, 2007; Ryan, et al., 2009) . Face-to-face interview helps understanding people's experience, belief, opinion, comprehension and attitude towards research questions and is especially used in qualitative research (Bullock, 2016). It can help exploring complex issues of research, result in optimum quality of data and is also helpful to avoid the chances of nonresponse (Lavrakas, 2008; Bullock, 2016). By establishing relationship between interviewer and interviewee (Kabir, 2012) this method can provide the interviewer better perception about the answers. For such interviews, question formats can vary from structured to semi structured to unstructured (Bolderston, 2012). Using this tool, experts have gathered opinion and experience of relevant stakeholders (e.g. academicians, government environmental agencies, consultants, civic society) regarding EIA efficacy for many years now (Sadler, 1996; Wood, 2003; Zvija´kova, et al., 2014; Kobus & Lee, 1993; Jha-Thakur & Khosravi, 2021; Clarke & Vu, 2021).

In this research, the interviews assist in data collection primarily for the third and fourth objective. However, it also contributes partially to the first objective. The interview schedule used in this research is semi structured, providing the researcher the opportunity to gather more information based on the initial responses.

The following steps are followed for this data collection method:

a) <u>Preparing initial questionnaire</u>

Qualitative research often uses semi structured or unstructured questionnaire, so the interviewee can provide his insights outside the framework imposed by the researcher and the interviewer can modify the line of questions according to the topic emerging (Bolderston, 2012). Thus, a semi structured interview incorporates open ended but predetermined questions, therefore, ensures control of researcher over the topic (Given, 2008) . However, being open ended it also encourages the respondents' independence in answering and preserves the scope of further explanations.

This research uses semi structured questions for interview. This interview schedule is divided into six sections (See Appendix I). After the general information section, the interviewer moves towards next section designed according to their expertise.

The questions encourage discussions on existing measures and practice of environmental protection relevant to textile industry and practice of EIA, administrative arrangement experience of practitioners, and government agencies. The line of questions is mainly derived from the sub-criteria formulated under framework of analysis for this research.

b) Piloting the interview questions

After formulating the initial interview questions, they were piloted amongst relevant experts to observe whether the questions are well expressed and self-explanatory to the participants. Alongside, it has helped in understanding the extent of details to be expected from the respondents for the final questions. For example, initially many of the questions were formulated focussing on the sector specific guideline. However, as a result of the pilot study, it became apparent that the key stakeholders like EIA consultants did not have access to the guideline and the monitoring officials follow different checklist. Therefore, the questions were rephrased.

c) Preparation of final interview questions

The pilot study helps in finalising the interview questions. Furthermore, the questions have been phrased precisely to avoid ambiguity, time delay and to keep participant interested.

d) Sample design

Sample size**:** According to Marshall (1996, p.523) 'an appropriate sample size for a qualitative study is one that adequately answers the research question'. Researcher's initial intension was to interview 30 respondents from five key stakeholder groups (see sampling technique for details) relevant to EIA system for textile industry in Bangladesh; six samples falling within each group. Expertise or knowledge of the topic under study has been the primary determinant of selection of participants (Cleary, et al., 2014).

Sampling technique: To ensure the positive engagement of the participants, researcher selects purposeful/judgement sampling and additionally snow-ball sampling. According to

Guest et al. (2014) purposive sampling is a great strategy where researcher is knowledgeable about the participants informing best on the study and are accessible to the researcher. This is a technique where "researcher actively selects the most productive sample to answer the research question" (Marshall, 1996, p.523). It can be beneficial while participants with specific knowledge or expertise are interviewed, and they are also able to refer more potential participants (Marshall, 1996). In this research, key stakeholder groups relevant to the EIA system for textile industry in Bangladesh are selected as participants for face-to-face interview. These key stakeholders are selected based on DoE (2021)'s list for EIA in Bangladesh, which includes proponents and related project beneficiaries, EIA consultants, the government agencies, affected public and other interest groups. However, the researcher realizes from the field visit that there are additional groups of stakeholders playing significant role in environmental control and management of textile industry. Therefore, DoE (2021)'s list is further expanded based on the findings from the field visit and policy documents (GoB, 2016; 2019; DoT, 2017). Additional stakeholder groups added in this study consist of international brands, auditors, Department of Textile (DoT), Bangladesh Bank and international NGOs (see section 6.3 in chapter six for details).

However, expected sample size of 30 could not be reached (Table 2.5), partly due to irrelevance, partly due to disruptions caused by pandemic. For example, since there is only one committee for review of EISs from red category industrial units in the whole country (see section 6.1.2 in chapter six), therefore two of the committee members are interviewed in this study. On the other hand, only three EIA consultants have been interviewed instead of six, as one cancelled the interview at the last moment and others did not respond to phone calls or could not be reached due to lockdown in pandemic. Similarly, only one monitoring officials from regional units has been interviewed. Additionally, the researcher was also not able to establish communication with more than three project proponents. Since the research utilizes snowball sampling, network to reach out to participant played very important role. Apart from this, expertise, experience, availability to respond influenced the selection process of the participants significantly.

Therefore, the key participant groups for this study include:

Government officials like a) EIA Reviewers and b) Monitoring personnel from Department of Environment, Ministry of environment, forestry and climate change, Bangladesh.

c) Academicians and experts from universities, environmental auditors, and international organizations (e.g., world Bank, IFC, GIZ).

d) Practitioners like EIA consultants from consulting firms

e) Project proponents/factory management officials from textile factories

Apart from them, representatives from government agencies like Department of Textile (DoT), Ministry of Industries (MoI), Bangladesh Bank along with DoE are also interviewed to understand their role in environmental issues of textile industry.

Table 2.5 Numbers of final face-to-face interviews conducted in this research

Participants	**No of interviews**
DOE officials (General+ review+ monitoring)	1+2+2=5
Academicians and experts	5
EIA consultants	3
Project proponents/factory management	3
Other government officials (DoT+ Ministry of Industry+ Bangladesh Bank)	3
Total	**19**

Source: prepared by author for this research

Although the expected sample size cannot be reached, the author realizes that point data saturation is reached in this research. When the interviewees appear to respond in a similar manner, the author realizes no further data for this research can be obtained from the interviews. The responses are also triangulated with the help of secondary resources, therefore the author gets a clear perception of the answers she received from interviews.

e) Interviewing the participants

This research complied with ethical procedure directed by University of Liverpool. Fieldwork risk assessment form according to the protocol of University of Liverpool has been submitted to the ethics approval committee along with the ethics approval form. Accommodation, transportation, communication arrangement along with other arrangements are taken care of efficiently since the study area is home country of the researcher. While visiting industrial units, personal safety from hazards like dust, chemicals and electrical equipment on site is ensured by using mask and maintaining safe distance from equipment while being accompanied by factory staffs.

Followed by selection of participants, telephone call is made to each of them. After describing the purpose of the study and the nature of the information required, their consent is taken for participating in the research by providing interview. Where they preferred, the participant information sheet is also sent through email prior to the appointment (see Appendix II). Following on, appointment has been fixed according to their convenience. Public offices are easily accessible in Bangladesh if an appointment is taken prior to arrival.

The interview schedule includes a brief introduction to the research topic and informed consent process. Before starting the interview, the participants have been informed about their rights as respondents, method and duration of data storage and process of anonymity. They have signed the consent form (see Appendix II) as a response to their understanding of the information provided and approving the researcher for interviewing with tape recorder.

Alongside the tape recorder to capture data in an efficient manner, researcher has taken notes simultaneously for supporting the statements given in the interview. Kabir & Momtaz (2018) argued observations to be an integral part in the face-to-face interview process, such as noting down gestures and the key issues emphasised by the interviewee. The researcher has also attempted noting those while taking the interviews.

The researcher ensures the requirement of privacy, silence and devoid of disruption in selection of location for the interview (Bolderston, 2012). Therefore, the participants are interviewed in their workplaces and completed the interview in the stated time period of 30-45 minutes.

Responses gathered from the interview are finally substantiated through documentary evidence or response of other interviewees to avoid the risk of inaccuracies (see 2.4.2 for more details).

The data collection technique has not seemed to create any discomfort in the participants while sharing their opinion in the interview, possibly because the key questions are more direct. However, semi structured nature of interview and existing literature sources help in gathering the facts behind the answers. For example: the project proponents are asked how much they have paid the consultants for EIA study of their units. On the other hand, the EIA consultants are questioned about the standard charge of conducting an EIA study in Bangladesh (Appendix I). Comparison of these two statements indicates the proponents' willingness to spend behind EIA. This is again verified from secondary literature sources (Kabir & Momtaz, 2018). Questions are formulated in a manner to avoid biased answers. For example: rather than asking that if the monitoring officials spend "adequate time" while their visits, they were asked about the duration spent (Appendix I). Therefore, such ethical issues rarely arose in the study. However, anonymity have helped some of the interviewees (Interviewee #6) to share the facts (e.g., about counterfeit EIA firms) in a more comfortable manner.

Ethical approval for this research was given on February 17, 2020 by University of Liverpool. From March 26, 2020, Government of Bangladesh declared country-wide lockdown due to Covid-19 which extended till September 1, 2020. Movements were restricted during lockdown. Therefore, researcher was not able to visit any participants for face-to-face interview during that period. Two interviews (interview #3, #5) were conducted via telephone and internet within the lockdown.

iv) Case study analysis

In order to establish the practice in observance of mitigation measures by the textile units, case study analysis is used in fourth objective. According to YIN (2003, p.02) "Case study method are very useful in understanding complex social phenomena by retaining holistic and meaningful depiction of empirical events". The steps of this method followed in this research are described below-

a) Selection of case studies

Selection of case study in this research begins with searching for the EISs of the red category[10] units. Through internet and personal connection, the researcher has been able to find only five EISs, while communication could be established with only two of their proponents. In addition to this, one more textile unit is reached using personal connections. The selection of case studies also ensures the following-

- Red category/heavy polluting textile units (incorporating dyeing-printing-finishing processes), as they have maximum impact on environment and also full EIA is required for them.
- Including both knit and woven units, since these are two major categories of fabric produced in Bangladesh and have difference in manufacturing processes. Significant share of textile units of Bangladesh is attributable to the knit composite units, thus the researcher included two of those in case study. In addition to these, one woven dyeing factory was selected.

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[10] Heavy polluting (see section 6.1.2 in chapter six)

- Formal units, since they are registered and goes through formal process of environmental clearance from DoE. Informal units are unregistered and difficult to trace.

Three red category, formal textile units are selected as case studies for this research. Proponents from these case studies are interviewed to understand the role of project proponents in EIA of textile units in Bangladesh (see section 9.2 and 10.2 in chapter nine and 10). Checklist on mitigation measures and EMP adopted by these units are filled by visiting their factories and conversation with employees (see section 10.3 in chapter 10). EISs of two among the three units are collected and reviewed to understand the quality of EISs for red category textile units in Bangladesh (see section 9.4 in chapter nine).

b) Site visit of case studies

After visiting the sites of the three case studies-

- The EISs of the case studies are collected for reviewing.
- The production area within the site is visited where the officials are consulted to fill up the checklist "to understand the units' performance in observing technical measures and EMP".
- The owner/ representatives are interviewed to understand "perception of project proponents on EIA for textile industry".

Among six ways of evidence gathering for case studies (Yin, 2003), this research uses three. Document analysis and face-to-face interview are already described in previous sections. This section describes the checklist used in the site visit in detail. Using multiple methods of data collection, this case study analysis is expected to provide a comprehensive empirical view regarding environmental management practice of textile units.

Fieldwork risk assessment and self-protection measures followed while visiting case studies is already mentioned in previous section (under "face-to-face interview" within section 2.4.1).

c) Document analysis

EIS of two of the case studies are collected from the site. The woven dyeing factory does not have EIA report, as it started prior to the regulation coming into force. According to regulation, such units only require submitting EMP for ECC. However, when asked they have been unable to produce the EMP report either. Therefore, only two EISs (among the five) belong to the case studies. Even within these two, one has some missing pages, so their report is incomplete (see section 9.4 in chapter nine).

d) Checklist

The checklist is prepared based on the mitigation measures proposed in existing sector specific guidelines for textile units in Bangladesh, contents of EMP in the generic EIA guideline and the international literature used in amending the EIS review package (see chapter seven for details). Alongside, quick scanning of the EISs on-site has also helped in forming additional queries.

The checklists are filled up with the support of the staffs from the factory on site. However, in some instances, researcher has also used own observation to note important details (e.g., practice of wearing personal protective equipment). There are two checklists, one for technical measures including the effluent treatment plant (ETP) (see Appendix III and section 10.3.1 in chapter 10), another for EMP (see 10.3.1 in chapter 10).

e) Face-to-face interview

After collecting information through checklist, researcher interviews the project proponents (or their representatives e.g., factory management) regarding their views on EIA process for their units, their knowledge on EIS prepared for their units, shortcomings and views on technical measures and EMP adopted for their units. This interview helps in understanding the "project proponents view of EIA system" and "performance of the textile units".

2.4.2 Validation of data through triangulation

In qualitative research, triangulation is referred as a method to increase its credibility. Pelto (2017, p. 242) used the term "Triangulation" as "an approach to assessing the validity and reliability of data-gathering methods in the social and behavioural sciences". Thus, it is a practice of using multiple sources for data collection or multiple approaches of data analysis to substantiate the information gathered or alternatively draw multiple perspectives towards a comprehensive understanding of research question (Salkind, 2010).

Accordingly, to ensure the validity of data in this research, data triangulation is used. Data extracted from the primary sources (e.g., interview, checklist etc.) are verified using alternative sources. For example, the DoE official's information on DoE running understaffed (specially in regional offices) has been verified using reports published by World Bank and conversations with experts. This example is also applied to explain the data analysis using NVivo (see (i) in section 2.4.3).

2.4.3 Data Analysis

Software tools used in this research predominantly are Nvivo and MS Excel.

Nvivo is a research software largely used for qualitative and mixed method research. It can help in gathering "richer insights from diverse data" (Timberlake, 2020). NVivo has been widely used by researchers (Sok, et al., 2011; Eckert, et al., 2020; Cotton & Alsaiari, 2014; Momtaz & Kabir, 2013) in the similar field of research. For this research, NVivo has been solely used for organization of data, which provides substantial support in validation of the data through triangulation. According to Richards (1999, p.04), "Nvivo provides a range of tools for handling rich data records and information about them for browsing and enriching text, coding it visually or at categories, annotating and gaining access data records accurately and swiftly". However, as it has been already mentioned (see section 2.1 in this chapter) that this research follows interpretivist epistemology. Hence, the data analysis is dependent on researchers' knowledge and experience gathered from the subjects interviewed and extensive literature sources. Therefore, the data analysis in this research follows more liberal approach than limiting itself into mechanical outcomes. NVivo is not used in interpreting or analysing the data of this research.

MS excel is a spreadsheet program that has been used for decades for organizing, calculating, analysing and visualizing data. This software is mostly used by the researchers in quantitative research field. However, qualitative researchers can also use the capacity of handling large volume of data, assigning attributes (or coding) and depiction of the outcome among many other functions offered by MS Excel (Meyer & Avery, 2009).

i) Use of Nvivo in the research

Nvivo is used in this study to consolidate and triangulate the qualitative data focussing on the sub-criteria used in the framework of analysis. Thus, data collected from face-to-face interview are cross-referenced with data collected from secondary source and other interviews.

For example: while evaluating the administrative capacity and institutional setup for environmental management within textile industry one of the sub-criteria listed in the analytical framework is "Adequate resources and capacity of environmental agencies for implementing EIA in practice". The response from the interview with DoE is verified with reports from The World Bank, interview with experts in the relevant field and organogram of DoE. Therefore, Nvivo is used here gathers data from all the sources, i.e., interview transcripts, reports from secondary sources and websites. Then all this information is consolidated under one node and shown in same window making comparison and referencing convenient. The stages are described below-

a) <u>Creating a project</u>

In this study the relevant data focussing on a key issue is compiled under one project. For example, all information relevant to environmental agency is analysed using one project in NVivo. Creation of a new project is shown in figure 2.6.

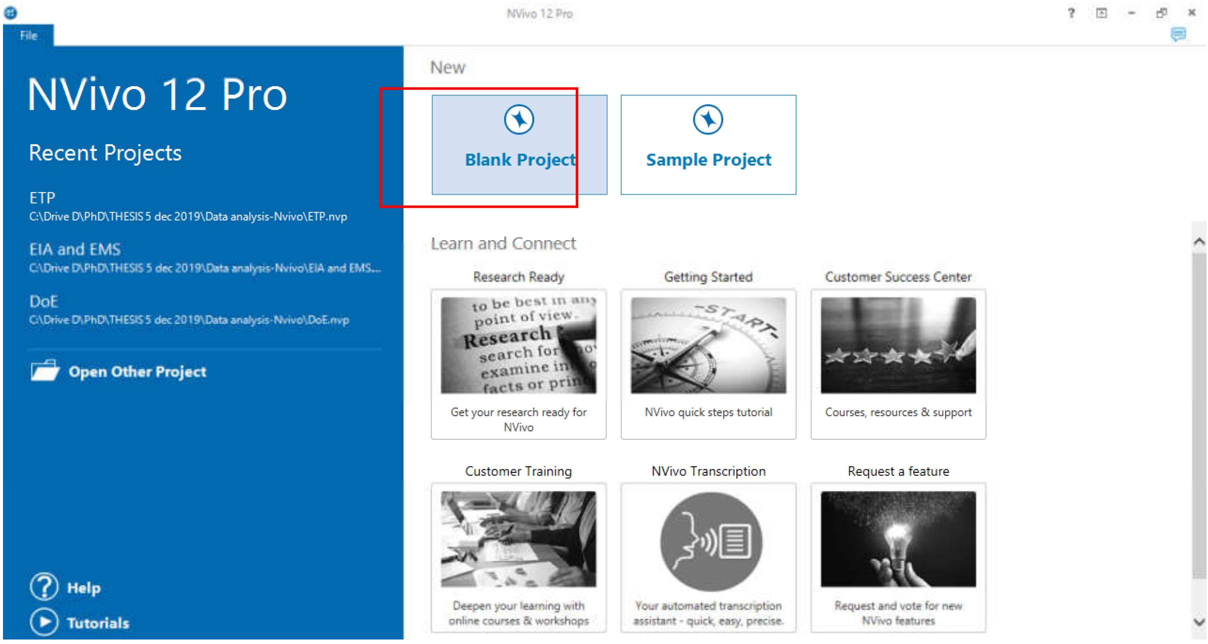

Figure 2.6 Creating project in Nvivo

Source: Author's own work

b) <u>Importing files from different sources</u>

The files are imported using the option "Import" from Menu bar. As marked with red rectangles in the figure 2.7, the menu offers options for data importing from variety of sources. For example: the websites are imported via NCapture. NCapture can be added as extension to existing browsers like Google Chrome or Internet Explorer. Files stored using referencing software like Endnote, Zotero or Mandeley can also be imported.

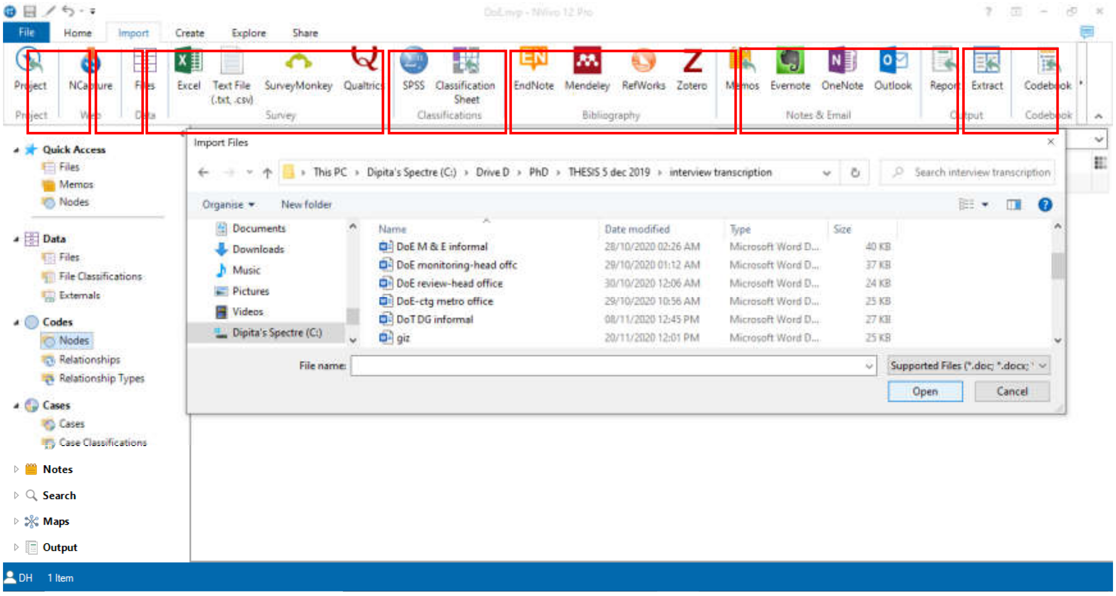

Figure 2.7 Importing data in Nvivo

Source: Author's own work

c) <u>Creating node and storing data within those</u>

Nodes perform as a container for storing reference about theme, criteria selected for research. The node is created using the "create" option from Menu Bar or "Codes>nodes" option from the left menu (figure 2.8).

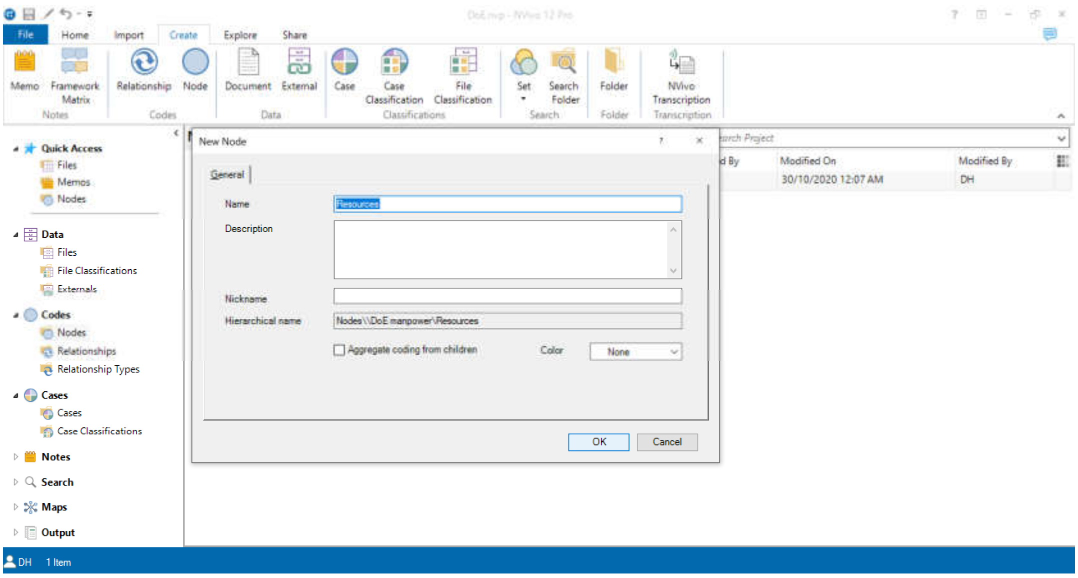

Figure 2.8 Creating nodes in Nvivo

Source: Author's own work

The files under this project are then opened one by one and data is referred within the node (figure 2.9) by selecting the text or picture and coding it within relevant node. The coding is done through following stages: selecting the text> right click > code> Nodes> "name of node".

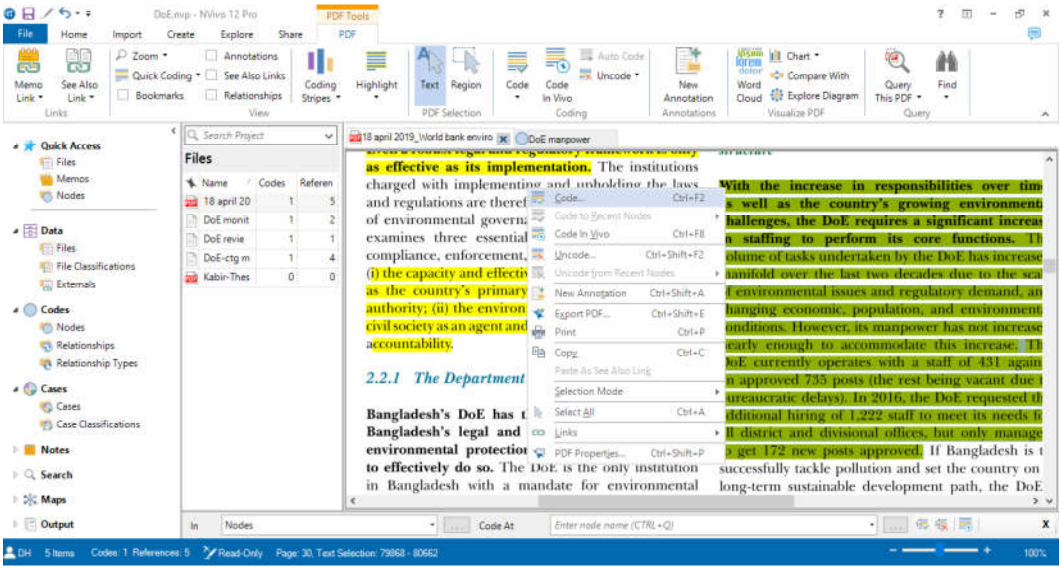

Figure 2.9 Coding data under node using Nvivo,
Source: Author's own work

After all such data have been coded under the relevant node, this can be seen altogether as the node is selected from the left menu under the option "code". Figure 2.10 provides a view of the information gathered from all different sources under the node. The marked rectangles indicate different sources referring to information gathered from each of them. Clicking on the sources here forwards directly to the source's file and show the extracted information.

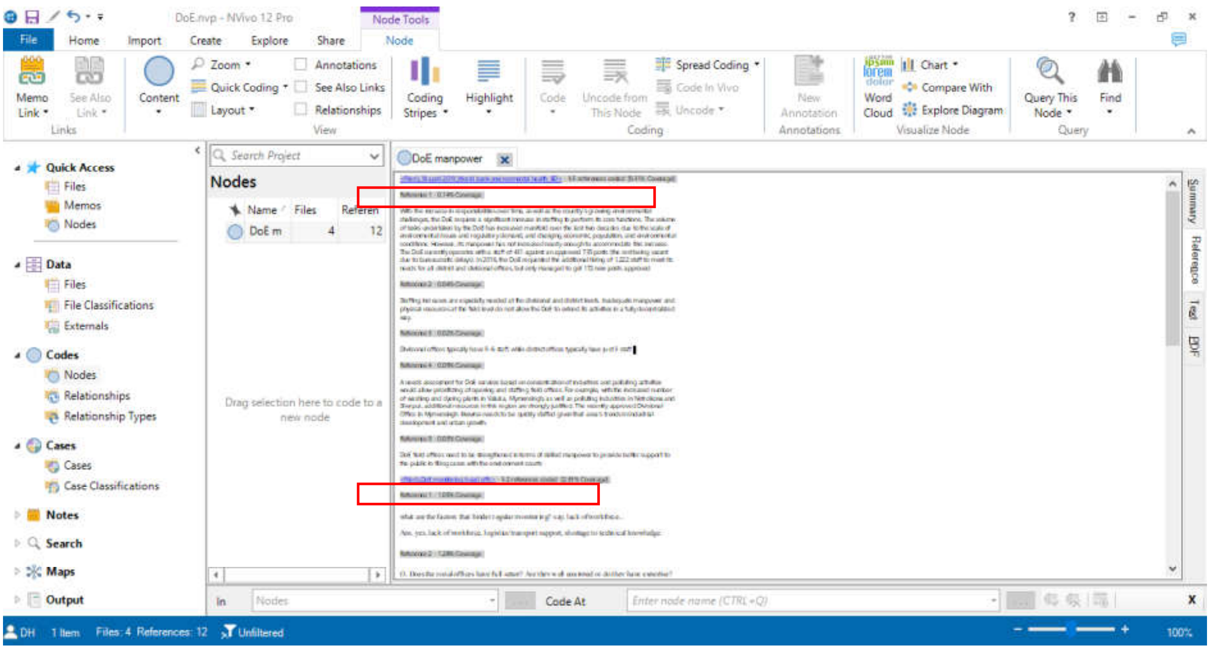

Figure 2.10 Coded information under the node can be viewed in one place using Nvivo

Source: Author's own work

For this study, Nvivo has been useful to a great extent in sorting and triangulating data, supporting findings and formulating recommendations.

ii) Use of MS Excel in the research

In this research, MS Excel predominantly helps in storing the evaluations, sharing it with other reviewer and driving the results from review of the EISs. The stages of using MS Excel in EIS review are shown here-

a) <u>Storing the evaluations</u>

There are 71 sub-categories requiring evaluation to understand the quality of sample EISs from textile units in Bangladesh (see chapter seven). The amended Lee-Colley package in this research uses symbols from A to F to store the evaluation. The evaluations are explained using the "comment" option available for the cells. Therefore, where the grades varied between the reviewers, the comments are consulted (figure 2.11).

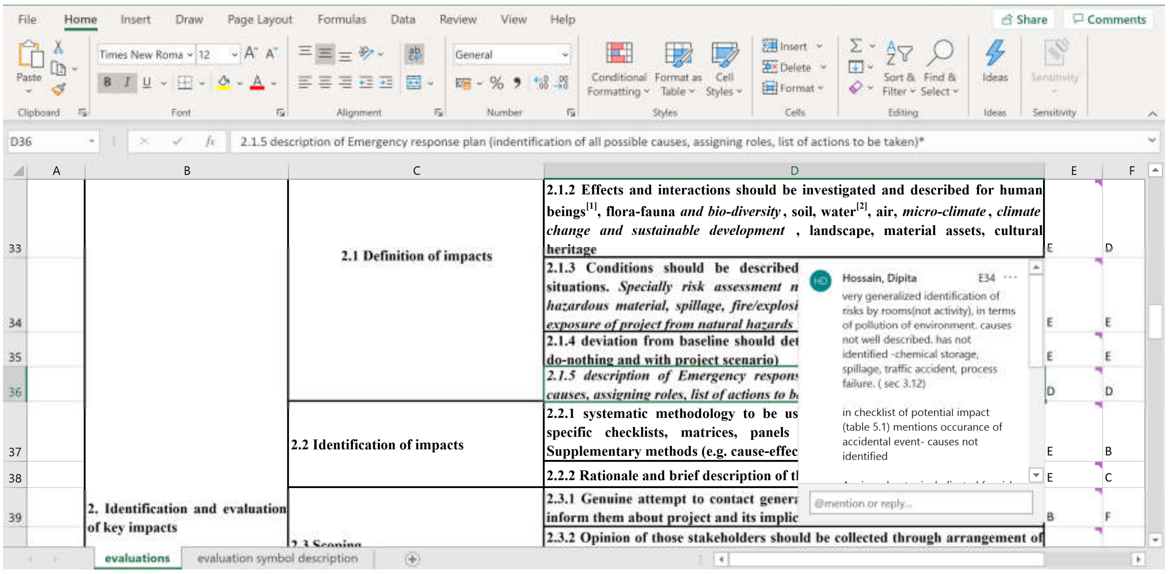

Figure 2.11 Using Excel for storing the evaluation and rationalizing the grades for EISs

Source: Author's own work

b) <u>b) Sorting the evaluation using 'filter' function</u>

The designated sub-categories of the review package (for fulfilling minimum requirement of this study) are then colour coded manually and filtered using the function "Filter" (figure 2.12). Filtered valuations for the five EISs are moved into separate sheet for further analysis.

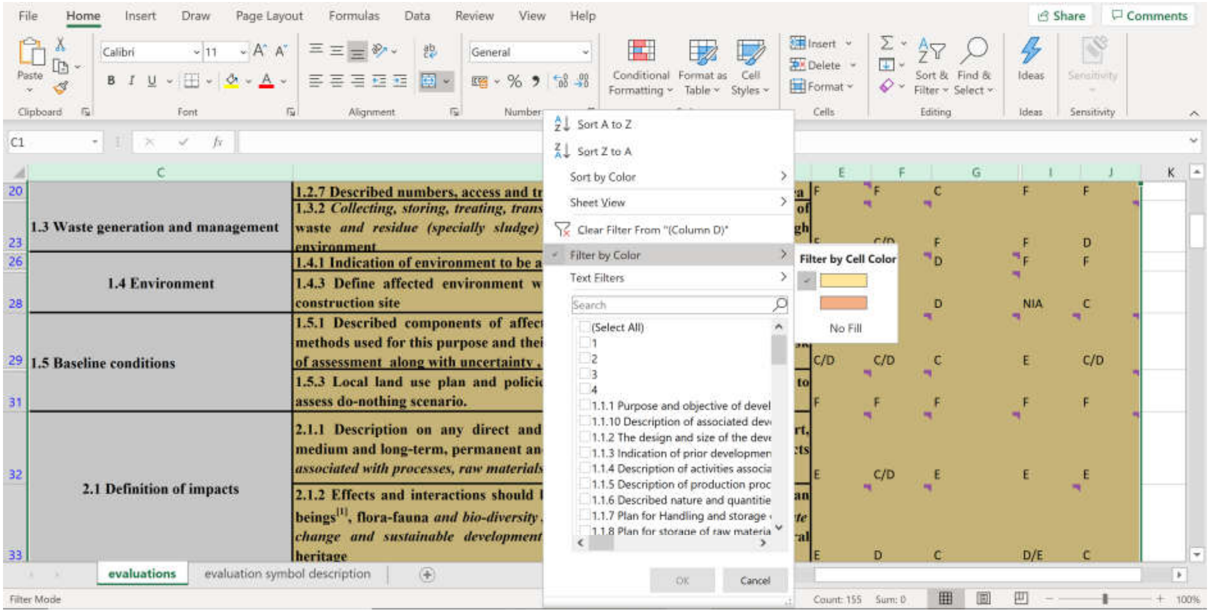

Figure 2.12 Using filter function to sort the evaluation on the designated sub-categories in EIS review process

Source: Author's own work

c) <u>Analysing data using "countif" function</u>

The evaluations are interpreted as satisfactory if the symbols appear A, B or C, and unsatisfactory if the symbols appear D, E and F. Thus, for each of the sorted sub-categories, the satisfactory and unsatisfactory responses can be summed up using the "countif" function (figure 2.13). This helps in identifying and estimating the sub-categories performed poorly in the EISs and also the ones those are adequately addressed.

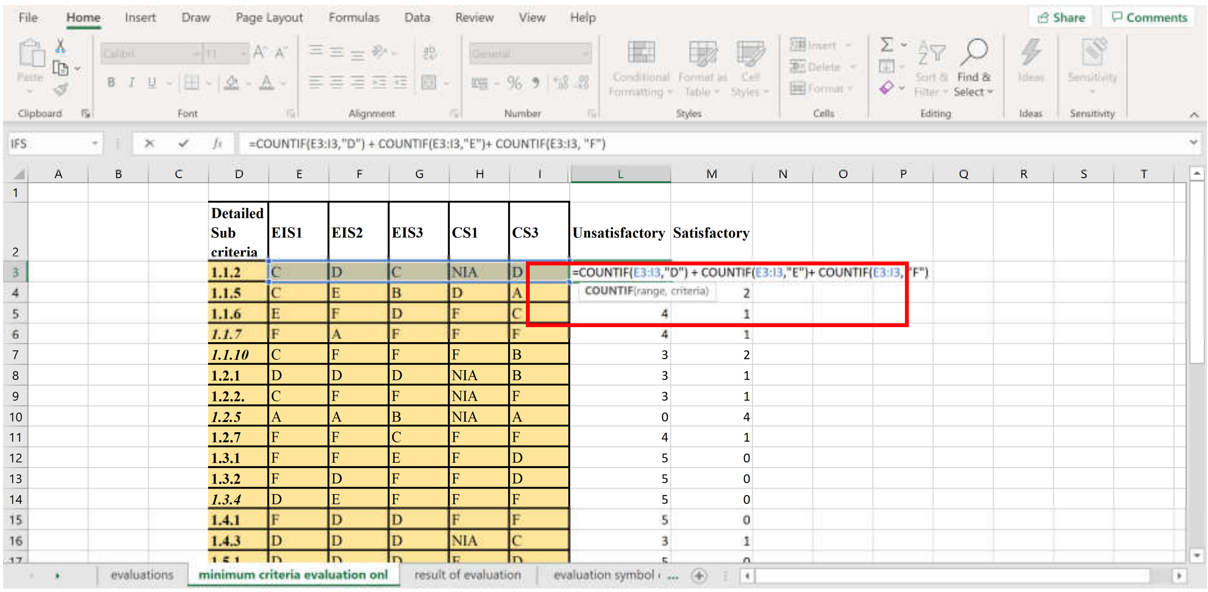

Figure 2.13 Using 'Countif' function to understand performance of the sub-categories in EIS review process

Source: Author's own work

Alongside, the symbols assigned to the sub-categories for evaluation in each of the reports are also calculated using the same function (figure 2.14).

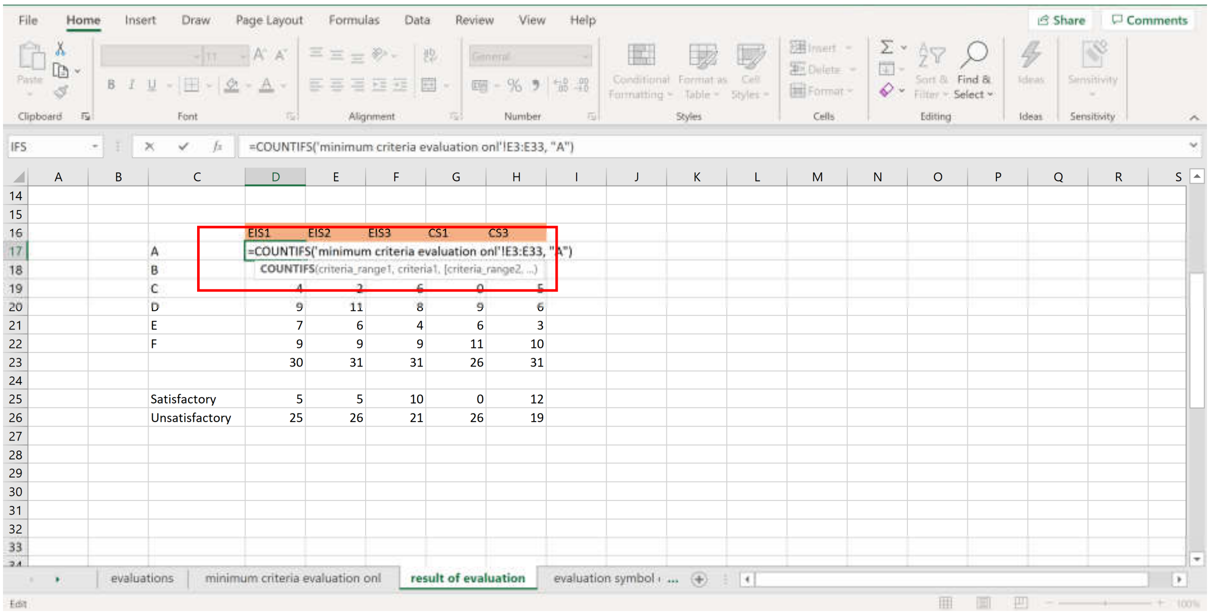

Figure 2.14 Using 'Countif' function to understand performance of the EISs, in EIS review process

Source: Author's own work

d) <u>Analysing data using 'sum' function</u>

The number of sub-categories performed satisfactorily or unsatisfactorily are estimated using the "sum" function. The number of responses receiving symbols A to C is summed up as satisfactory and number for responses for symbols D to F is summed up as unsatisfactory (figure 2.15).

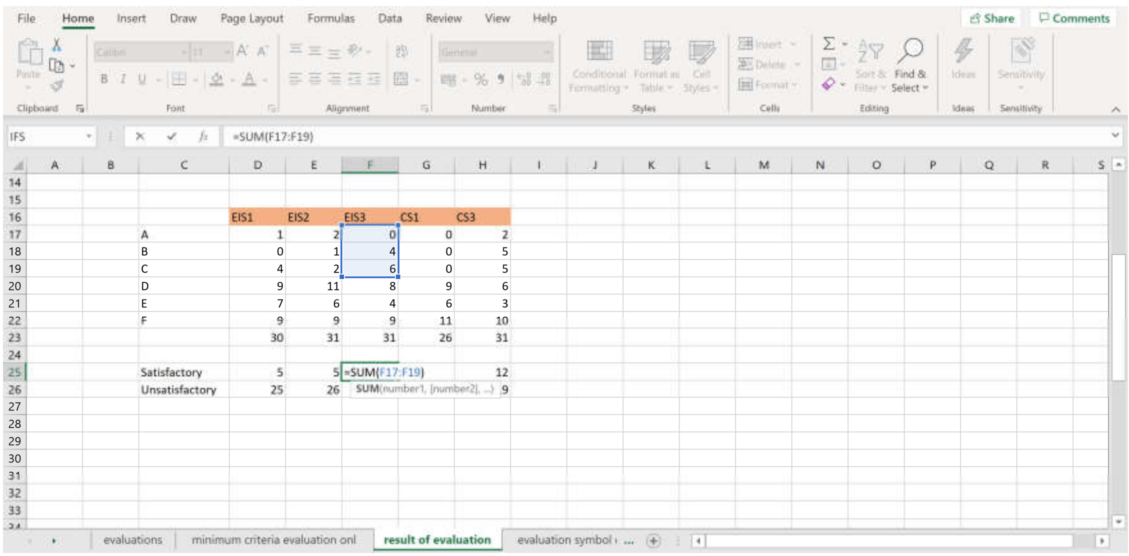

Figure 2.15 Using "sum" function to calculate number of sub-categories performed satisfactory or unsatisfactory in EIS review process

Source: Author's own work

e) <u>Visualizing the performance of the EISs using the chart</u>

Finally, the Performance valuation of the EISs is depicted using a chart produced from the last section (figure 2.16). The steps followed here are Selection of data range>insert> Column> 2D column>100% stacked column. The reason of choosing 100% stacked column was to avoid the impact of the missing information from one of the reports.

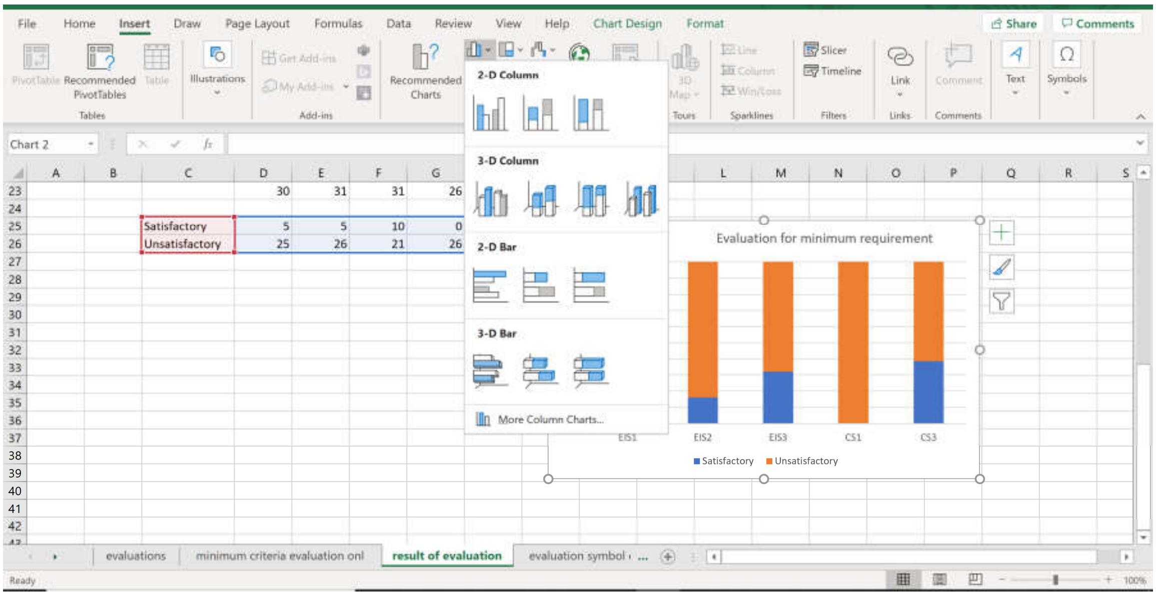

Figure 2.16 Visualizing the outcome of the evaluation by producing chart in EIS review process
Source: Author's own work

Chapter summary

This research explores the role of EIA system in delivering environmental sustainability within the textile industry of Bangladesh by evaluating both theoretical (system requirement) and empirical (pre and post decision EIA practice) dimensions of EIA. The aim and objectives are attained using six consecutive stages in the research strategy starting from problem identification, context setting to developing recommendations. Four qualitative research methods (i.e., face-to-face interview, literature review, document analysis and case study analysis) are used for this purpose. NVivo and MS Excel are the two main software used in data analysis of this research.

Section B: Understanding textile industry, its impact on environment and relevant environmental policy instruments

Chapter Three: The textile industry and its environmental impacts

Chapter three provides understanding of the textile industry and its impacts through three major sections. The first section discusses economic importance and definition of textile industry. The second section describes this industry's structure through the manufacturing processes and components. Finally, the last section is focussed on environmental impacts induced from the processes specific to textile industry by resource (i.e., water, energy) consumption, chemical usage, and waste (i.e., wastewater, solid waste, air emission) generation. This chapter uses extensive literature review to establish the first part of the first objective. Outcome of this chapter helps the second and fifth objective by supporting construction of framework of analysis and formulation of recommendation respectively.

3.1 Definition and importance of textile industry in the world economy

> "Textiles represent one of the earliest human craft technologies, and they have always been a fundamental part of subsistence, economy and exchange". - Strand, et al. (2010, p.150)

Earliest textile components can be dated back to Upper Palaeolithic era with variety of items (e.g. knotted nets, basketry, plain woven and twilled objects, braided cordage) identified in Czech Republic (Adovasio, et al., 1996; Soffer, et al., 2000). In fact, dyed-printed specimens of clothes existed as early as sixth, fourth and second century BC in China, India and Rome respectively (Encyclopedia Britannica, 2021). Since inception, weaving remained as cottage industry for until 18th century (Adanur, 2000; Encyclopedia Britannica, 2021). It gradually gained pace through development of machineries (e.g., handloom, power loom, replacement of waterpower with steam power) from around the period of industrial revolution (Adanur, 2000; Encyclopedia Britannica, 2021). Development of modern machineries kept progressing through following centuries elevating the rate of production and reducing the price of the products. Around in 20th century nearly fully automated machines were deployed in production wherever possible (Encyclopedia Britannica, 2021).

The term "textile" can be traced back to seventeenth century, originating from Latin noun textilis (woven) and French verb texere (to weave) (Encyclopedia Britannica, 2021; Lexito.com, 2021; Online Etymology Dictionary, 2021). Historically "textile" was referred to the woven fabric, however with the course of time, number and variety of components have expanded (Encyclopedia Britannica, 2021). Now, textile industry is commonly known as the industry with units producing fibre, yarn, fabric and garment (Madhav, et al., 2018; Parisi, et al., 2015; Karthik & Gopalakrishnan, 2014). the last is sometimes also considered as a separate industry named ready-made garments (RMG) or apparel or fashion industry (European Union, 2017). Together they can be called textile and clothing industry. However, for the purpose of this research, this industry is identified simply as Textile industry.

Therefore, Textile industry is a wide-ranging sector involving number of activities, "from raw materials production, through their processing in yarns and fabrics, dyeing and finishing operations, up to the final garment sewing"- (Parisi, et al., 2015, p. 515)

Global market for textiles was estimated at USD 942.8 billion in 2020 (ReportLinker, 2020). Considering the impact of COVID crisis, the market is expected to grow at compound annual growth rate of 2.7% and reaching at USD 1.1 trillion by 2027 (ReportLinker, 2020). Schumann, et al. (2020) considered textile industry as the "cornerstone" of development with vast socio-economic impacts for many countries of the world. Supply chain[11] of global clothing industry employs more than 300 million people (Turnbull, et al., 2020). In year 2019, China, Europe and India were among the top three exporters of textile (39.2%, 21.7% and 5.6% respectively). While China, Europe and Bangladesh were top three clothing exporters in the same year (30.8%, 27.6% and 6.8%) (WTO, 2020). European Union was the largest importer of both textile and clothing in 2019. While Bangladesh is one of the top exporters of clothing, it needs to import large amount of textile to make that possible (Selim, 2018). In 2019, Bangladesh was the fifth largest importer of textile, just after China (see WTO (2020) for more statistics).

3.2 Structure of textile industry

Textile industry comprises diverse activities (Parisi, et al., 2015; Pérez, et al., 2017; Madhav, et al., 2018; Ghosh & Gangopadhyay, 2000) related to fabrication and processing of textile associated commodities[12] (Madhav, et al., 2018). Therefore, insight on the manufacturing activities and commodities (i.e., components) can help understanding the structure of this industry.

3.2.1 Manufacturing process within textile industry

Textile industry as a complex sector involves a variety of manufacturing processes through the entire production cycle (Karthik & Gopalakrishnan, 2014; Pérez, et al., 2017; Madhav, et al., 2018; Ren, 2000). These processes include obtaining, processing of raw material and producing yarn; transforming yarn into fabric, processing the fabric to add quality and finally altering

[11] definition in 3.2.1
[12] fibres, yarn, fabric, clothing, household and industrial products

fabric into clothing (Madhav, et al., 2018; Karthik & Gopalakrishnan, 2014; Ghosh & Gangopadhyay, 2000; Uddin, 2019). The four key manufacturing processes within this industry require specialized skill and equipment (Strand, et al., 2010; Pérez, et al., 2017; Madhav, et al., 2018; Radhakrishnan, 2015). These manufacturing processes move in sequence and therefore product of one process can serve as raw material in other. Such flow of goods within and among businesses can be termed as supply chain[13] (figure 3.1) (Begum & Das, 2018). There can be separate industrial units specializing on each of the process or they can exist together within a composite unit.

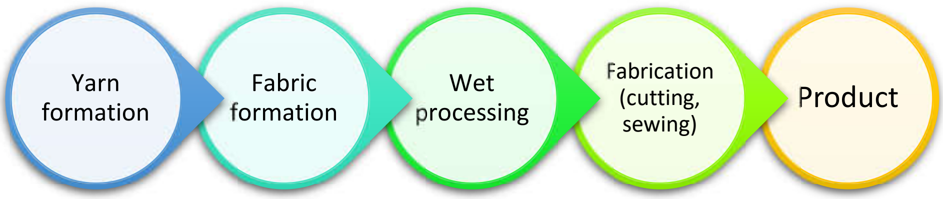

Figure 3.1 Simplified textile and clothing supply chain
Source: Adapted from Choudhury (2014)

The key manufacturing processes within textile industry are-

i. Yarn Manufacturing (i.e., spinning)

ii. Fabric manufacturing

iii. Wet processing (i.e dyeing-printing-finishing) and,

iv. Textile fabrication (i.e., Clothing preparation)

Flow diagram of the processes within textile industry is shown in figure 3.2 (Radhakrishnan, 2015). Details of these manufacturing processes are described in the following sub-sections.

[13] If elaborated, scope of supply would include all sorts of organizations involved in transportation, sourcing, warehousing, information processing etc.

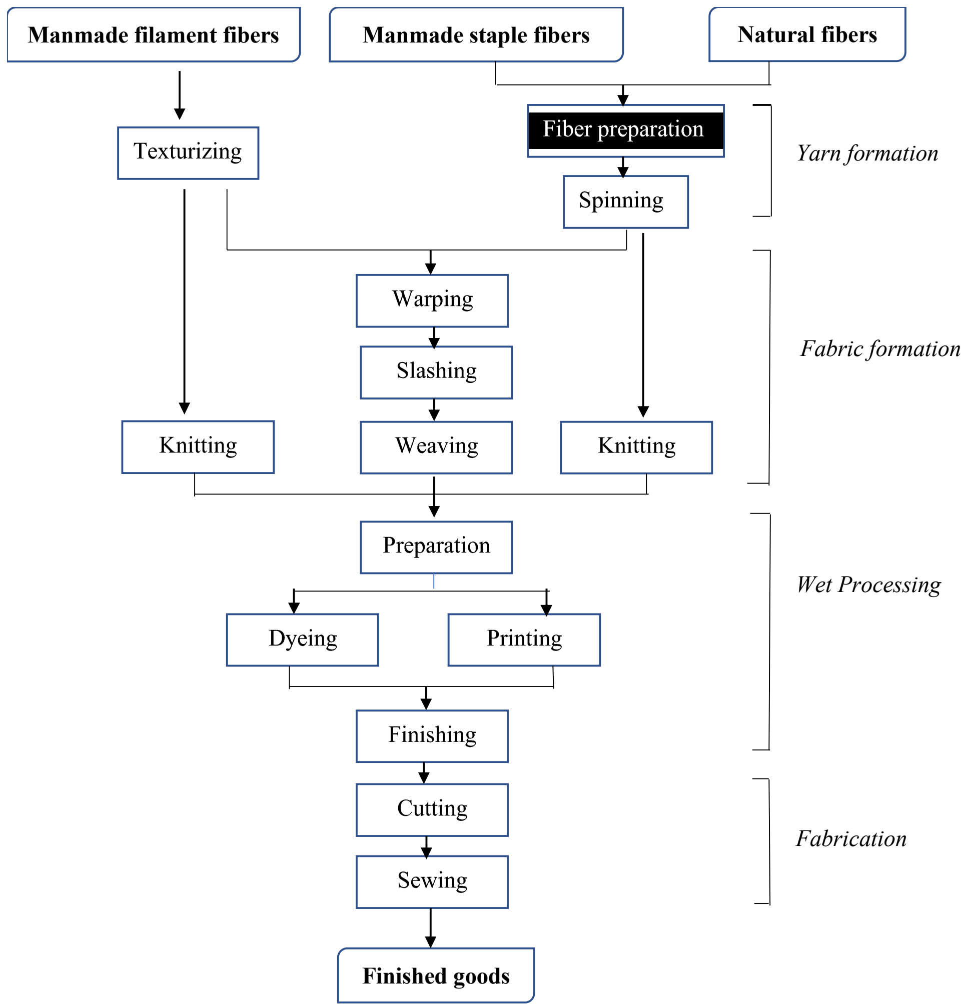

Figure 3.2 Process flow diagram of processes within textile industry

Source: Prepared from Radhakrishnan (2015, p.310)

i) Yarn manufacturing or Spinning

Yarn manufacturing activity starts with obtaining and preparation of fibre (Uddin, 2019). Broadly the fibre sources can be divided into natural and man-made (Pérez, et al., 2017). Typology of fibres is discussed in section 3.2.2.

Spinning is known as the process of converting the fibre mass into yarn through twisting and drawing out (Strand, et al., 2010). In between the raw material goes through several stages (shown in figure 3.3). Details on these stages can be found on Alagirusamy & Das (2015).

Ring spinning, rotor spinning, hollow-spindle spinning, air-jet spinning; dry spinning, wet spinning, melt spinning are some of the spinning processes used in this industry (Alagirusamy & Das, 2015).

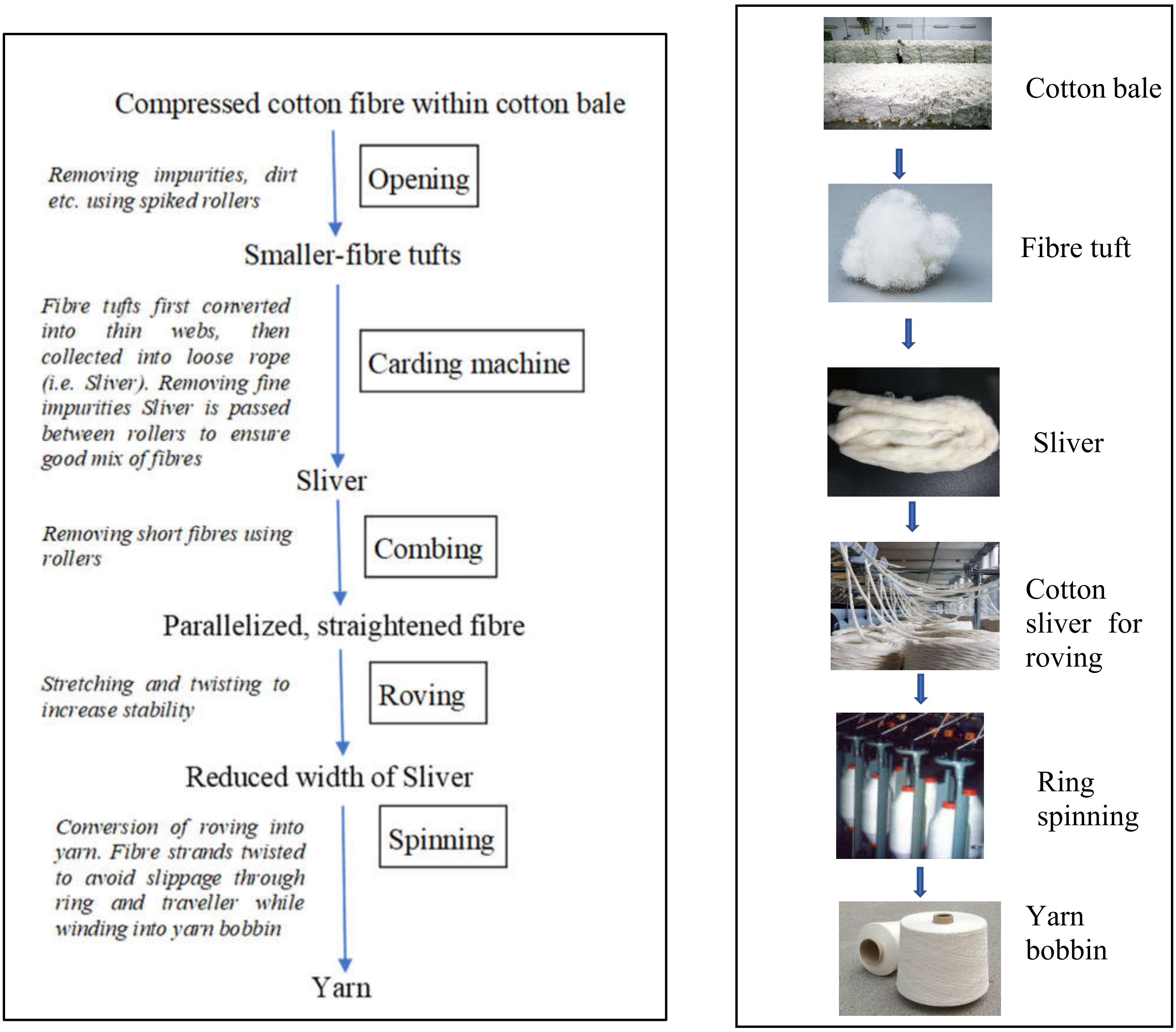

Figure 3.3 Process flow diagram of yarn manufacturing (through ring spinning)

Source: Flow diagram adapted from Alagirusamy & Das, (2015) and photo from IndiaMART (2021); English fine cotton (2016)

ii) Fabric manufacturing

Fabric manufacturing takes place through conversion of yarn into two-dimensional structure (Strand, et al., 2010; Uddin, 2019). It is commonly known as weaving being one of the earliest and most common fabric formation methods (Shaker, et al., 2016; Wadje, 2009; Stankard, 2015; Ujiie, 2015). However, these days, variety of formation techniques are used to manufacture fabric. Weaving, knitting, braiding, felting and tufting are some of the commonly used techniques (Shaker, et al., 2016; Pérez, et al., 2017).

<u>a) Weaving</u> involves interlacing of two sets of threads. The warp threads run vertically through the length and weft (or filling) threads run horizontally across the width of fabric (Stankard,

2015; Adanur, 2000; Pérez, et al., 2017). Stages of weaving depends on the type of yarn used (figure 3.4). More can be found at Adanur (2000) regarding this.

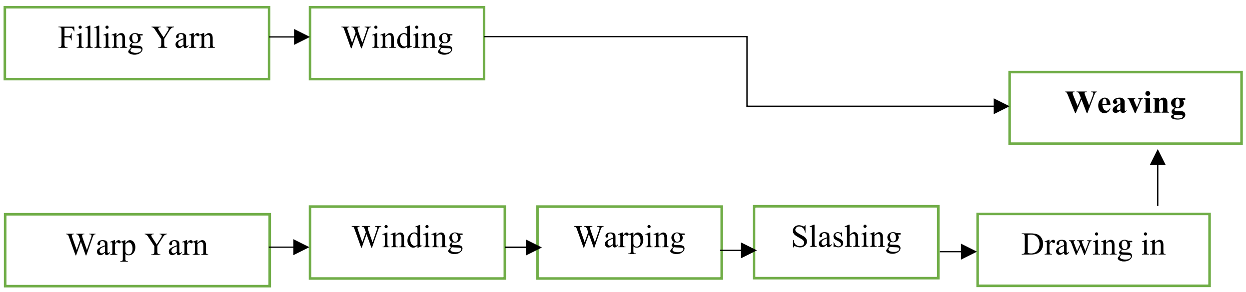

Figure 3.4 Stages in weaving process
Source: Adanur (2000, p.36)

b) Knitting is the second largest and fast emerging technique of fabric manufacturing (Shaker, et al., 2016). Knitting refers to interlooping of one yarn system to manufacture textile (Adanur, 2000). Quoting Shaker, et al. (2016, p.09), "Knitting is fabric formation technique in which the yarn is bent into loops and those loops are interconnected to form fabric". Two major techniques followed in knitting are weft and warp knitting (Pérez, et al., 2017; Adanur, 2000). These are shown in figure 3.5.

c) Braiding refers to generating fabric from intertwining two to three yarns in alternative fashion following certain algorithm (Pérez, et al., 2017; Adanur, 2000). Here yarns are intertwined diagonally towards edge of the fabric (figure 3.5) (Pérez, et al., 2017). Braiding does not require to go through preparatory processes and thus is often known as the simplest way of fabric formation (Adanur, 2000).

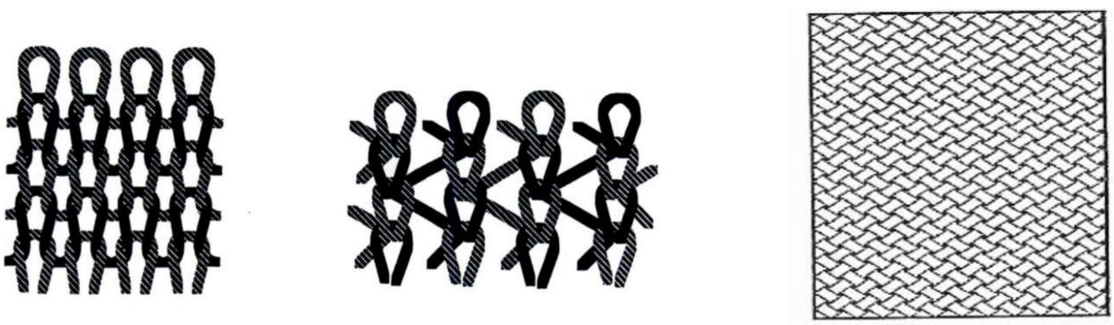

Figure 3.5 (from left) Schematic of weft knit, warp knit, braided fabric
Source: Adanur (2000, p.03)

d) Non-woven fabric manufacturing is an emerging manufacturing process (Uddin, 2019) due to ease of production process (Shaker, et al., 2016). According to the standard ISO-9092:2017, the nonwovens are: "sheet of fibres, continuous filaments, or chopped yarns of any nature or origin, that have been formed into a web by any means, and bonded together by any means, with the exception of weaving or knitting" (ISO, 2017). Steps of producing non-woven fabric is shown (figure 3.6) from Shaker, et al. (2016, p.20). Details can be found in Shaker, et al. (2016).

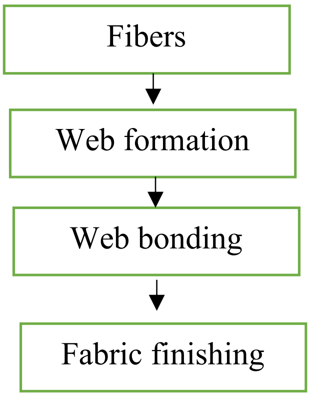

Figure 3.6 Steps of Non-woven manufacturing process

Source: Shaker et. al, (2016)

iii) Wet processing

This process is referred as 'finishing' by some experts (Strand, et al., 2010; Pérez, et al., 2017) while others call it 'wet processing' (Madhav, et al., 2018; Wadje, 2009; Choudhury, 2014; Radhakrishnan, 2015). For convenience, this stage of textile manufacturing process will be referred to as wet processing throughout this report.

Wet processing is known as 'key stage' and 'value addition' in textile manufacturing as it adds highest worth by providing elegance and practical properties to yarn, fabric or garment (Madhav, et al., 2018; Uddin, 2019).

> "Wet processing is the most water, energy and pollution intensive, especially for natural fibres" - Ren (2000, p. 473)

Jiang, et al. (2010) claims, dyeing within the wet processing accounts for more than 80% of the textile sector's total wastewater. Considering environmental impacts of wet processing, it will be discussed in detail in this report.

There are three main stages in wet processing a) pre-treatment, b) coloration, c) finishing (Radhakrishnan, 2015; Wadje, 2009; Uddin, 2019). The stages are shown in figure 3.7 followed by description.

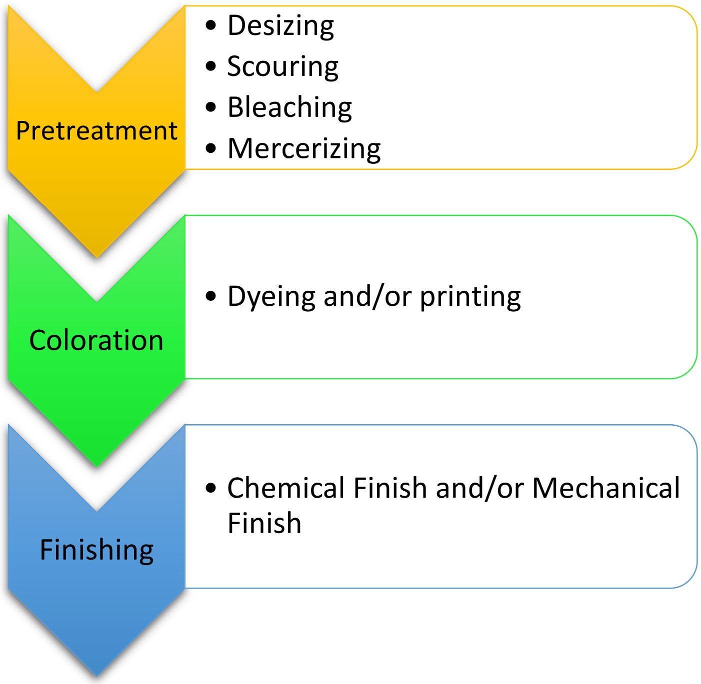

Figure 3.7 Stages in wet processing

Source: Adapted from Madhav, et al. (2018); Radhakrishnan (2015); Wadje (2009)

a) <u>Pre-treatment</u>

Pre-treatment is the stage where yarn or fabric or garment is prepared before entering the coloration process. Pre-treatment serves two purposes: removal of unwanted contents (i.e., dust, lint, colour) from the item and adding or altering aesthetic and functional property (i.e., softness, absorbency, strength, brightness) (Uddin, 2019; Parisi, et al., 2015). Determination of the process depends on intended use, demand of user, amongst other factors (Hauser, 2015).

De-sizing is the first stage of pre-treatment, performed for removal of sizing elements. Sizing is performed by applying chemical solution to the yarn for the ease of weaving or knitting. But presence of its elements hamper coloration and finishing process, thus de-sizing is required (Madhav, et al., 2018; Wadje, 2009).

Scouring is the next stage after de-sizing. Scouring is the process of removal of fat, wax, or water insoluble impurities (Wadje, 2009; Madhav, et al., 2018; Hauser, 2015). This increases absorbency of the textile component and eases further processing (Wadje, 2009).

Bleaching is the process of decolourisation of the natural colour present in the textile component and allow for appropriate appearance of colour after dyeing (Madhav, et al., 2018; Hauser, 2015).

Mercerizing is performed after bleaching to increase shine and strength along with the enhancement of dye absorption capacity (Madhav, et al., 2018; Hauser, 2015).

Chemicals used in these stages are discussed in section 3.3.

b) Coloration

After the fabric is prepared in pre-treatment stage, pigment containing chemical solution is applied to textile component to provide colours (Madhav, et al., 2018). Applying pigment to whole or larger segment of textile component is known as dyeing (Samanta, et al., 2019). Dyeing is deemed as the most important stage considering the technical complexity and high value addition within textile industry (Jiang, et al., 2010). It is notably resource intensive (Kiran-Ciliz, 2003; Moore & Ausley, 2004) and release most amount of pollutants in textile processing (Madhav, et al., 2018; Ren, 2000). According to Richards (2015), Chemical reaction between dye and fabric is responsible for adherence of dye to fabric. To increase absorption of dye into the textile, numerous chemicals can be added, most of which are polluting. These are known as dye auxiliaries[14] (SDC, 1988). Selection of dye and process of dyeing depends on nature of fibre, variety and quality of fabric and quality standards required from final product (Kumar, 2018). For example: vat dyes, reactive dyes, direct dyes are suitable for cellulose fibres, disperse dyes are suitable for acrylic and polyester (Richards, 2015).

Printing is applied on the desired segment of fabric depending on the intended design (Madhav, et al., 2018). It is often referred as localized dyeing due to application in a smaller area compared to dyeing (Madhav, et al., 2018; Samanta, et al., 2019). Most commonly used printing chemical is Urea, which has high pollution load value (Babu, et al., 2007). Details on printing can be found at Ujiie (2015)'s research.

c) Finishing

Finishing is an integral process for both natural and man-made fabrics depending on intended durability and application (Pérez, et al., 2017). Wide-ranging finishing agents are

[14] 'A chemical or formulated chemical product which enables a processing operation in preparation, dyeing, printing or finishing to be carried out more effectively or which is essential if a given effect is to be obtained'- SDC (1988)

used to add precise traits in the refined fabric (Madhav, et al., 2018). Finishing can be divided into two major categories: mechanical finishing and chemical finishing. Mechanical finishing is used for smooth or fuzzy finishes, while chemical finishing can be used for water repellence, flame retardance, antimicrobial finish, mothproofing among others (Wadje, 2009).

iv) Textile fabrication

The final product of textile industry can be apparel, home furnishing or industrial/technical textile (Adanur, 2000; Canavan, 2014). Apparel or RMG industry is an organized sector where each worker specializes in one or few operation (Wadje, 2009). The fabric is cut, grouped by similar part in a bundle. A specific bundle moves to the specialized worker to perform her task and place it in buffer (Wadje, 2009).

3.2.2 Components of textile industry

Textile and apparel supply chain as one of the most diverse in terms of raw material and products along with deployed technology (Begum & Das, 2018). Four main categories of commodities or components resulting from manufacturing processes within textile industry are: a) fibre, b) yarn, c) fabric and d) clothing. Specialized manufacturing units in textile industry act as backward and forward linkages[15] among themselves. For example: fibre is the raw material in yarn manufacturing (spinning units), yarn is raw material in fabric manufacturing (weaving units) (figure 3.8). Therefore, spinning units are backward linkage to weaving units, while weaving is forward linkage to spinning units. Along with the basic materials, other raw materials like water, energy, chemicals are also required in these manufacturing processes. Alongside the product, each of them generates polluting elements for environment as output (figure 3.9).

[15] Backward linkage for an industrial unit provides substantial input to the latter's production process. the latter known is the forward linkage to the first (Implan Group, 2021).

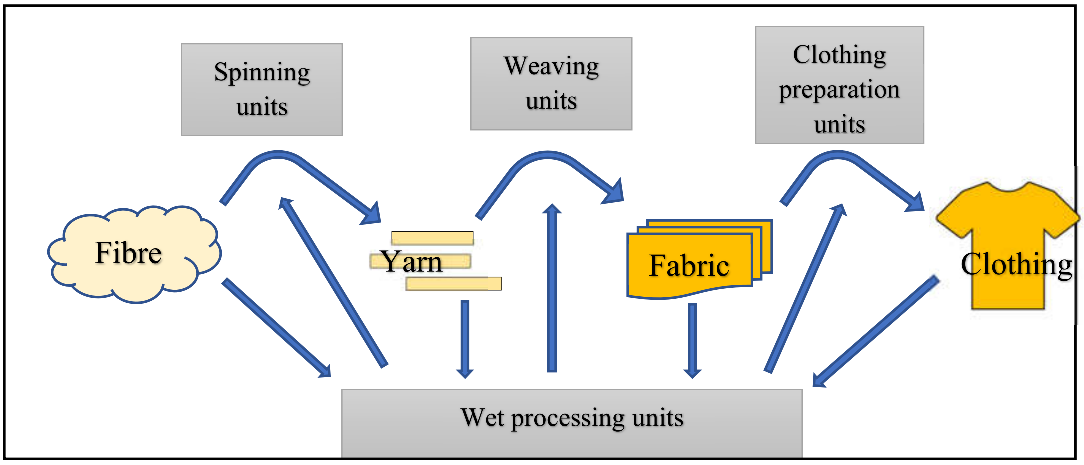

Figure 3.8 Relationship between manufacturing processes and components within textile industry

Source: Prepared by author

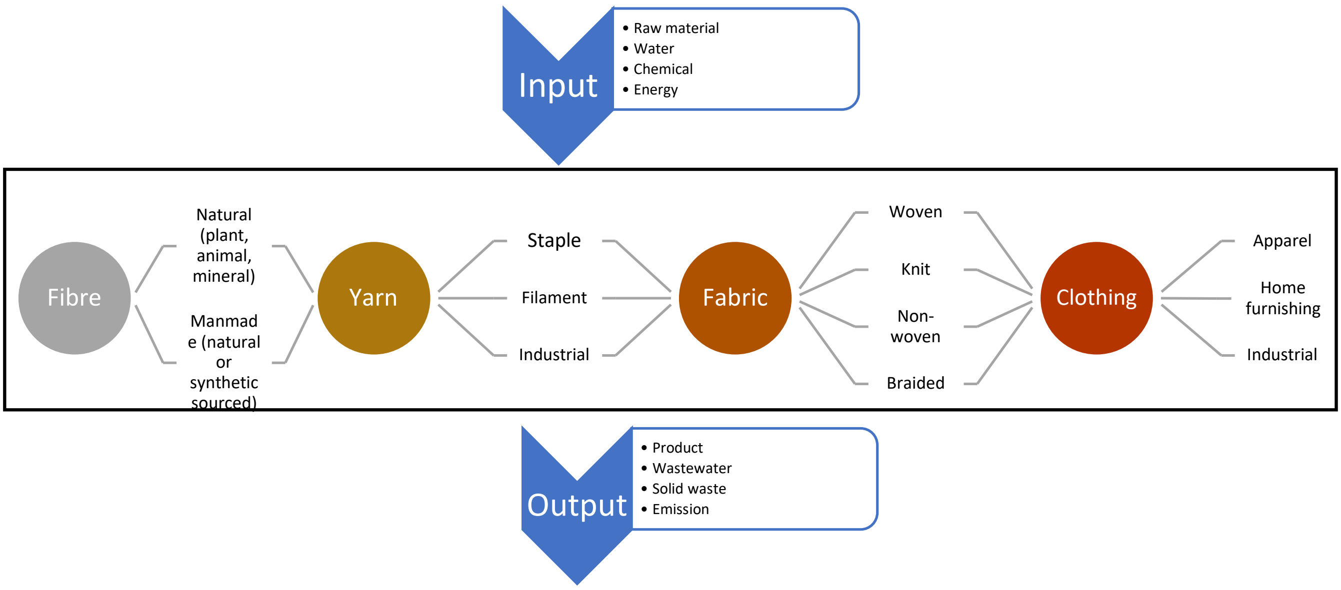

Figure 3.9 Simplified material flow diagram in textile industry's fibre to fabric process

Source: Adapted from Adanur (2000); Choudhury (2014); Resta, et al. (2016); Alagirusamy & Das (2015); Grishanov (2011); Uddin (2019); Canavan (2014)

The major components of textile industry are discussed briefly-

i) Fibre

Fibre is either sourced naturally or produced in industry. There are three natural sources of fibre: plant, animal and mineral (Grishanov, 2011). On the other hand, manmade fibres are divided into three types: natural polymer based (i.e., viscose); synthetic polymer-based fibres (i.e., polyester, nylon and acrylic) and other (i.e., carbon, glass) (Grishanov, 2011).

Fibre with fixed length is known as staple fibres, while the ones with unlimited length are known as filament fibres. Natural fibres both have staple (i.e., cotton) and filament fibre (i.e., Silk) forms. Man-made fibres are initially produced as filament, then cut down according to requirement (Grishanov, 2011).

ii) Yarn

> "Yarn may be defined as a linear collection of filaments or fibres in a twisted state or bound by other means and possessing good tensile strength and elasticity properties" - Alagirusamy & Das (2015, p. 159).

Based on physical properties and functionality, major types of yarns are staple yarn, filament yarn and industrial yarn (Alagirusamy & Das, 2015).

Staple yarn is produced by twisting strands of fibres to produce length. Filament yarn can also be used to produce staple fibre. Cotton yarn is staple yarn (Alagirusamy & Das, 2015).

Filament yarns are produced either naturally(i.e. silk) or manufactured by squeezing out polymer solution through a spinneret (Alagirusamy & Das, 2015).

Industrial yarns are produced to serve specific function, thus demand specific treatment to perform under required conditions. Asbestos, glass yarns, rubber threads, elastic threads are some of the examples of industrial yarn (Alagirusamy & Das, 2015).

iii) Fabric

Fabric is the two-dimensional product manufactured from yarn (Strand, et al., 2010; Uddin, 2019). Major categories of fabrics based on their production process are woven, knitted, braided and non-woven (discussed in (ii) within section 3.2.1 of this chapter).

iv) Clothing

The final product of textile industry can be diverse including apparel, home furnishing or industrial/technical textile (Adanur, 2000; Canavan, 2014). Generic term "clothing" is used in this study as globally industry is often called "textile and clothing industry". The term "Apparel" represents the garment or fashion wear used as protective or decorative product (Canavan, 2014).

Home furnishing products are used for practical and functional purpose of covering and protection of interior items or furniture (e.g., bedding, towel, napkin) (Canavan, 2014).

Industrial textile alternatively known as technical textiles, serve specific functions where aesthetics is not priority. Medical textile (e.g. in device, surgery) transportation textiles (e.g. used in vehicles or by vehicle users), protective clothing are some of the examples of technical/industrial textile (Jason Mills, 2021; Canavan, 2014).

3.3 Environmental impacts of manufacturing processes within textile industry

Textile and clothing sector is now a matter of public dialogue in the issues of climate change, chemical society, water shortage and human rights (Boström & Micheletti , 2016). Social impacts of this industry are listed as inequitable trading conditions due to limited access to information and market; poor working conditions from low wages, child labour, long hour, worker health, gender inequity; welfare of the animals farmed for raw materials like fur (DEFRA, 2007). Ene (2021) noted only 2% among the 75 million factory workers employed within the clothing industry, earn a living wage.

On the other hand, textile industry is known as the second most polluting industry after oil (Ene, 2021). The current trend of fast fashion[16] is resulting in increased dumping of textile products and making the industry significantly unsustainable compared to other sectors (Boström & Micheletti , 2016). According to ILO (2021, p. 15), "the increase of fast fashion has stimulated demand for fast, cheap and low-quality goods. It is both the growing volume of garment production and how these garments are used and disposed of that has meant climate change impacts from the sector are increasing". Between 2005 to 2016, the climate impact of various production stages in the apparel sector increased by 35 per cent and is projected to continue to increase under a business-as-usual scenario (Quantis, 2018). Fast fashion occupies one fifth of UK's market (DEFRA, 2007). DEFRA (2007) warns that since UK imports 90% of its clothing, its significant impacts are mostly experienced overseas. Similar concerns were expressed by Sajn (2019)

> "Clothing accounts for between 2% and 10% of the environmental impact of EU consumption. This impact is often felt in third countries, as most production takes place abroad". – Sajn (2019, p. 01)

[16] "Characterized by low cost, short lifetime garments"- (DEFRA, 2007)

DEFRA lists key environmental impacts resulting from the stages of manufacturing processes within textile industry. These include: i) significant water use, toxicity from fertilizer, pesticide and herbicide use for conventional cotton growing; ii) energy use, resource depletion and Greenhouse gas (GHG) emissions from fossil fuels while producing synthetic fibres; iii) Water use, toxicity, hazardous waste and effluent associated with pre-treatment chemicals; iv) dyes and finishes at textile fabrication stage (DEFRA, 2007). Quoting from Sajn (2019, p. 03),

> "In 2015, the global textiles and clothing industry was responsible for the consumption of 79 billion cubic metres of water, 1715 million tons of CO2 emissions and 92 million tons of waste. It also estimated that by 2030, under a business-as-usual scenario, these numbers would increase by at least 50%*"*.

Till date, numerous research have been carried out to identify environmental impacts induced from textile industry and recommendations for minimizing them (Choudhury, 2014; Ren, 2000; Karthik & Gopalakrishnan, 2014; Radhakrishnan, 2015; Rana, et al., 2015; Jena, et al., 2015; Sajn, 2019; Madhav, et al., 2018; Uddin, 2019; Y & Connell, 2015). Experts suggest, the factors making life cycle of textile and clothing unsustainable are: i) water use and contamination, ii) profligate use of harmful and toxic chemicals, iii) excessive use of non-renewable resources like energy, iv) waste production and v) transportation from countries of production to countries of use, vi) direct Carbon-di-oxide (Co_2) emission (Sherburne, 2009; Resta, et al., 2016; Choudhury, 2014). This research has only concentrated on the bio-physical impacts but as mentioned above, the sector is associated with various socio-economic impacts as well.

Summarizing, three key areas causing environmental impacts from textile industry are–

i) Resource consumption
ii) Use of chemicals
iii) Generation of waste (i.e., liquid, solid and gaseous waste)

In general, these areas are attributable to impacts like scarcity of resources, degradation of air and water quality, threatening sustainability of ecosystem and human health through toxic waste generation and emission, adding to greenhouse effect and global warming including many others (Karthik & Gopalakrishnan, 2014; Choudhury, 2014; Radhakrishnan, 2015; Sajn, 2019; Boström & Micheletti , 2016; Slater , 2003; Y & Connell, 2015). These three key areas with their sources and associated impacts are described below-

3.3.1 Resource consumption

Rapidly industrializing countries are experiencing significant consumption of natural resources coupled with environmental degradation in past 40 years which is often disregarded (Van der Voet, et al., 2009; European Environment Agency, 2005). Textile and clothing industry are no exception to that. All the stages of textile and apparel production (see section 3.2.1) consume vast amounts of energy, water and chemicals (Parisi, et al., 2015; European Union, 2017). Such consumption results in huge amount of waste generation (Karthik & Gopalakrishnan, 2014). Low process efficiency is a common practice in this industry that bring about significant wastage of resource and damage to environment (Karthik & Gopalakrishnan, 2014).

i) Sources of water consumption within textile manufacturing

Water consumption in this sector starts with raw material production. Cotton is considered as one of the main fibres in the globe (35% of the fibre consumption) and involves large scale agricultural practice and high demand of water (Y & Connell, 2015; Draper, et al., 2007; United States Department of Agriculture, 2013). Inefficient production practice can lead towards consumption of 3400 gallons of irrigated water to grow 1 pound (lb) cotton (Y & Connell, 2015).

Preparation stages of fibre and fabric require water in form of solvent or washing agent (Y & Connell, 2015; Madhav, et al., 2018). As a matter of fact, different uses of water in this industry are- a) as medium; b) solvent for diluting chemicals; c) washing agent after almost every process and d) producing vapor for heating the process baths (Madhav, et al., 2018). Here, mechanical processing (i.e., spinning and weaving) consume lot less water than the chemical processing (i.e., wet processing) since water is essential for the latter (Samanta, et al., 2019).

Water and chemical, both are required in all the stages of wet processing (see (iii) in section 3.2.1) for applying the chemicals and rinsing off before beginning the next stage (Choudhury, 2014; Samanta, et al., 2019). About 100–150L of water is needed for processing 1kg cotton textile (Samanta, et al., 2019). Around 16% of the total water consumption in an average textile mill is attributable to dyeing and 8% in printing (Parisi, et al., 2015). Water requirement for dyeing dependent on the process (Samanta, et al., 2019). Textiles resistant to dye absorption can require up to eight dye baths for attaining the desired colour, each bath requires fresh-water input (Hessel, et al., 2007). On the other hand, fibre sources from animals (i.e., wool and silk) also require great amount of water primarily for scouring and coloration process. In fact, bleaching of cellulose fabric requires more water than any other wet processing.

Apart from the core manufacturing processes, poor housekeeping and maintenance, inefficiency of equipment and processes can also contribute towards excessive water consumption (Choudhury, 2014).

ii) Sources of energy consumption within textile manufacturing

In textile industry, electricity is mainly consumed while operating machineries, controlling temperature within processes (heating or cooling or providing convenient temperature) and finally powering light and office equipment (Rana, et al., 2015).

Mechanical processes like yarn manufacturing, yarn preparation for fabric manufacturing, weaving or knitting consume energy (Y & Connell, 2015). On the other hand, production of polyester fibre and yarn both are energy intensive, requiring 5-4 times energy than the conventional cotton (Cherrett, et al., 2005).

Within the total energy used in this industry, around 23 % is consumed in weaving, 34 % in spinning, 38 % in chemical processing and the rest (5%) is used in miscellaneous purposes (Choudhury, 2014). The wet processing stage mainly utilizes thermal energy (i.e., heat), and the mechanical processes of spinning and weaving primarily require electric power (Choudhury, 2014; Richards, 2015). Drying wet textile and running the processing machines are the two ways of major energy usage in this industry (Samanta, et al., 2019). A significant amount of thermal energy is lost during steam generation (Choudhury, 2014), which could be potentially utilized followed up process optimization or upgradation of equipment (Hasanbeigi, 2010).

Apart from the processes within industry, transportation of final product from country of production to country of use also involves use of fuel and causes emission (Choudhury, 2014; Sherburne, 2009).

iii) Environmental impacts of resource consumption in textile manufacturing

After agriculture, textile and associated industries are considered to be the second highest consumer of water (Oecotextiles, 2012). An average size textile mill (producing 8000kg fabric a day) consumes around 1.6 million litres of water everyday (Kant, 2012). However, the amount of water used within a unit varies depending on the processes, the used equipment and management practice (Samanta, et al., 2019; Madhav, et al., 2018). Globally, this industry's water consumption in 2015 (79 billion cubic meters) had the capacity to fill 32 million Olympic-size swimming pools (Ene, 2021). The consumption of global energy industry in 2014 was almost 35% less (52 billion cubic meters) than this amount (Ene, 2021). In year 2020, globally demanded textile production alone consumed 7 trillion litres of water (Siegle, 2011). While. production of a single t-shirt consumes 2,700 litres of water (European Union, 2017), production of a regular cotton shirts consumes about 2500-3000L of water (Choudhury, 2014). Water required for production of a t-shirt can serve as drinking water for a person for three years (European Union, 2017). Globally 2 billion t-shirts are bought every year (European Union, 2017) so it's impact on water scarcity is presumable. On the other hand, it takes around 7,000 litres of water to produce one pair of jeans, equivalent to a person's consumption of 5-6 years (Fashion Revolution Germany, 2018). As wet processing involves the largest amount of water requirement within this industry, it also generates almost equal volume of wastewater (Karthik & Gopalakrishnan, 2014). See (iv) of section 3.3.3 for impacts of wastewater.

On the other hand, the textile industry uses energy sources from both electricity and fuels, depending upon the industrial structure of relevant country (Hasanbeigi, 2010). For example, in United Stated (US), electricity to fuel share is about 40-60 for textile industry (Hasanbeigi, 2010). In 2010, global textile and apparel industry consumed electricity equivalent to 132 million tons of coal (Siegle, 2011) and coal is one of the major sources of Green House Gases (GHG) (Zaffalon, 2010). The fuel consumed by global fashion industry every year is equivalent to the amount of fuel required by a car to drive 800,000 times (Ene, 2021). Since this industry has a substantial dependency on fossil fuel, it is identified as one of the largest industrial contributors to GHG emissions (Choudhury, 2014; Zaffalon, 2010) and thus climate change. The textile industry accounts for nearly 10% of total global emissions (Zaffalon, 2010) (See more statistics on air emission in (iii), section 3.3.3 of this chapter).

Excessive use of resource in the industry results in production of excessive waste (Karthik & Gopalakrishnan, 2014). Fast fashion results in low quality and short-term items with frequent replacement and increased waste (Sajn, 2019; Niinimäki & Hassi, 2011) (see more on statistics on solid waste in (ii) of section 3.3.3).

3.3.2 Use of chemicals

Chemical is one of the heavily used raw materials in textile industry with potential hazardous impacts. All stages of textile and clothing production consume vast amounts of chemicals starting from raw material production to finishing of the final product (Parisi, et al., 2015; European Union, 2017).

i) Manufacturing processes involving use of chemicals in textile industry

Cotton is one of the most chemical intensive crops, involving consumption of some of the most toxic chemicals (Draper, et al., 2007; Karthik & Gopalakrishnan, 2014). Unfortunately, the plants absorb a small portion of these hazardous chemicals, while a significant share enters the ecosystem and pollute it (Y & Connell, 2015). On the other hand, production of synthetic fibres also involves toxic inputs resulting in hazardous emissions. For example, manufacturing of polyester often involves a carcinogen (named antimony) as a catalyst and discharges heavy metal in air and water (Y & Connell, 2015). Moreover, not only the production of natural dye requires harmful pesticides, but also its application require auxiliary chemicals (or mordants[17]) containing toxic metals (SDC, 1988; Saxena & Raja, 2014). Quoting from Saxena and Raja (2014, p.74), "Only a small amount of these metal salts gets fixed onto the textiles and the rest is discharged as effluent which leads to the contamination of land and water resources". Residue of some of these hazardous chemicals (e.g., NP ethoxylates alternatively NPEs) used in manufacturing process remain in the finished product. While washing, these chemicals are discharged into waterbodies turning themselves into more toxic and hormone-disrupting chemical (Greenpeace International, 2012).

Preparation of fibre and fabric involve diverse chemicals. Desizing involves acid or enzymes (Madhav, et al., 2018; Wadje, 2009). Hot alkali, detergent, or soap solutions are used in scouring to improve absorbency of fibre to colour (Wadje, 2009; Madhav, et al., 2018; Hauser, 2015). Bleaching involves chemicals like Sulphur dioxide, peroxide and hypochlorite (Wadje, 2009; Karthik & Gopalakrishnan, 2014). The most used chemical in mercerizing is caustic soda (i.e Sodium Hydroxide) that helps improved performance and dye affinity of the fabric (Choudhury, 2014; Wadje, 2009). On the other hand, dye can be sourced naturally or manufactured in factories. Natural dyes are biodegradable themselves, but their affiliation with auxiliaries (for improved performance on a fabric) makes the process polluting (Saxena & Raja, 2014). Azo based synthetic dye is carcinogenic and now listed under banned substances in EU, China, India, Vietnam along with other countries (NimkarTek, 2015). Metal based dyes are hazardous but still exists in market due to their unique contribution in producing colours like turquoise, blue, green, violet (Radhakrishnan, 2015). Finishing processes like wrinkle recovery incorporates Formaldehyde or related products (Karthik & Gopalakrishnan, 2014). For adding

[17] Helps attaching dye with fibre or fabric

antimicrobial characteristics to fabric, biocidal finishing agents are used, which add significant level of toxicity in the wastewater (Madhav, et al., 2018).

Heavy metals and Volatile Organic Compounds (VOCs) are the prime toxic substances used in textile industry (Choudhury, 2014). Basing on the impacts of such chemicals on environment and human health, restricted list of substances (RSL) has been prepared and upgraded constantly. This is used in regulating chemical usage for manufacturing textile products globally (Choudhury, 2014).

ii) Environmental impact of use of chemicals in textile manufacturing

The textile industry uses numerous chemicals, and more are being added to the list every day. Greenpeace International (2011) claims that around 25% of world's produced chemicals are used in global textile industry. According to a report prepared for European Commission (2019), production of clothing involves more than 1900 chemicals. Among these, 165 are classified as hazardous[18] to health or the environment by EU (Sajn, 2019). Apparently only 9% of the used chemicals in this industry are hazardous, however this number is large in absolute terms (Choudhury, 2014). Therefore, discharged wastewater from this industry containing residual chemicals is a threat to environment (Karthik & Gopalakrishnan, 2014). Inefficient dyeing and finishing process can potentially release 200,000 tons of used dyestuff to the environment (Uddin, 2019). Dyeing wastewater contain around 72 toxic chemicals, almost half of which cannot be removed (Ene, 2021).

Impacts from some of the commonly used chemicals in this industry are presented in table 3.1. It is evident from the table that the impacts resulting from use of chemicals within this industry are mostly persisting.

[18] Chemicals with health (irritation, sensitization, and carcinogenicity) or physical hazard (flammability, corrosion, and explosibility) are defined as hazardous chemicals by US Occupational Health and Safety Administration (US Occupational Health and Safety Administration, 2020). Choudhury (2014) further categorized hazardous substances as combustible and flammable substances, oxidizers, reactive substances, or corrosive substances.

Table 3.1 Environmental impacts of the common chemicals used in processes within textile manufacturing industry

Processes within textile manufacturing Industry		**Commonly used harmful chemicals**	**Impacts**
1. Raw material production	Natural Fibre production	Pesticides/agrochemicals	Decrease soil fertility; contaminate surface and groundwater; presence of nitrate and phosphates can cause accelerated growth of algae restricting sunlight and hindering photosynthesis, reducing oxygen level for other aquatic lives therefore killing them. Health issues in surrounding communities may include nausea, diarrhea, and eye, nose, and throat irritation.
	Manmade Fibre production	Antimony	Discharges heavy metal in air and water (impact of heavy metal is discussed in dyeing stage)
		Phenol	Exposure at high concentration can cause nausea, vomiting, diarrhoea, sweating. Severe case can show drowsiness, breathing difficulty, heart problems, lung and kidney damage
2. Sizing		Auxiliaries (i.e., chlorides, phenols, oxidisers, waxes, peroxides) in sizing mixture	Very high BOD[19] load and up to 80 % of the total COD[20] load in the wastewater
3. Scouring		Alkylphenols in surfactant, detergent	Toxic to aquatic life
		Caustic Soda/ Sodium hydroxide	Hazardous, corrosive as solution and can ignite combustible material. Can cause burn to tissue and cause damage to eye if exposed.
4. Desizing		Acid/enzymes	Enzymes are degradable with high BOD load

[19] BOD is Biological Oxygen demand, 'estimates the degree of contamination by measuring the oxygen required for oxidation of organic matter by aerobic micro-organisms (Show, 2008)
[20] COD is chemical oxygen demand, 'is defined as the amount of oxygen equivalents consumed in the chemical oxidation of organic matter by strong oxidant' (Hu & Grasso, 2005).
Higher BOD and COD value indicate greater amount of oxygen demanded by the water since less is present within it. So, the water is polluted, and aquatic life has reduced amount of oxygen available for them.

Processes within textile manufacturing Industry		Commonly used harmful chemicals	Impacts
5. Bleaching		Acid/peroxide	Hydrogen peroxide is known as environment friendly but dangerous/hazardous, some aquatic animals are sensitive to it as well. chlorine bleaching is skin irritant
6. Mercerizing		Caustic Soda	(Discussed in scouring stage)
7. Dyeing	Dyes	Azo dye made from phenol, aniline and amine (currently banned)	Amine can be absorbed in body, cause skin cancer; (impact of phenol is discussed in raw material production stage)
		Metals	Mostly non-biodegradable but can react to produce new substances. Can accumulate in soil, water, aquatic and human organs. Exposure of humans to lead can cause brain, nervous system and kidney damage; mercury can damage brain, cadmium cause disorder is respiratory system kidney; chromium can cause skin and respiratory disorders and cancer; copper can cause diarrhea, headache or kidney failure
		-	Dye disposal in water can increase water temperature, hinder photosynthesis, low aerobic biodegradability, damaging reproductive system and accumulation in aquatic life forms. Dyes can enter human body through food chain and impacting DNA.
	Wet processing auxiliary/agents	Salt	Chlorinated, metallic salt is responsible for aquatic toxicity

Processes within textile manufacturing Industry		Commonly used harmful chemicals	Impacts
		Solvent	Some chlorinated solvents are carcinogenic (perchloroethylene), some are ozone depleting (trichloroethane). VOCs can cause long-term health effects, key symptoms can be skin and eye irritation, discomfort in nose and throat, headache, difficulty in breathing, nausea, fatigue, dizziness. Some chemicals can be carcinogenic or cause birth defects. VOCs are responsible for ozone layer depletion. Wide variety and different concentrations of chemicals are used for mixing and preparing these auxiliaries cause difficulty to identify the components and relate to their impacts; and hinder their separation from mixture.
8. Printing		Phthalate	Negative impact on human reproduction system (reduce fertility) and embryos (impairing development), unsafe to workers
		Urea	High BOD load
9. Finishing		Tributyltin (TBT)	Surface water pollution inhibiting fertility of aquatic life
		Formaldehyde	Is a VOC and also indoor air pollutant. Also, water soluble, thus reactive with biological macromolecules. Can cause eye, skin, respiratory tract irritation. Also is a potential carcinogenic hazard to human

Source: Adapted from Choudhury (2014); Y & Connell (2015); Alzieu (2000); Eske (2020); Gita, et al. (2017); World Health Organization (2002); Public Health England(2016); Karthik & Gopalakrishnan (2014); Lin, et al. (2018); Radhakrishnan (2015); Babu, et al. (2007); Boyle, et al., (2016); Madhav, et al. (2018); Scarborough, et al. (1989)

It is evident from table 3.1 that the impact of chemical use within textile industry extends from the ozone layer depletion to threatening aquatic and human life including embryos. Especially the occupational health is a great concern (Richards, 2015). Ren (2000) has prioritized the environmental concerns from different processes (specially wet processing) within textile industry. Desizing, scouring and dyeing are the processes within textile industry with most significant impact on environment, among which dyeing causes the highest environmental issues (Ren, 2000).

Therefore, the waste streams of this industry need extensive treatment before discharge. However, according to Sajn (2019), in the developing countries with the most concentration of textile units, waste is often discharged without treatment.

3.3.3 Generation of waste (i.e water, solid waste and air emissions)

Waste generated from textile industry can be divided into three major categories based on their state: liquid, solid and gaseous or alternatively- wastewater/effluent, solid waste, air emission. Karthik and Gopalakrishnan (2014, p.174) identified wet processing as "potentially greatest waste-generating part of textile industry".

i) Sources of Liquid waste from textile industry

According to an estimation by World Health Organization (WHO), 17%–20% of the total industrial water pollution in globe is attributable to the wet processing part of textile industry (Simlai, 2013). Numerous environmentally unfavourable, non-biodegradable chemicals are used in different stages of textile processing and disregarded with wastewater (Madhav, et al., 2018). Specially the residual dyes leaving with wastewater is a great concern since it make the effluent heterogenous, highly toxic including persistent chemicals and tendency of resistance to treatment (Hessel, et al., 2007; Ren, 2000; Madhav, et al., 2018; Environmental Technology Best Practice Programme, 1997). The concentration of pollutants in printing wastewater is also complex and difficult to treat (Bonomo, et al., 1997; Kabdasli, et al., 2000; Rigoni Stern, et al., 1996). On the other hand, 50% of the total wastewater from a textile unit is generated in desizing process alone, resulting in high BOD load (Madhav, et al., 2018). It is identified as one of the highest environmental impact areas (Ren, 2000). Contribution of wet processing stages into wastewater is shown in a table in Appendix IV.

The main concerns from the textile effluent are excessive levels of BOD and COD, high pH, increased total suspended solids (TSS), oil and grease, sulphates, phosphates, heavy metals and their salts, nitrogen, colorants, VOCs (Hessel, et al., 2007; Ren, 2000; Tufekci, et al., 2007; Choudhury, 2014). Authorities usually set maximum allowable limit for these parameters, monitor the effluent and impose some sort of penalty (e.g., fine, banning production, ceasing equipment) for non-compliance (Richards, 2015). Definition of the wastewater parameters are discussed in table 3.2. Table 3.2 also includes usual parameter values from generic cotton textile mills. Maximum allowable limits of these parameters set by the World Bank are shown alongside for comparison. Vast difference between these values implies that the raw wastewater needs treatment prior to their release to the environment (Madhav, et al., 2018).

Globally, installation of wastewater treatment plant is required by law, especially for such heavy polluting industrial units. However, the treatment plant also generates sludge (semisolid in nature) as a by-product while treating wastewater (Patel & Pandey, 2009; Dey & Islam, 2015; Madhav, et al., 2018). Although there are some wastewater treatment techniques that can avoid sludge production (e.g., Electrochemical destruction, Photocatalytic degradation techniques) (Madhav, et al., 2018).

Table 3.2 Description of wastewater parameters of textile industry, designated limit for those by World bank and respective values from cotton textile mills

Parameters	**Description**	**Parameters values of effluents from cotton textile mills** (Babu, et al., 2007)	**Maximum allowable concentration (mg/L), except pH designated by World Bank**
pH	Measure indicating the extent wastewater is acidic or basic	9.8-11.8	5.5-9.0
Total suspended solids (TSS)	Particles within wastewater that cannot pass through a 0.45-micron filter are referred to as total suspended solids (TSS), higher TSS is expected to result in higher turbidity.	-	100
Biological oxygen demand (BOD)	Measures the oxygen required within certain duration for biochemical degradation of organic material and for oxidising inorganic material (i.e., sulphides and ferrous iron	760–900	30
Chemical oxygen demand (COD)	Measures the oxygen required for oxidation of the organic matter present in the wastewater by a strong chemical oxidant	1400–1700	250
Total residual chlorine	The total amount of chlorine present in a sample. (Summation of number of chlorine that has reacted with nitrates and hypochlorite ion and/or acid)	-	1
Oil and grease	Measurement of lipids extracted by solvent	-	10
Chromium	Hard metal (bioaccumulative, highly toxic and carcinogenic) mainly used in dyeing process	10–13	2
Sulphide	Sulphur compounds are measured in wastewater as sulphide, sulphite and sulphate. These are mostly used in dyeing process	-	2
Phenolic compounds	organic hydroxy compound, highly toxic and used in several processes like scouring, bleaching	-	1

Parameters	Description	Parameters values of effluents from cotton textile mills (Babu, et al., 2007)	Maximum allowable concentration (mg/L), except pH designated by World Bank
Total solids	Summation of total suspended solids and total dissolved solids in wastewater. Indicates turbidity and conductivity. Measured through weighting material left after evaporation and drying of a water sample	6000–7000	
Total Alkalinity[21]	acid neutralising ability of water measured in terms of calcium carbonate ($CaCO_3$) present in water	17–22 as $CaCO_3$	

Source : Adapted from Bisschops & Spanjers (2003); Woodard & Curran Inc (2007); Bratby (2015); USEPA, (2017); The World Bank (2014); US National Library of Medicine, (2021); USEPA (2012); United States Geographic Survey (2021)

ii) Sources of Solid waste and sludge generated from textile industry

Sludge:

Sludge can be identified as one of the solid wastes produced from industry (Choudhury, 2014). Textile effluent containing heavy metals and chemicals can generate hazardous and heterogeneous sludge (Anwar, et al., 2018; Celebi & Kendir, 2002). There are cases where the sludge is directly discarded in water or landfill without any processing (UNEP, 1994; Anwar, et al., 2018). Secure landfill and sealed disposal are recommended for such hazardous waste to prevent leaching into groundwater (Karthik & Gopalakrishnan, 2014; Celebi & Kendir, 2002).

General Solid wastes:

Solid wastes like cardboard boxes, bale wrapping film, soiled fabric, plastic bags, non-reusable paper cones and tubes, waste fabrics, yarns, and fibres can be generated from textile industry (Choudhury, 2014). Additionally, large amount of unused raw material is also discarded from this industry as waste (Briga-Sá, et al., 2013). Preparation of yarn, knitting and weaving generates solid wastes like fibre and yarn. Wet processing generates wastes like dye and other chemical containers, cloth scraps. Sheets, boxes, plastics are generated from packaging, while the wastewater treatment generates fibre and sludge (Karthik & Gopalakrishnan, 2014). Unmanaged solid wastes are prone to be disposed in landfills (Choudhury, 2014).

[21] Alkaline compound produces a basic solution when dissolved, for which pH value is greater than 7.

iii) Sources of Air emission from textile industry

The textile industry has been identified as one of the largest producers of GHGs (Kissinger, et al., 2013) and fifth largest contributor towards CO_2 emissions (Athalye, 2012). "Carbon footprint[22] of textile industries mostly comes from the production, processing, and use of the products made from these fibres" (Rana, et al., 2015, p. 148). For cotton textiles, fibre manufacturing phase emits the most GHG, apart from consumer use phase (Rana, et al., 2015). On the other hand, production of one tonne of polyester generates five times CO_2 than cotton (Rana, et al., 2015). In fact, most processes in textile industry results in atmospheric emissions, including wet processing (Karthik & Gopalakrishnan, 2014). Apart from CO_2, textile industry is also accountable for emission of Nitrogen oxides (NO_x) and Sulphur oxides (Sox), VOCs, particulates, Ammonia, hydrocarbons, Chlorine compounds (Choudhury, 2014; Karthik & Gopalakrishnan, 2014). Overall, air emission from textile industry can be divided into four categories: oil and acid mist, solvent vapours, odor, dust and lint (Chavan, 2001). Sources of such emissions are shown using table 3.3 from Karthik & Gopalakrishnan (2014, p.173).

Table 3.3 Sources of air pollutants from different processes within textile industry

Process	**Source of emission**	**Pollutant emitted**
Energy production	Boiler	Particulates, NO_x, SO_x
Cotton handing	Preparing, carding, combing and fabric manufacturing processes	Particulates
Sizing	Sizing compound (gum, PVA)	NO_x, SO_x, Carbon Monoxide (CO)
Bleaching	Chlorine compound	Chlorine, chlorine dioxide
Dyeing	Disperse dyeing, sulphur dyeing, aniline dyeing	Carriers of hydrogen sulfide
Printing	-	Hydrocarbons, ammonia
Finishing	Resin finishing, heat setting	Formaldehyde carriers, Polymers
Chemical Storage	Storage tanks	VOCs
Wastewater treatment	Treatment tanks and vessels	VOCs

Source: Karthik & Gopalakrishnan (2014, p.173)

[22] "A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions" (The Nature Conservancy, 2022). For textile industry, carbon footprint is calculated based on "embodied energy" in the fabric. It comprises of the energy used in all stages of manufacturing process to create the fabric.

Therefore, air emission from textile industry needs to be controlled. Methods like use of scrubbers[23], absorbers[24], modification of stack height, use of filters can help controlling parts of it (Chavan, 2001; Multilateral Investment Guarantee Agency, 2004). The World Bank's standard limits for air pollutant emission from textile industry can be found in Appendix IV.

iv) Environmental impacts of textile industry wastes

In 2006, textile and clothing impacts in UK alone, was attributable to generation of 31 million tons CO_2, 70 million tons of wastewater and 1.5-2 million tons of solid waste (DEFRA, 2007). Wastewater[25] discharge alone constitutes 80% of the total emissions by textile industry (Wang, 2016) and it is almost equal to amount of the water consumed in the units (Samanta, et al., 2019). With regards to this, a mass balance model is shown in figure 3.10 depicting the volume of water provided as input and wastewater generated from a part of wet processing in a sample cotton textile unit in Gujarat, India. The figure shows that among the 1200 kilos of fresh water provided as input, 1012.5 kilos was discharged as wastewater through Effluent Treatment Plant (ETP) and the rest is evaporated. It should be noted that such secondary data for the entire manufacturing process within the textile industry is rarely available. The wet processing of textile industry is attributable to 17%–20% of all industrial water pollution (Simlai, 2013). Therefore, textile wastewater is identified as the most polluting among all the industrial sectors considering volume and composition of effluent (UNIDO, 2003). Discharge of untreated textile effluents is the main cause of environmental impacts (Yacout & Hassouna, 2016; Karthik & Gopalakrishnan, 2014; Bhatia, 2017). Approximately 53 billion gallons of untreated wastewater is discharged by textile manufacturing units every year containing heavy metals, solvents, toxic sludge and other wastes (Chen, 2006; UNEP, 1994). As a result, one ton of fabric can pollute up to 200 tons of water through the chemicals used within it (Moore & Wentz, 2009). It can threaten human health and aquatic life (Lawrence, 1996; Badania, et al., 2005; HSRC, 2006; Choudhury, 2014). The pollutants in the effluent can cause skin irritation, cancer, bio accumulation, hinder photosynthesis alongside many other impacts (Choudhury, 2014). Detailed impacts of chemicals used in textile industry is already discussed in table 3.1. The textile industry is responsible for more than 20% of the registered levels of water pollution in

[23] Used to control air pollution by removing "harmful particles, gases, or chemical by products from industrial exhaust streams"- Industrial Access (2021)

[24] Condenses a gaseous pollutant from the air into a contacting liquid Britannia (2010)

[25] Industrial wastewater is defined as the 'used water that contains waste substances' (Oxford University Press, 2021). On the other hand, Industrial liquid waste is often termed as effluent (Oxford University Press, 2021). However, these terms are often used interchangeably.

Turkey, Indonesia and China; while for Macedonia this value is about 44% (Paraschiv, et al., 2015).

Air emissions from textile industry is the second highest environmental concern after water pollution (Tiwari & Babel, 2013). Burning of coal or gas in textile industry can discharge large number of toxic gases into atmosphere (Karthik & Gopalakrishnan, 2014). The Polyester production in 2015 generated about 706 billion kg of GHGs in 2015, equivalent to 185 coal power plants in a year (Ene, 2021). In year 2018, the global fashion industry produced more GHG than the sum of total emissions from France, Germany, and UK. This industry is deemed responsible for up to 10% of global greenhouse gas emissions (Ene, 2021). The yearly fuel consumption of fashion industry is equivalent to 230 million passenger vehicle driven in a year (Ene, 2021). Apart from these, air pollutants released from this industry can be breathed or absorbed through the skin. These can cause health issues e.g., breathing difficulty, allergic reactions and even cancer. These pollutants can also mix with surface and ground water systems and infiltrate within soil (Woodard, 2001; HSRC, 2006; Lo, et al., 2012). GHG emission from textile industry is contributing to global warming (Athalye, 2012; Kissinger, et al., 2013; Rana, et al., 2015). Emitted nitrogen and sulphur oxides from this industry are responsible for acid rain and acidic atmosphere leading to deterioration of infrastructures and formation of smog (Choudhury, 2014). Impacts of VOCs and chlorinated solvents are already discussed in table 3.1.

In management of the sludge generated from the industry, the standard practice is to incinerate and dispose the residue in landfill (Celebi & Kendir, 2002). Even the residual sludge is toxic by US and EU legislations due to heavy concentration of metals (Anwar, et al., 2018; Celebi & Kendir, 2002). Around 1.14 kg of solid sludge is generated per cubic meter of wastewater (Anwar, et al., 2018). This sludge is toxic in nature and often disposed of untreated (UNEP, 1994). It contaminates soil, surface water and groundwater system of the landfill through leaching and threatening environment and health of surrounding ecosystem (El-Fadel, et al., 1997; Woodard, 2001; Lo, et al., 2012; Yacout & Hassouna, 2016). Such waste also pollutes the air through decomposition of organic materials and emitting GHGs, especially methane which is identified 20 times more powerful in impacting climate change (USEPA, 2013). On the other hand, only EU consumers generate about 5.8 million tonnes of textile waste every year, equating to 11.3 kg textile waste per person (Beasley & Georgeson, 2014). Such waste is also responsible for air and groundwater pollution in the landfill sites (European Union, 2003). US identified 5.2% of its municipal solid waste as postconsumer textile in year 2014 (USEPA, 2014). In the year 2015, disposal of 92 million tons of waste were attributable to Global textile and clothing industry (Global Fashion Agenda and Boston Consulting Group, 2017). The numbers were predicted to rise 50% by 2030 if business continued as usual (Global Fashion Agenda and Boston Consulting Group, 2017).

Summarizing the discussion provided in this section (section 3.3), different areas of environmental impacts from textile manufacturing processes are presented in table 3.4. All the processes involved in textile manufacturing are attributable to some sort of environmental impact (table 3.4). Yarn, fabric production seems to have least impact on environment among all the processes, while wet processing has maximum.

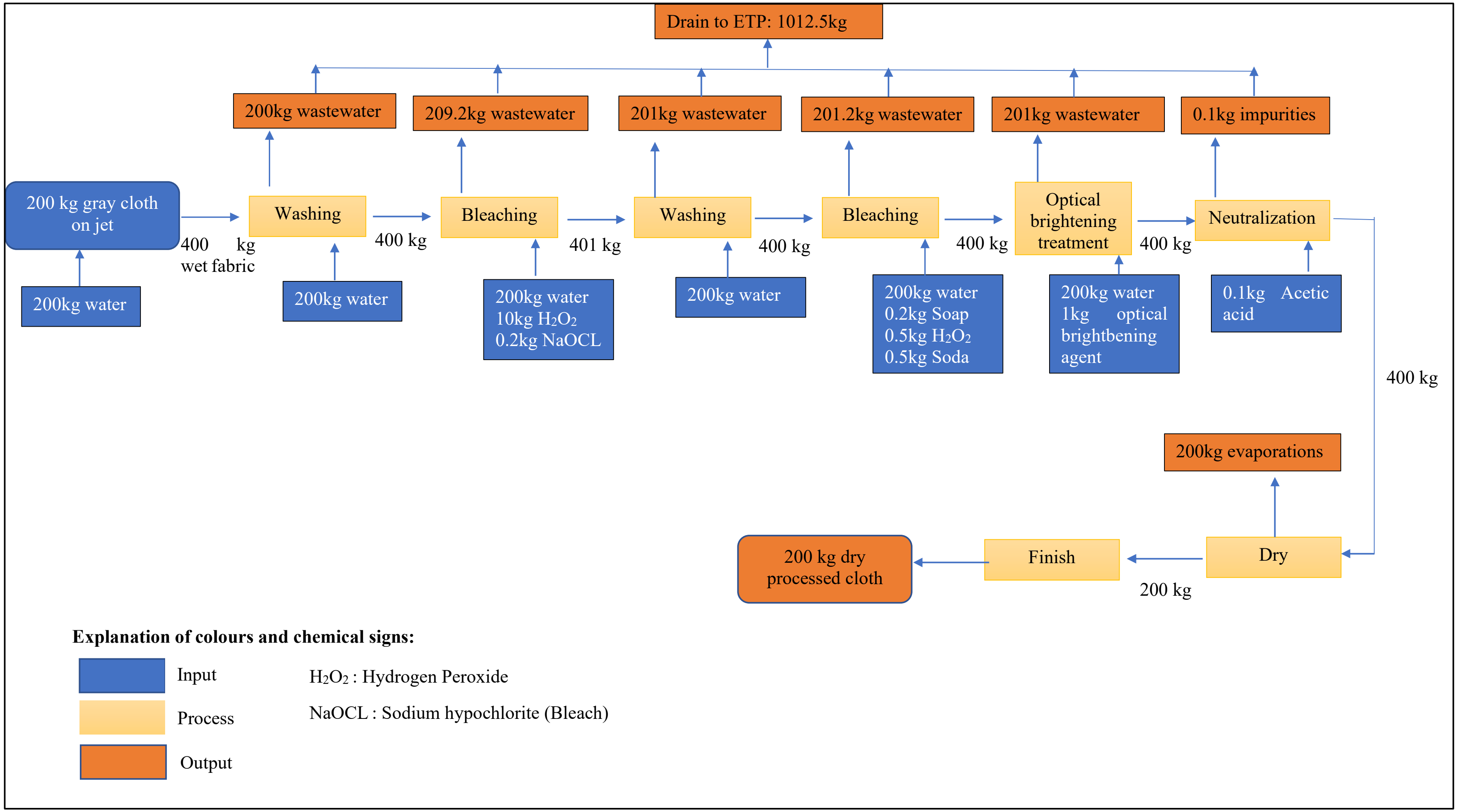

Figure 3.10 Mass balance of part of wet processing in a sample cotton textile unit in Gujarat, India.

Source: Adapted from GIZ-IGEP & GCPC (2015)

Table 3.4 Environmental impact areas of different processes within textile industry

Processes within textile industry		Resource consumption		Use of chemicals	Generation of waste		
		Water	**Energy**		**Liquid**	**Solid**	**Gaseous**
Raw material production		√		√	√	√	√
Yarn production			√			√	
Fabric preparation		√		√	√	√	
Fabric production			√			√	
Wet processing	**Desizing**	√	√	√	√	√	√
	Scouring	√	√	√	√		√
	Bleaching	√	√	√	√		√
	Mercerizing	√	√	√	√		
	Dyeing	√	√	√	√		√
	Printing	√	√	√	√		√
	Finishing	√	√	√	√	√	√
Garment preparation			√			√	√

Source: Adapted from (Babu, et al., 2007)

The process of minimizing the abovementioned impacts, i.e., "using the resources and energies effectively along with the elimination of toxic raw materials and reduction in toxicity of all emissions and solid wastes" is known as cleaner production technique, which is alternatively known as "sustainable technique" (Manavalan, et al., 2021; Gönlügür, 2019). Areas of application of cleaner production techniques include : raw material and input, technology, operation, product, waste and emission (Demirer, 2015) Best Available Technique (BAT) is a reference document formulated by European Union for cleaner production within textile industry in 2003, that has been able to offer 65 and 70% of savings in water and energy, respectively (Gönlügür, 2019). Therefore, environmental sustainability within textile industry can be brought about by reducing the impacts through cleaner production techniques.

Chapter summary

The textile industry is one of the fastest growing sectors around the globe. However, the industry is composed of complex processes and has potential to manufacture diverse products. The key manufacturing processes within this industry are yarn manufacturing, fabric manufacturing, wet processing and textile fabrication. Accordingly, the industry produces fibre, yarn, fabric and clothing. The requirement of varied manufacturing processes for this industry generates wide range of impacts over the physical environment, aquatic life and human health. While the wet processing is known as the "value addition" stage in textile manufacturing, it is also the most water, energy and pollution intensive stage specially for natural fibres. However, the other stages of textile manufacturing are also involved in resource consumption, chemical usage and waste generation in various degrees.

Chapter Four: Environmental policy instruments for textile industry

This chapter provides an understanding on the environmental policy instruments relevant to environmental control & management within textile industry and identifying the role of EIA amongst this. Accordingly, it is divided into four major sections. First section provides introduction to the environmental policy instruments with a brief note on their evolution. The second section is focussed on major environmental policy instruments and examples of their use in textile industry. The third section describes EIA, its purpose, and components. The final section focuses on EIA's role as policy instrument for textile industry. Through extensive literature review, this chapter contributes to establishing the second part of the first objective and paves the way forward. Outcome of this chapter supports in formulation of recommendation (fifth objective).

4.1 Introduction to environmental policy instruments and their evolution

Policy, law and regulations are some of the closely used terminologies. Policy is a set of principles proposed by an organization (British Ecological Society, 2017). On the contrary, legislation passed by parliamentary bodies becomes law and works to enforce course of actions within policy (University of Colorado, 2021; British Ecological Society, 2017). Whereas the regulations (also known as rules) are tools for implementing law (University of Colorado, 2021).

Policy instruments are known as governing techniques for implementing policies and impacting behaviour of citizens and businesses (Howlett, 1991; Bemelmans-Videc & Rist, 1998). Policy instruments directly or indirectly affect (in terms of availability, prices, quality) production or consumption of goods and services (Virta & Räisänen, 2021) .

Table 4.1 summarizes the environmental policy instruments listed by experts in various studies. These instruments have evolved through time and different instruments have coexisted to provide comprehensive outcome (OECD, 2001). Bouwma, et al. (2015) suggested that although the policy instruments are mostly described in their ideal forms, hybrids exist in practice.

Quoting from Environmental agency of England and Wales (2003, p.01),

> “As times have changed, regulation has modernised too. Dialogue and joint problem solving, and the ‘carrots’ of incentive and reward are increasingly being used to supplement or replace the traditional ‘stick’ approach. Modern regulatory thinking has developed a wider and smarter range of tools than ever before – to include taxes, trading schemes, voluntary agreements and environmental management systems”

Table 4.1 suggests that the major types of environmental policy instruments identified by the experts include: a) regulatory; b) market based and c) voluntary & information-based instruments. This typology represents three generations of environmental policy instruments (Labandeira , et al., 2009; Tietenberg, 1998). The three generations of environmental policy instruments are known as: the traditional era, the modern era and the post-modern era (Sand, 2008). The traditional era extends from early 1900s to 1970s where natural resource management was the primary concern. The modern era starts at 1972 with the first UN conference on the human environment in Stockholm and extends up to 1992 UN Rio conference on environment and development with increased focus on environmental degradation resulting from developmental activities (Sand, 2008). These two UN conferences were termed “pathbreaking” by Weiss (2011) due to their significant influence on advancements in developing and implementing international environmental law[26]. The post-modern era which started after the Rio-conference continues till date with primary focus on climate change and sustainable development (Sand, 2008). Timeline of the key environmental instruments are shown using figure 4.1.

Among these key instruments, regulatory instrument is the oldest and remained most influential policy instrument till 1990s (OECD, 2001; Jordan , et al., 2005). Between 1970s to 1990s significant evolution of environmental policy instruments could be observed. While most of the countries lacked environmental regulations in 1972, around 1100 binding and non-binding international legal instruments relevant to environment were in place within next two decades (Weiss, 2011). Between traditional and modern era, in year 1970, Environmental Impact Assessment (EIA) was introduced as a regulatory instrument by legislation in USA (Orlando, 2012).

[26] Content of global environmental law is the common set of legal principles developed by international, national and transnational environmental regulatory systems (Yang & Percival, 2009). See Yang & Percival (2009, p.617) for more definitions.

Market instruments could also be traced back to 1970s (Meckling & Jenner, 2016). Their increased use has been observed since 1990s (OECD, 2001). Around 14 OECD countries were using market driven economic instruments in 1987, which rose to 150 by 1993 (OECD, 1997). Regulatory and market-based/economic instruments are primarily government policy instruments (table 4.1) (OECD, 2001; Department for Environment, Food & Rural Affairs , 2004; Eskeland & Jimenez, 1992).

On the other hand, voluntary and information-based instruments can be termed as "decentralized approaches" (Kotchen, 2013). Although negotiated agreements, public voluntary programs are some voluntary instruments initiated as part of government policy (OECD, 2001; Jordan , et al., 2005). At around mid-1980s, EU's environmental law started adopting these innovative decentralized measures like: EIA, eco-labelling[27], public access to environmental information (Orlando, 2012). Therefore, another prominent instrument is information-based instrument (e.g., eco-labelling, certifications for environmental management systems like International Organisation for Standardisation-ISO). Voluntary and information based (VIB) approaches gained popularity following Rio conference through the rise of non-state actors, non-legally binding instruments and public-private partnership (Weiss, 2011). These instruments can facilitate public access to environmental information. Additionally, businesses themselves can adopt these as part of their corporate image development, performance improvement or fulfilment of sustainability demands from financers and consumers (OECD, 2001; Virta & Räisänen, 2021; Jordan , et al., 2005; Orlando, 2012). Descriptions on use of these instruments can be found in section 4.2 of this chapter.

[27] Although world's first ecolabel (named Blue Angel) was introduced by Germany in 1978, which is before 1980s (oneplanetnetwork, 2018).

Table 4.1 Environmental pollution instruments identified by experts in different studies

Authors:	Oates & Baumol (1975) for National Bureau of Economic Research, USA	Eskeland & Jimenez (1992) (For World Bank)	OECD (2001)	DEFRA Regulation taskforce, (2004)	Jordan , et al., (2005)	Bouwma, et al. (2015)	Xu, et al., (2018)	Virta & Räisänen (2021)
Aim of the study	Exploration of the potential and limitations of the various policy tools available for environmental protection	Effectiveness of policy instruments for pollution control in Developing Countries	As a report from Business and Industry Policy Forums (4th) for Encouraging Environmental Management in Industry	-	Identify change from government to governance in main instrument types	Analysing current state of policy instruments choice and modes of governance in European Union	Analysing the major environmental policies for textile industry in China	Recognizing policy instruments for supporting sustainable textile production and consumption in Finland
Identified terminologies for environmental policy instruments	Direct controls (e.g., rationing, prohibition, technical specification)	Command and control (e.g., regulation of emission, equipment, performance)	Regulatory (command and control)	Prescriptive (e.g environmental standard, performance standard, process specification	Regulatory (legislations)	Legislative instruments	Command and control (i.e., law and regulation on standard, technology)	Regulatory (i.e., legislation)
	Price incentives (e.g., tax, subsidies)	Market based incentive (e.g., effluent charge, tradable permit, tax, subsidies)	Economic instruments (e.g. tax, charge, tradeable permits)	Market based (e.g., tax, tradable permit, liability)	Market Based (e.g., tax, tradable permit, subsidies)	Economic/fiscal instruments	Market based (e.g., tradable permit, pollution tax, performance bond	Economic (e.g., Tax, emission compensation)

Authors:	Oates & Baumol (1975) for National Bureau of Economic Research, USA	Eskeland & Jimenez (1992) (For World Bank)	OECD (2001)	DEFRA Regulation taskforce, (2004)	Jordan , et al., (2005)	Bouwma, et al. (2015)	Xu, et al., (2018)	Virta & Räisänen (2021)
	Moral suasion (e.g voluntary compliance)	Government production or expenditure (e.g., expenditure for cleanup, waste disposal, cleaner technology development)	Voluntary instruments (e.g. public voluntary programs and negotiated agreements)	Soft (e.g., information, self-regulation, voluntary management, negotiated agreement)	Voluntary agreement (e.g., negotiated agreements, public voluntary schemes)	Agreement based/co-operative instruments	Voluntary (i.e., self-regulation through cooperative process)	Information (e.g., ecolabel, standards)
	Public production (e.g. transfer of activities from private to public sector)	-	Measures to improve efficiency and performance, adopting guidelines and standards as code of conduct	Economic (subsidy)	Eco-label (inform consumers about impact through e.g., external verification, unverified self-declaration)	Information/communication-based instruments (e.g., campaign, certificate or ranking)	-	Consumer influence (i.e., demand of sustainability)
			-	-	Environmental management system (e.g., International Standard Organization's EMS)	Knowledge and innovation instruments (social learning. i.e., exchanging best practice)	-	-

Source: Mentioned within the table

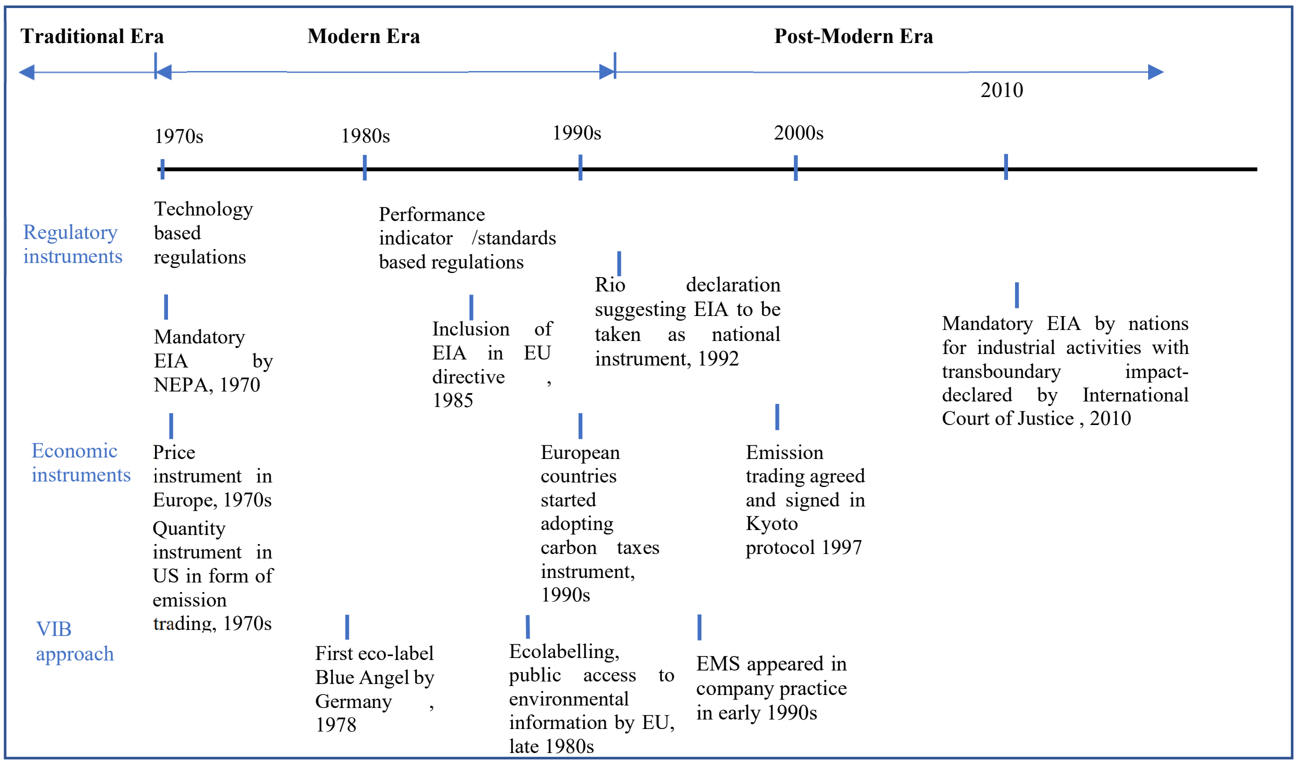

Figure 4.1 Timeline of key environmental policy instruments

Source: Adapted from United Nations (1998); Meckling & Jenner (2016); Austin (1999); OECD (2001); Sand (2008); Orlando (2012); Weiss (2011); IAIA (2009); Zilahy, (2017)

4.2 Description of environmental policy instruments and their use in textile industry

"The choice of pollution control instrument is a crucial environmental policy decision" - Goulder & Parry (2008, p. 152).

With rising environmental concerns around the globe, the industrial sector causing major pollution and consumption of resources, started requiring significant attention (OECD, 2001). Carefully designed environmental policy was especially useful here with explicit intent to treat negative externalities originating from economic activities (Jaffe, et al., 2000). Description of major instruments and their use in textile industry is discussed below-

4.2.1 Regulatory instruments

OECD (2001) argued that most of the firms are driven by environmental compliance due to government regulations. "command and control" pattern of such instruments can set emission limits through "technical standards[28]" or "environmental/performance standards[29]". Incompliance here would likely result in a penalty (Austin, 1999; OECD, 2001). While regulatory instruments shifted towards performance standards in 1980s, corporate strategies also shifted focus from "end-of-pipe" solutions to development of "cleaner" production techniques, thus encouraging innovation (OECD, 2001; Austin, 1999).

[28] Specifies the methods and equipment to be used by the firms for achieving the target (Austin, 1999; OECD, 2001; Goulder & Parry, 2008)
[29] Sets overall standard (i.e., firms output meeting certain conditions) for firm allowing some flexibility to attain it (Austin, 1999; OECD, 2001; Goulder & Parry, 2008)

Apart from such standards, innovative mechanisms like EIA were also introduced as regulatory instrument (Orlando, 2012). EIA is the oldest of the impact assessment measures (see section 4.3 within this chapter for more discussion) (IAIA, 2009).

Use in textile industry

There seems to be a lack of any comprehensive environmental law or regulation designed specifically for the textile industry. National textile policies in different countries (e.g., Bangladesh, India), mostly have a mere section on environmental norms or incentives for using environment friendly equipment in the textile industry (DoT, 2017; National Jute Board, 2000). However, such sectoral policies mostly focus on strategies for economic advancement of the sector. Apart from this, considerable number of generic environmental laws, acts, regulations are relevant and applicable to textile industry in different countries. For example, chemical control regulations by European Union and US Environmental Protection Agency are applicable to diverse chemicals used in textile industry (European Union, 2006; Government of United States, 2016). Hazardous waste management rules and regulations adopted in India applies to hazardous wastes generated by this industry (Central Government of India, 1989). Generic acts adopted for clean air and water in different countries are also applicable to textile industry being one of the greatest polluters among industrial sectors (Begum & Kumar, 2018). National standards for textile wastewaters and air emission are also incorporated within key environmental regulations of US, Bangladesh, India, Pakistan among many other countries (EPA, Pakistan, 2000; Bureau of Indian Standards, 1992; USEPA, 1982; USEPA, 2002; DoE, 1997b).

However, some of the state governments in different countries formulated regulations focussing on textile industry (e.g. air emission requirement from textile dyeing and finishing plants by Victoria state government in Australia, Zero liquid discharge legislation 2006 by Tamil-Nadu state in Tirupur, India (Victoria State Government, 1982; Grönwall & Jonsson, 2017).

On the other hand, EIA is used as a regulatory instrument for textile units with polluting manufacturing processes (e.g., dyeing, printing, finishing) in more than 100 countries (Resta & Dotti, 2015) (table 4.2 for more examples on regulatory instrument).

4.2.2 Economic/market-based instruments

> "Economic instruments aim to control pollution by harnessing the power of market incentives, offering a more cost-effective, flexible and dynamic form of regulation than conventional measures" -Austin (1999, p. 01).

Therefore, they are alternatively known as market instruments. Economists suggest it can be used as a substitution, or supplement to direct regulation (Austin, 1999). Such instruments include pollution tax[30], tradable permits[31], deposit-refund scheme[32], subsidies and other incentives

[30] Indicate the price paid for discharging pollutants into the environment depending on quality and quality of pollutants (Austin, 1999). It can be either imposed directly on the pollutant or the product causing pollution (Austin, 1999).
[31] The system decides aggregate quality of emission and allocates emission entitlements (i.e., rights to pollute) to the polluting sources. It also allows the permit holders to trade their entitlements to others on the open market (Austin, 1999; Tilley & Gilbert, 1990).
[32] The system imposes additional charge on price of the polluting product that is returnable. Once the product or their residuals are returned, and pollution is avoided that deposit is returned back to the consumer (OECD, 2017)

(OECD, 2017; Austin, 1999). Apart from these, there can be grants, tax exemptions as incentives for environment friendly equipment purchase or improved environmental performance.

Use in textile industry

Market mechanisms like taxation can be applicable to pollution sources or on products of textile industry. Tax on pollution sources can be generic, e.g., eco tax on emission by China, Carbon tax by EU (Just Style, 2019; World Trade Orgnization, 2020). Tax might be imposed while buying textile products like the ones in place in Denmark and France (OECD, 2014).

Emission trading mechanisms may explicitly list sectors like textile or sometimes only designate margin of emission. For example, EU Emission Trading System (ETS), Directive 2004 is applicable to all units with combustion installations of a total rated thermal input of more than 20 Mega Watt (International Carbon Action Partnership, 2015). On the other hand, mandatory and voluntary emission trading schemes exist all over the world (e.g. Japan, India, Korea) listing textile sector explicitly (International Carbon Action Partnership, 2015; International Carbon Action Partnership, 2021; Environmental Defence Fund, 2013).

Some of the leading textile producing countries like China, Bangladesh, India, Vietnam, Ethiopia has provision of incentives, subsidies, green finance as market instruments for their industries in general. Tax holidays, subsidies for installation of end of pipe technologies like Central Effluent Treatment Plant (CETP) & Effluent Treatment Plant (ETP), provision of green finance to support green equipment, innovation, research & technology are some of the measures introduced in these countries (Wakeford, et al., 2017; OECD and DRC, China, 2017; United Nations Climate Change, 2021; Climate Development Knowledge Network, 2020; Thong, et al., 2017). Such incentives can encourage the producers to invest in cleaner production technologies (See table 4.2 for more examples on economic instruments)

4.2.3 Voluntary and information based (VIB) instruments

These instruments are measures beyond legal obligations or market instruments, referring to the commitments by the firms for improved environmental performance (OECD, 2017). Kotchen (2013, p.276) suggests the contents of VIBs-

> “Include decentralized policies, programs, and market trends, such as programs that disclose information about potential environmental liabilities, markets for “green” goods and services, third-party eco-labelling, and programs that provide “reputation” benefits in exchange for meeting voluntary environmental standards”

Some of these can take form of voluntary agreements[33] with government, through public[34] or negotiated[35] programmes (OECD, 2001). While some can be sponsored by industry or third-party organizations (Kotchen, 2013).

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[33] “Allow building consensus and engage stakeholders but are often supported by regular oversight to verify that environmental performance actually improves”- OECD (2017, p. 11).
[34] Units enter into agreements with government regarding their environmental performance criteria and conditions of membership (OECD, 2001; Jordan, et al., 2003).
[35] Units enter into contract with public authorities regarding particular environmental problem and a schedule for achieving the target (OECD, 2001; Jordan, et al., 2003).

Apart from these, there are voluntary standards and certifications systems. These are mostly formulated by business and/or non-governmental organizations (NGOs) for certifying self-regulatory standards of products in a variety of sectors and contribute towards environmentally sustainable business practices (Wijen & Chiroleu-Assouline, 2019). Certification can be either based on product or process (Radhakrishnan, 2015). Examples of this are eco-labelling[36], environmental management system (EMS)[37], Self-assessment indices[38]. Worldwide, currently there are 456 ecolabels in 199 countries, and 25 industrial sectors (Ecolabel Index , 2021). On the other hand, although EMS is listed as a VIB, it can also be implemented via a regulation (e.g., Eco-Management and Audit Scheme (EMAS) by EU).

Furthermore, policy tools like generic and sectoral guidelines are considered as part of the code of conduct (OECD, 2001; Jordan, 2001). Guidelines can be introduced by both state and non-state actors depending upon the purpose (e.g., generic guidelines[39], guidelines for implementation of policy instruments like EIA, sector specific guidelines[40])

Use in textile industry

Government in the countries of Thailand, Netherlands, UK, Bangladesh have introduced voluntary agreements specifically with textile industry. These agreements aim setting permit criteria of dyeing-printing-finishing units, performing CSR activities, zero discharge plan or collaborate on carbon, water and circular textile targets (upcoming in UK) (WRAP, 2021; UNEP & UNIDO, 2006; The Kingdom of Netherlands, 2016; DoE, 2015). Apart from these, international organization like IFC is also working with textile units in Bangladesh, China, Pakistan and Vietnam collaborating with international brands, donors and local stakeholders. They bring resource efficiency and cleaner production programs for textile units as voluntary agreement (IFC, 2017).

Some well reputed international eco-labels for textile are Standard 100, Made in Green, EU Ecolabel, Blue Sign, Blue Angel. Apart from these, there is a green building rating system known as Leadership in Energy and Environmental Design (LEED), based on performance of the physical structure of the manufacturing units (e.g. energy savings, water efficiency, CO2 emissions reduction) (Boston University , 2021). Various Readymade Garment (RMG) units within textile industry have been certified with LEED in Bangladesh (Kiron, 2021).

EMS in textile units can provide: i) "effective framework" for development of product and process, ii) improved environmental performance and likely reduction of negative incidences, iii) reduced cost of compliance, iv) saving of resources and ethical leadership (Joshi, 2001; Zimon & Madzík,

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[36] Voluntary method of environmental performance certification and labelling, providing information on environmental impact of products & services, thus helping in informed decision making (The Global Ecolabelling Network, 2021; Jordan, et al., 2003).

[37] Voluntary system of certification by third party by auditing the environmental impact resulted from their activities, monitor and reduce the impacts through establishment of in-house management systems and provide stakeholders with a regular statement (Jordan, et al., 2003).

[38] Helps business to assess environmental performance by themselves. However, certification/declaration of performance results require detail verification (i.e audit) by trained verifiers (Sustainable Apparel Coalition, 2021; Société Générale de Surveillance (SGS), 2015).

[39] Known as "general statements of environmental principals" (OECD, 2001, p. 22).

[40] formulated by government and non-government organizations for issues like waste management, chemical management, environment, health and safety within polluting industries (ZDHC foundation, 2017; World Bank and IFC, 2007; Asian Development Bank, 2017).

2019; Milieu Ltd & Risk and Policy Analysis Ltd, 2009). ISO 14001 is highly popular EMS among textile units and applicable to all types of organizations (environmental aspects of their activities, products and services). On the other hand, EMAS was introduced by EU in 1993, before ISO 14001 extending to all economic and service sectors (European Commission, 2021a; IEMA, 2021). A new EMS named as Zero Discharge of Hazardous Chemicals (ZDHC) is launched by ZDHC foundation. It specifically focusses on chemical management, though can also be incorporated into wider EMS like ISO 14001. Since ZDHC foundation mainly aims sustainability in apparel and footwear sector, it is very relevant to textile units (ZDHC foundation, 2020).

BEPI[41] by Amfori, Higg index[42] by Sustainable Apparel Coalition, Detox[43] to Zero by OEKO-TEX are some of the popular self-assessment indices among textile brands to ensure sustainability at their production sources. While BEPI is open for all industries, 21% of its members belong to garment and textile brands like Aldi, Everland Sports Manufacturing, We Fashion (amfori, 2019). On the other hand, more than 500 global (apparel and footwear) brands have committed on using Higg index. These include Gap Inc, H&M, JC Penny, Levi's, M&S, New Look, Nike, River Island (Sustainable Apparel Coalition, 2021). More than 80 fashion brands including Nike, Tesco, Zara, H&M have signed the Detox campaign (Greenpeace International, 2021).

There are several national and international guidelines on technology and manufacturing processes of textile industry. For example: Best available techniques (BAT) by EU and Environment-health and safety (EHS) guideline for textile industry by IFC & The World Bank (European Commission, 2019; IFC & The World Bank, 2007). There are also guidelines on EIA management practice and monitoring process relevant to textile industry (USEPA, 1996; Government of Federal Republic Germany, 2013). Generic EIA guidelines adopted in different countries are also applicable to textile industry (see table 4.2 for more examples on VIBs).

[41] "For retailers, importers and brands committed to improving environmental performance in supplying factories and farms worldwide" (amfori, 2021).
[42] Used for assessing the manufacturing, brand and product impacts and measuring sustainability score of apparel, footwear products and companies (Sustainable Apparel Coalition, 2021; MCL group, 2021).
[43] in commitment with the Detox campaign with Greenpeace. It mainly aims at improved environmental performance with specific focus on hazardous substance control in discharged wastewater, sludge and use of chemicals in textile industry (OEKO-TEX, 2021).

Table 4.2 Examples of use of environmental policy instruments in textile industry

Type of policy instruments	Taxonomy of the instrument	Some examples of use in textile industry
1. Regulatory instrument	**Legislations**	**Chemicals control**: Registration, Evaluation, authorization and restrictions of chemicals (REACH) regulation 2006 by EU (European Union, 2006); and Toxic Substances Control Act 1976 by USEPA amended by Chemical Safety for the 21st Century Act 2016 (Government of United States, 2016), Consumer Protection Act 1994 prohibiting use of Azo dyes in Germany, Netherlands law banning Azo dyes in 1996 (Begum & Kumar, 2018) Prohibition of 182 toxic dyes through Notification No. 03 (RE-2001)/1997-2002 by Government of India
		Waste management: The Hazardous Wastes Rules 1989 (includes textile production and residual chemicals as hazardous waste) by India (Central Government of India, 1989); Trade Effluent (Prescribed Substances and Processes) Regulations, 1989 by UK (Government of UK, 1989), Resource Conservation and Recovery Act 1976 by USEPA for hazardous and non-hazardous solid waste management (EPA, 2020)
		Mandatory EIA requirement including textile processing units: National Environmental Protection Act 1970 by US government (U.S. Council on Environmental Quality, 1970); Directive on Environmental Assessment 1985 by European Union (European Union, 1985), Environmental Conservation Act 1995 by Bangladesh (Department of Environment (DoE), 1995); Environmental Act 1986 (mandatory EIA enacted 1992) by India (Central Government of India, 1986); Law on environmental Protection, 1993 by Vietnam (Socialist Republic of Viet Nam, 1983); Environmental Protection Law 1979 and Law on Environmental Impact Assessment by China (The People's Republic of China, 1979; The People's Republic of China, 2002)
		Other: Clean Air Act 1970 by USEPA, Air emission requirement from textile dyeing and finishing plants in Victoria, Australia (Victoria State Government, 1982), Zero liquid discharge legislation 2006 by Tamil-Nadu (Government of Tamil Nadu, 2007), Water Pollution Prevention and Control Law 1984 by China Government
	Performance Standards	**Standards for textile wastewater** discharge by Government of Bangladesh (Department of Environment (DoE), 1997); Government of Pakistan (EPA, Pakistan, 2000), Government of India (Bureau of Indian Standards, 1992), Government of United States (USEPA, 1982), National Emissions Standards for Hazardous Air Pollutants (includes textile processing) by USEPA (USEPA, 2002)
2. Market instruments	**Tax**	Eco-tax by China Government in January 2018 (Just Style, 2019); EU carbon border adjustment mechanism to introduce carbon tax on imported goods (sectors yet to announce but could include textile) (World Trade Orgnization, 2020), Textile consumption tax (environment related) in Denmark and France (OECD, 2014)
	Tradable permits	EU Emission Trading system directive 2004, Guangdong and Shanghai (Pilot) Emissions Trading Scheme (International Carbon Action Partnership, 2015); Japan voluntary action plan 2008 on emission trading includes, India performance achieve trade (2012-2015) (Environmental Defence Fund, 2013). Korea (mandatory) Emission trading (2015-2017) (International Carbon Action Partnership, 2021).

Type of policy instruments	Taxonomy of the instrument		Some examples of use in textile industry
	Subsidies, green finance and other incentives		Tax holidays and eco-industrial park for textile industry in Ethiopia (Wakeford, et al., 2017); subsidies for installing install end-of-pipe technologies to reduce emissions of SOx, NOx and COD in China's 11^{th} five year plan (OECD and DRC, China, 2017), Provision of Green finance for compliance with environmental requirements in China, Bangladesh, India (OECD and DRC, China, 2017; United Nations Climate Change, 2021; Climate Development Knowledge Network, 2020),IFC's Global Trade Supplier Finance (GTSF) providing short term finance conditioned with the buyer's approval (IFC, 2017).
3. Voluntary and information-based instruments	**Agreements**		Netherland government's negotiated agreements with 50 industries aiming reduction of GHG emission as part of their National Environmental Policy Plan (OECD, 2001). Voluntary Agreements in 33/50 program by US government to reduce their releases of toxic chemicals, and the Eco-Management Auditing Scheme in the European Union to establish and monitor environmental program (OECD, 2001). Voluntary agreement between Thai Government and Industry 1992 for setting permit criteria for textile dyeing-printing and finishing units (UNEP & UNIDO, 2006); upcoming voluntary agreement (April 2021) between UK government and signatories to collaborate on carbon, water and circular textile targets (WRAP, 2021), Zero Liquid Discharge program with industrial units (as negotiated agreement) by Department of Environment, Bangladesh (DoE, 2015).
	Standards and certifications	**Ecolabelling**	**International Ecolabels:** Standard 100, and Made in Green by OEKO-TEX (OEKO-TEX, 2021), EU Ecolabel by European Commission (European Commission, 2021b), Blue Angel by Federal government of Germany (Blue Angel, 2021), Blue Sign by Blue Sign Technologies, Switzerland (Blue Sign Technologies, 2021); **National ecolabels:** by China-Taiwan (Green Mark), India (Eco-Mark), Netherlands (Eko-Seal), Thailand (Thai green level)
		EMS	ISO 14001, ZDHC CMS framework (ZDHC foundation, 2020); EMAS by EU
		Self-assessment	Detox to Zero by OEKO-TEX (OEKO-TEX, 2021), Higg index by Sustainable apparel coalition (Sustainable Apparel Coalition, 2021), BEPI by amfori (amfori, 2021);
	Guidelines		**International:** Best Available Techniques (BAT) Reference Document (draft) 2019 by European Union (European Commission, 2019); Environment health and safety(EHS) guideline by IFC-World Bank ((IFC-World Bank, 2007); Global organic textile standard implementation manual by Global Standard, Germany (Global Standard gGmbH, 2020); EIA model for priority industries in UNIDO Environmental program (UNIDO, 1990), Guidance Manual on How to Establish and Operate Cleaner Production Centres by UNEP 2006 (UNEP & UNIDO, 2006) **National:** Environmental standards guideline in the textile and shoe sector by Germany (Federal Environmental Agency , 2011); Advice notes for preparing EIS by Ireland-EPA (including pre-treatment units of textile) (EPA, Ireland, 2015); Manual for best management practices for pollution prevention in textile industry by USEPA (USEPA, 1996); Hazardous Waste Generator Guidance for textile industry by USEPA, Guidance on EIA by European Commission (including textile processing) (European Commission, 2001); Due diligence guidance for responsible supply chains in the garment and footwear sector by OECD (OECD, 2018), EIA guidelines for industries, Sector-specific guideline for textile industry by DoE, Bangladesh (DoE, 1997a; 1997b); EU Green Public Procurement (GPP) Criteria for Textile Products and Services (European Commission, 2020), Environmental Handbook on Environmental impacts monitoring and evaluating (including textile processing by Germany (Government of Federal Republic Germany, 2013)

Source: Mentioned within the table

With increasing number and participation of non-state actors, diverse policy instruments are available for textile sector now. Currently, instruments relevant to voluntarism, knowledge development and procedural change seem to play more prominent role in the environmental policy mix than direct regulatory control (Hertin, et al., 2008). However, utilizing environmental policy instruments to its fullest potential is still a challenge for developing countries those are production hub of renowned textile brands (Boström & Micheletti , 2016). One of the challenges is that the producer countries are usually encouraged by the international organizations to prioritize economic development before stronger environmental and social regulation (Boström & Micheletti , 2016). On the other hand, private regulations (e.g., code of conduct) are still not effectively addressing the problems from this industry (Boström & Micheletti, 2016). OECD (2001), opines that, regulations will keep playing a significant role in influencing firms' behaviour no matter the number of other policy instruments. Therefore, regulatory instruments with the potential of connecting and utilizing diverse policy instruments can prove useful for textile industry. One such instrument is EIA.

4.3 Understanding EIA: the widely practiced environmental policy instrument

4.3.1 Impact Assessments and EIA

EIA is the oldest of the impact assessment (IA) methods (IAIA, 2009). IA is a structured process for considering the implications of proposed actions (from policies to projects) on people and their environment, while there is still an opportunity to modify or abandon (if appropriate) (IAIA, 2021). The concept of "environment" in IA includes physical-chemical, biological, visual, cultural, socio-economic and health components (IAIA, 2021). It is argued that sustainability is embedded within the concept of IA (IAIA, 2021). Specific forms of assessment of environment include Social Impact Assessment (SIA)[44], Health Impact Assessment (HIA)[45] among others (IAIA, 2021). At strategic level of decision-making environmental assessment (EA) is performed using the system of Strategic Environmental Assessment (SEA)[46] (IAIA, 2021). Therefore, while EA at project level is referred to as EIA,

[44] "SIA includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions" (IAIA, 2021)

[45] "HIA is a practical approach used to judge the potential health effects of a policy, programme or project on a population, particularly on vulnerable or disadvantaged groups" (World Health Organization, 2021)

[46] SEA is "an impact assessment process that aims to mainstream environmental, social, economic, and health issues and ensure the sustainability of strategic decisions." (IAIA, 2015)

above project level, i.e., for policies, plans and programmes, EA is termed as SEA (Fischer, 2005). Legal provisions of SEA are still emerging and yet to be as widespread as EIA, especially in developing countries (OECD, 2012; IAIA, 2021). After EIA, other top mainstreaming activities are cost benefit analysis, ISO standards and SEA, in descending order (OECD, 2012). Quoting OECD (2012, p.24),

> "EIA is the only tool that has been formalised in law in almost every country"

EIA is practiced as an IA tool across more than 187 countries (UNEP, 2019). More than 100 countries use EIA for environmental control and management of textile industry (Resta & Dotti, 2015).

4.3.2 Environmental sustainability and its relationship with EIA

Although precise role of EIA within sustainability is yet to define (Cashmore, et al., 2004), due to its substantive aim, EIA is increasingly being positioned within a broader context of sustainability (Glasson, et al., 2005). EIA has been recognized as one of the instruments to foster sustainable industrial development in Agenda 21, suggesting Governments to develop, improve and apply EIA. Environmental sustainability is one of the domains of sustainability (WCED, 1987).

The aim of Environmental sustainability is,

> "To improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans"- Goodland (1995, p. 03).

In another definition Goodland (1995) recognizes environmental sustainability as a set of constraints on the four major activities divided in source side and sink side. Source side contains renewable and non-renewable resources. Sink side contains pollution & waste assimilation, thus regulate the "scale of the human economic subsystem" (Goodland, 1995). Being a resource and pollution intensive industry, growth and sustainability of textile industry is largely dependent on how resource and pollution are managed (ILO, 2021). However, the approach of different nations to sustainability is different with regards to the balance of attention between output and input (Goodland, 1995).

4.3.3 Definition of EIA

EIA is often recognized as "a systematic process that examines the environmental consequences of development actions, in advance" (Glasson, et al., 2005, p. 03). The definition of EIA adopted by International Association for Impact Assessment (IAIA) in 2009 is, "EIA is the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made"

According to Barker & Wood (1999, p. 387),

"Environmental impact assessment (EIA) is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from a major activity that are likely to have significant environmental effects"

In short, EIA is an "assessment of the impact of a planned activity on the environment" (United Nations Economic Commission for Europe, 1991)

4.3.4 Purpose of EIA

EIA has been recognized as both legislative and management instrument by the experts. Komínková (2016, p. 01) opines that EIA is "one of the main legislative tools established to minimize an anthropogenic impact on the environment". On the other hand, according to Yang & Percival (2009, p.627), EIA is "possibly most widely adopted environmental management tool across the world".

On the other hand, Sinha (1998) suggested, EIA acts as both planning and "decision-making" tool. Jay, et al. (2007) contradicted by saying EIA is decision aiding rather than a decision-making tool. EIA being a decision aiding tool rather puts unduly pressure on the decision maker with the assumption that they can utilize the information provided by EIA to them and make decision on project (Jay, et al., 2007). As a planning tool, EIA prescribes methodologies and procedures for identification, prediction and evaluation of potential environmental impacts of projects by project cycle (Sinha, 1998). If integrated properly, benefits of EIA can be observed in all stages of projects starting from exploration, planning, construction, operations, decommissioning to site closure (Biamah, et al., 2013; Sinha, 1998).

UNEP (2002) lists two core purposes of EIA: i) providing information on environmental consequences of proposed development for decision making; ii) promote sustainable development through identification of appropriate mitigation measures, which were also mentioned in Glasson, et al (2005).

EIA has the potential to serve environment in both short and long terms. According to UNEP (2002), the immediate objectives of EIA are: i) to improve environmental design of the proposal, ii) to ensure appropriate and efficient use of resources, iii) to identify appropriate mitigation measures against potential impacts of the proposal, iv) to facilitate informed decision making and set conditions for environment friendly implementation. On the other hand, the long-term objectives carried out by EIA are: i) to ensure safety and protection of human health, ii) to avoid irreversible changes and damage to environment, iii) to safeguard nature, its resource, area and ecosystem components, iv) to enhance social aspects of the proposal (UNEP, 2002).

4.3.5 Components of EIA system

i) EIA system and its dimensions

UNEP (2002) describes EIA system using three components: i) legal and institutional frameworks for regulation, guidance, procedure establishing the conduct of EIA; ii) steps and activities of EIA process, iii) practice and performance of EIA from quality of EIA reports, decisions taken, and environmental benefits achieved. Experts have used variety of components while evaluating EIA system (see chapter seven for details).

EIA system can have two major dimensions (figure 4.2). Firstly, there is a theoretical side "designed to operate on certain principles" and secondly there is the practice of "how it operates" (Emmelin, 1998, p. 132). The theoretical side of EIA system can be explored through legal, institutional frameworks (i.e. system capacities), guidance and procedure to conduct EIA (Kolhoff, et al., 2009; Emmelin, 1998). These are also known as 'foundation of EA system' (Sadler, 1996). The practice can be explored using the concrete and measurable outcomes like EIA report, quality of process and project modifications (See chapter seven for more) (Kolhoff, et al., 2009; Emmelin, 1998).

Therefore, EIA process is a component within overall EIA system, alongside the legal and institutional framework. EIA report (EIS) preparation, review, decision making, implementation and monitoring of mitigation measures are some of the key stages and components of EIA process (Glasson, et al., 2005; UNEP, 2002; Sadler, 1996).

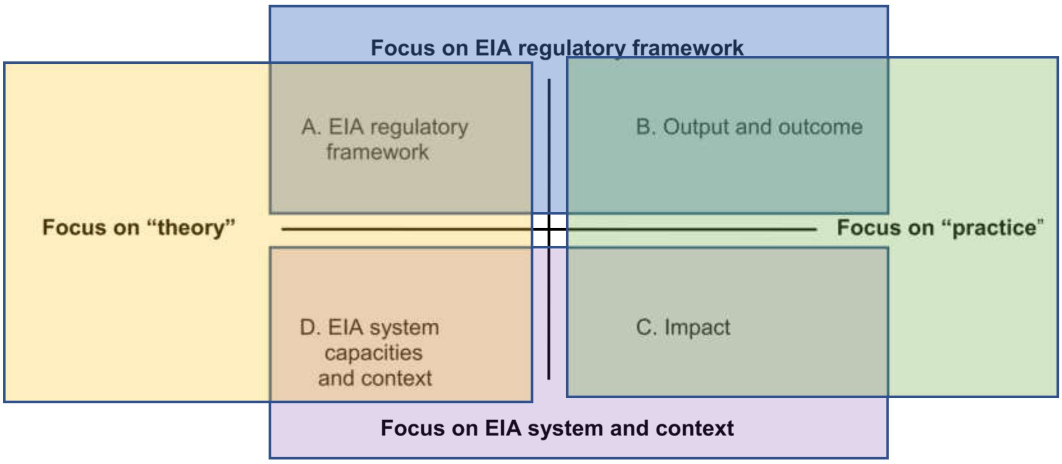


Figure 4.2 Emmelin's (1998) dimensions for approach of EIA system evaluation,
Source: Adapted from Kolhoff, et al. (2009)

ii) Stages and Components of EIA process

Glasson, et al. (2005) suggests EIA assesses impacts of development on environment in a "systematic, holistic and multidisciplinary way". They added, EIA should be a cyclical activity with feedback and interaction between various steps. The summary of the steps followed in an EIA process are described below from Glasson, et al. (2005) and UNEP (2002) -

a) Screening: This step determines whether the project requires EIA depending on their prospective environmental impacts. It can be partially subjected to regulation of the country of concern.

b) Scoping: Identifies the crucial and important issues and impacts to be addressed among all the impacts and alternatives of the project. It helps to establish Terms of Reference (ToR) of EIA.

c) Consideration of alternatives: Ensures all possible approaches (e.g., based on location, scales, process, operating conditions) have been identified including the no action alternative (without project scenario). It helps to establish most environmental-friendly option while achieving the objectives of the project.

d) Description of project: Includes rationale of the project and details on location, processes among the other issues of the project.

e) Description of environmental baseline: Helps to establish present state of the surrounding environment and future in absence of the project however resulting from other natural and anthropogenic occurrences.

e) Identification and prediction of major impacts: Here, firstly potentially significant adverse and beneficial impacts are identified. Then magnitude and other dimension of changes expected in the environment are identified and compared with no action alternative.

f) Evaluation and assessment of significance of impacts: Draws focus on major adverse impacts from assessment of the significance of predicted impacts.

g) Propositions for mitigations: Proposes mitigation measures to *avoid, reduce, remedy or compensate* for significant adverse impacts.

h) Public consultation and participation: Ensure public's opinion are adequately addressed in decision making process and using that quality and effectiveness of EIA is ensured.

i) Preparation of EIS: Aim of this vital step is to document the impacts of proposal, significant effects and concerns of affected communities along with other information.

j) Review of EIS: This is a systematic appraisal to determine whether report satisfies the ToR, adequately addresses the impacts and provides sufficient information for decision making.

k) Decision making: It is performed by relevant authority on the basis of EIS, consultation and other considerations. Proposal can be approved or rejected, or terms of its implementation can be established.

l) Post decision monitoring and auditing (follow up): Post decision monitoring can strengthen future EIA application and enhance environmental management through checking compliance with terms and conditions of approval, application, and effectiveness of mitigation measures. Environmental audit can be undertaken to evaluate quality of prediction and effectiveness of mitigation measures.

4.4 EIA in controlling and managing environmental concerns of textile industry

4.4.1 Potential of EIA for textile industry

Developing countries produce and supply a significant share of textile products in global market (Boström & Micheletti , 2016). Therefore, these regions are overwhelmed with the surge of industrialization leading towards increased pressure on natural resources, pollution and environmental degradation (UNEP, 2002). The objectives of EIA (see section 4.3.4) fit here impeccably, indicating EIA as a substantially potential instrument to address the environmental sustainability of developing countries, where industrial pollution is one of the key concerns.

Although EIA is 'one of the several policy instruments' that can facilitate sustainability, it has great potential to contribute and draw from the other instruments in this quest (Lawrance, 1997). It can influence the effectiveness of other policy instrument in a supportive cultural, political and institutional context. Its requirement for careful planning through systematic data collection, analysis, extensive consultations and transparency, decision-making and implementation can aid the other policy instruments (Lee & George, 2000). Thus, EIA can connect and assist in application of diverse policy instruments relevant to textile industry. Therefore, although EIA started its journey in the traditional era of the environmental policy instruments, it has the potential of incorporating the instruments from modern and post modern era.

For pollution-intensive textile units (e.g., textile wet processing units) EIA can provide framework for analysing impacts considering their location, design/process alternatives. it can also indicate areas needing attention and therefore suggest suitable development actions and modification to minimize the adverse impacts in textile units. EIA can aid in rational and systematic decision making for the relevant authority. It can serve as the basis for negotiation between proponent, affected groups and regulators for making decision on the best environment friendly alternative (Glasson, et al., 2005). Therefore, as a proactive tool, it can aid in environmentally sound development and operation of the textile units.

According to Bartlett & Kurian (1999), successful EIA can influence the mandate, rule and procedures of the agencies through incorporating "ecological rationality in decision making". Therefore, EIA can be used in development permit and environmental licensing regulations (Lee & George, 2000) for textile units. Also, it can ensure compliance with environmental standards (UNEP, 2002) like emission and effluent standards suggested in regulations of different countries. Compliance to such standards is usually verified through the monitoring stage of EIA in practice.

EIA can also serve as a market-based tool. According to Lee ad George (2000), EIA can assist in appraisal of economic instruments for environmental protection and environmental expenditure programmes by the government. Private sector incentives are also influenced by EIA or EIA induced development permit, especially as prerequisite of loan approval or sometimes as business requirement (Bartlett & Kurian, 1999). Thus, EIA provides information aiming at protection of environment while improving “the effectiveness of self-regulation and market forces” (Bartlett & Kurian, 1999, p. 420).

EIA also serves as an information processing model (Bartlett & Kurian, 1999). This is especially, in developing countries experiencing industrialization, EIA brings quality information facilitating long-term development (Bartlett & Kurian, 1999). EIA can assist the voluntary and information tools like ecolabelling (Bartlett & Kurian, 1999), which is widely used for textile products and can help consumers in informed decision making. Even EIA is embedded within environmental management schemes for impact evaluation, improve management system and performance (Bartlett & Kurian, 1999; Glasson, et al., 2005). Glasson, et al. (2005) suggests, “EMS can thus be seen as a continuation of EIA principles into the operational stage of a project”. These days, EMS are getting increasingly popular among brands and producers, and EIA can utilize its own mandate through EMS in textile industry.

EIA has been identified as most widely adopted environmental policy instrument around the world (Yang & Percival, 2009) . It has been legally adopted in majority of developing countries since mid-1990s (Wood, 2003; Glasson, et al., 2005). Therefore, EIA can possibly formulate an encompassing framework incorporating diverse range of policy instruments relevant to textile industry and contribute towards their effectiveness.

4.4.2 Limited sectoral studies

As widespread the use of EIA is visible for textile industry, comprehensive studies on this regard are not widely available. Exploring environmental impacts of textile industry is a familiar research topic among experts, often concluding with remedies through cleaner production technologies (See section 3.3 in chapter three for more details) (Hasanbeigi, 2010; Babu, et al., 2007; Madhav, et al., 2018; Parisi, et al., 2015; Karthik & Gopalakrishnan, 2014; Rana, et al., 2015; Samanta, et al., 2019; Choudhury, 2014; Sajn, 2019). Apart from these, there are research on impact assessment methods, environmental performance indicators for textile industry (Ren, 2000; Resta & Dotti, 2015). Studies on exploring major environmental policy instruments and their role are also visible for this industry (Xu, et al., 2018; Virta & Räisänen, 2021; Blackman, et al., 2010). Compliance to relevant policy instruments and environmental management practice are also common for textile industry (Samad, et al., 2015; Hemachandra, 2015; Ghatak, 2019). On the contrary, study on the role of EIA for textile industry is quite limited. As a matter of fact, limited research could be found on evaluation of EIA system or its components for different industrial sectors. Examples include effectiveness of EIA follow up for Platinum mines in Zimbabwe (Gwimbi & Nhamo , 2016; Gwimbi, 2014); open cast coal mines in India (Jha-Thakur, et al., 2009); water sector management in Iran (Khosravi, et al., 2019); evaluation and analysis of EIA process in: Oil, gas and mining industry of Nigeria (Ingelson & Nwapi, 2014; Wifa, 2014; Morounkeji , 2012).

On the other hand, studies on evaluation or comparison of generic EIA system within or among countries are very common (See chapter seven for more) (Lee & George, 2000; Wood, et al., 1996; Sadler, 1996; Jha-Thakur & Fischer, 2016; Barker & Wood, 1999; Annadale, 2012; Glasson & Salvador, 2000; Lee, et al., 1999; Arts, et al., 2012; Kabir & Momtaz, 2013) .

Being a polluting sector, textile and clothing industry is included within mandatory EIA regulation of more than 100 countries of the world including US, EU, India, Bangladesh, Vietnam, China and international organisations like UNEP, World Bank, Asian Development Bank (ADB) (Resta & Dotti, 2015; U.S. Council on Environmental Quality, 1970; European Union, 1985; Central Government of India, 1986; Socialist Republic of Viet Nam, 1983; The People's Republic of China, 1979). However, very few of the countries have developed sector-specific EIA methodology (Parashar, et al., 1997). Many countries have provided sector-specific guideline for EIA process or EIS of textile industry as supplement to the core regulation (see chapter seven for more). However, adherence to guideline is voluntary. Therefore, exploring the role of EIA system as a policy tool in textile industry is a challenging but much needed research.

Chapter summary

The key environmental policy instruments (i.e., regulatory, market based, and voluntary & information based) are utilized for environmental control and management textile industry around the world. Although, currently voluntary and information-based approaches are widely popular, it is also argued that the units are driven to environmental compliance because of the regulatory instruments. Presently, EIA is practiced in more than 187 countries of the world. It not only serves the regulatory purpose, but it is also increasingly used in planning and management. EIA also has great potential in drawing from other environmental instruments. Therefore, it can utilize and make effective use of the diverse policy instrument applicable to textile industry globally. However very limited studies are available regarding EIA’s efficacy for textile industry. Therefore, exploring the role of EIA system as a policy tool in textile industry is a challenging but compelling research.

Chapter Five: Textile Industry in Bangladesh, its environmental impacts and relevant environmental policy instruments

Chapter five helps developing understanding on textile industry of Bangladesh and its environmental impacts along with the relevant environmental policy instruments in practice. Consequently, this chapter is divided into three major sections. The first section describes economic importance, structure and statistics considering variety of units within the textile industry of Bangladesh. The second section explores the environmental concerns raised by this industry in the country. Following on, environmental policy instruments relevant to textile industry in Bangladesh is discussed in the third section along with the role EIA plays within them. This chapter is predominantly a literature review chapter, however, notes from the face-to-face interviews also supported discussion in some of the sections. This chapter accomplishes third part of the first objective and finally supports in formulating recommendation (i.e., objective five) for this research.

5.1 Textile industry of Bangladesh

Around 50% of the total gross value added from the manufacturing sector of Bangladesh is attributable to the country's textile industry[47] (BBS, 2012). Alongside, this industry constitutes 40% manufacturing establishments of the country and is responsible for employment of 71% manufacturing industry workforce (BBS, 2012). Readymade garment (RMG) manufacturing[48], which is a part of textile industry of Bangladesh (discussed in section 5.1.2) is contributing largely towards country's economic growth since 1970s (World Economic Forum , 2017; Selim, 2018). Export of RMG by Bangladesh has experienced significant rise in last ten years (Selim, 2018). In the year 2020, the RMG sector of Bangladesh shared 83% of country's total exports, which was worth USD 27.95 billion (Statista, 2021). Furthermore, income multiplier[49] for the sectors within textile industry is very high. A study by Raihan & Khandker (2010) found that for one-unit injection[50] in the sectors of knitting, RMG, dyeing and bleaching, handloom cloth and cloth mills, nine to 11 units of income yield is resulted within the economy.

[47]Alternatively called "textile and apparel industry" or "textile and clothing industry" or "textile and readymade garment industry". Author will use "textile industry" through the report for clear understanding.
[48] Alternatively called clothing or apparel manufacturing
[49] Amount of new income generated from an addition of extra income.
[50] Injections can be investments, government incentives (Raihan and Khandakar, 2010)

In the global market, Bangladesh is also a major supplier of RMG. The fibre base of Bangladesh is dominated by cotton, which is reflected in the RMG exports (Begum & Kumar, 2018; Kaul & Anusuya, 2021).In the year 2019, Bangladesh was the third largest exporter of RMG in global market just after China and EU (Satista, 2021). In 2015, the largest importer of textile and RMG products of Bangladesh was EU (61%), while North America was the second largest (24%) (table 5.1) (WITS, 2021). Including these two countries, at least 151 other nations import RMGs from Bangladesh (Masum, 2016). The global RMG market is projected to grow up to 2.25 trillion USD by 2025 from 1.5 trillion USD in 2020 (Statista, 2021). Being responsible for significant share of supply in the global market, this demand is likely to affect the textile industry of Bangladesh. Specially the wet processing units are predicted to grow significantly over the next few years (Restiani, 2017).

Table 5.1 Share of textile and RMG exports from Bangladesh in year 2015 by global regions

Regions	**Share of textile and clothing exports from Bangladesh**
Europe and Central Asia	62%
North America	24%
East Asia and Pacific	9%
Latin America and Caribbean	1%
South Asia	1%
Middle East and North Africa	1%

Source: WITS (2021)

5.1.1 Definition and structure of the textile industry in Bangladesh

The Textile policy (2017) by Department of Textile (DoT) defines textile industry of Bangladesh as the manufacturing units involved in diverse range of processes starting from production of yarn to fabrication of textile (DoT, 2017). In other words, this industry constitutes all manufacturing units between yarn production to textile fabrication.

i) Structure and components of textile industry of Bangladesh based on manufacturing processes

The four key manufacturing processes within textile industry recognized in international literature are: i) yarn manufacturing, ii) fabric manufacturing, iii) wet processing and iv) textile fabrication (see section 3.2.1 in chapter three). These are known as key sectors for textile and

RMG industry of Bangladesh too, in addition to few others (table 5.2). Manufacturing units within the textile industry of Bangladesh are classified and identified differently throughout the policies and databases (table 5.2). The classification provided in the Textile policy 2017 of Bangladesh appears to be a thorough and complete list of diverse "sectors" (i.e., main processes) and "sub-sectors" constructing textile industry.

Table 5.2 Terms used in different policy documents and databases for classifying establishments or sectors within textile industry of Bangladesh

From sectoral guideline by Department of Environment (DoE) (1997)	**From Textile policy by DoT (2017)**	**From Statistics of establishments in Survey of manufacturing industries of Bangladesh by Bangladesh Bureau of Statistics (BBS) (2012)**	**From raw database of DoT (2019)**
Textile Spin and composite	Fibre Preparation	Preparation and spinning of textile fibres (yarn manufacturing)	Yarn Manufacturing (Spinning)
Weaving and spinning	Yarn Manufacturing	Weaving of textiles (Fabric manufacturing)	Fabric Manufacturing
Dyeing, printing, finishing	Preparatory industries[51] for fabric manufacturing	Finishing of textiles including dying, bleaching etc. (Washing-dyeing-finishing sector)	Textile Dyeing, printing, washing and Finishing
Readymade and Hosiery Garments	Woven fabrics	Manufacture of wearing apparel, except fur apparel (Clothing sector)	Composite Textile factories
Hosiery and Hosiery Composite	Non-woven fabrics	Other (e.g., manufacturing handloom textile, carpet, rug, knitted and crocheted fabric)	Readymade Garments
Others	Knitted fabrics	-	Accessories Manufacturing

[51] Most commonly used term "industries" in policy documents of Bangladesh actually refer to factories/mills

From sectoral guideline by Department of Environment (DoE) (1997)	From Textile policy by DoT (2017)	From Statistics of establishments in Survey of manufacturing industries of Bangladesh by Bangladesh Bureau of Statistics (BBS) (2012)	From raw database of DoT (2019)
-	Crocheted Fabrics	-	Other Textile factories
-	Textile dyeing, printing and finishing	-	-
-	Clothing industries	-	-
-	Cloth processing industries	-	-
-	Clothing accessories manufacturing industries	-	-
-	Other textile industries (e.g., sanitary towel, embroidery)	-	-

Source: DoE, (1997c);DoT (2017); BBS (2012); DoT (2019)

To avoid confusion, author amended and simplified the classification for the units belonging to textile industry of Bangladesh. For example: there are some important categories like composite units within the textile industry of Bangladesh (Table 5.2). These units comprise of range of processes starting from yarn manufacturing to finished apparel. However, in the Textile policy (2017), these units are considered as sub-sectors under yarn manufacturing. This research will keep composite units as separate sector, since these units are relatively more complex and involves more polluting activities than yarn manufacturing. The revised classification of sectors and associated sub-sectors of textile industry in Bangladesh for the purpose of this study is presented in table 5.3.

Table 5.3 Revised list of sectors and subsectors within textile industry of Bangladesh prepared by researcher

Sectors	**Sub-sectors**	
1. Yarn manufacturing	1.1 Fibre preparation	1.1.1 Ginning (extraction of cotton from seeds
		1.1.2 Manufacturing of manmade fibre
	1.2 Spinning	1.2.1 Textile spinning (open end or Rotor spinning, Ring spinning)
		1.2.2 Waste cotton spinning
	1.3 Manufacturing of filament yarn	
	1.4 Rope and twine natural fibre	
	1.5 Rope and twine manmade fibre and filament	
2.Textile composite industries(factories)		
3. Fabric manufacturing	2.1 Preparatory industries(factories) for fabric manufacturing	2.1.1 Twisting
		2.1.2 Zori Manufacturing
		2.1.3 Warping
		2.1.4 Sizing
		2.1.5 Winding
	2.2 Woven Fabrics	2.2.1 Weaving handloom
		2.2.2 Weaving powerloom
		2.2.3 Weaving specialized textile (for cotton and mixed fibres)
		2.2.3 Weaving specialized textile (for silk, synthetic and mixed fibres)
		2.2.4 Weaving carpet
		2.2.5 Weaving blanket
	2.3 Non-woven fabrics	
	2.4 Knitted fabrics	2.4.1 Warp knitting
		2.4.2 Fish netting
		2.4.3 Circular knitting (hosiery)
		2.4.3 Circular knitting (socks)
		2.4.3 Circular knitting (rib fabrics)
		2.4.3 Circular knitting (gas metals)
		2.4.3 Circular knitting (others)
		2.4.4 Flat knitting
	2.5 Crocheted fabric	
4. Textile dyeing, printing and finishing	3.1 Mercerizing of yarn and fabrics	
	3.2 Yarn dyeing and printing	
	3.3 Knit dyeing, printing and finishing	
	3.4 Woven dyeing, printing and finishing	
	3.5 Water proofing	
	3.6 Calendering	
	3.7 Raising (flannel cloth)	
	3.8 Flat sueding of fabrics	

Sectors	Sub-sectors	
5. Clothing industries (factories)	4.1 Garment manufacturing	4.1.1 Readymade Garments (knit wear and woven)
		4.1.2 Hosiery garments
		4.1.3 Cap manufacturing
		4.1.4 Other garments
	4.2 Cloth processing industries(factories)	4.2.1 Laundering
		4.2.2 Garment washing
		4.2.3 Garment printing
	4.3 Cloth accessories manufacturing	4.3.1 Sewing thread
		4.3.2 Fusing materials (Woven Bocrom)
		4.3.2 Fusing materials (non-woven)
		4.3.3. Padding materials
		4.3.4 Zipper and Zip
		4.3.5 Tape woven label manufacturing
		4.3.6 Non-woven label
		4.3.7 Braiding industries (factories)
		4.3.8 Netting industries (factories)
		4.3.9 Stickers
		4.3.10 Label printing
		4.3.11 Hantack
		4.3.12 Button manufacturing
6. Other textile industries(factories)	5.1 Absorbent cotton	
	5.2 Sanitary towels	
	5.3 Embroidery	
	5.4 Chumki	
	5.5 Fabric bag (woven, nonwoven, others)	

Source: Amended from textile policy 2017 (DoT, 2017)

Table 5.3 shows that Bangladesh produces great variety of commodities within its textile industry (e.g., natural and manmade fibre, staple and filament yarn, woven, knit and nonwoven fabrics and apparel). Alongside, the wet processing units within the industry performs dyeing-printing-finishing-washing for all variety of textile commodities (e.g., yarn, fabric and apparel). Also, the industry includes units producing clothing accessories like zipper, label, stickers and industrial textiles (table 5.3).

Quoting Masum (2016, p.111) "The production processes of textile-clothing firms in Bangladesh mainly fall into three types: i) vertically integrated, i.e., they buy fibre and then process the fibre into finished apparel; ii) semi-vertically integrated, i.e., they buy yarn and then convert the yarn into finished clothing; and iii) horizontally integrated, i.e., they buy fabric and then convert fabric into finished clothing". The researcher has prepared a schematic diagram (figure 5.1) depicting the flow of manufacturing processes within textile industry of Bangladesh

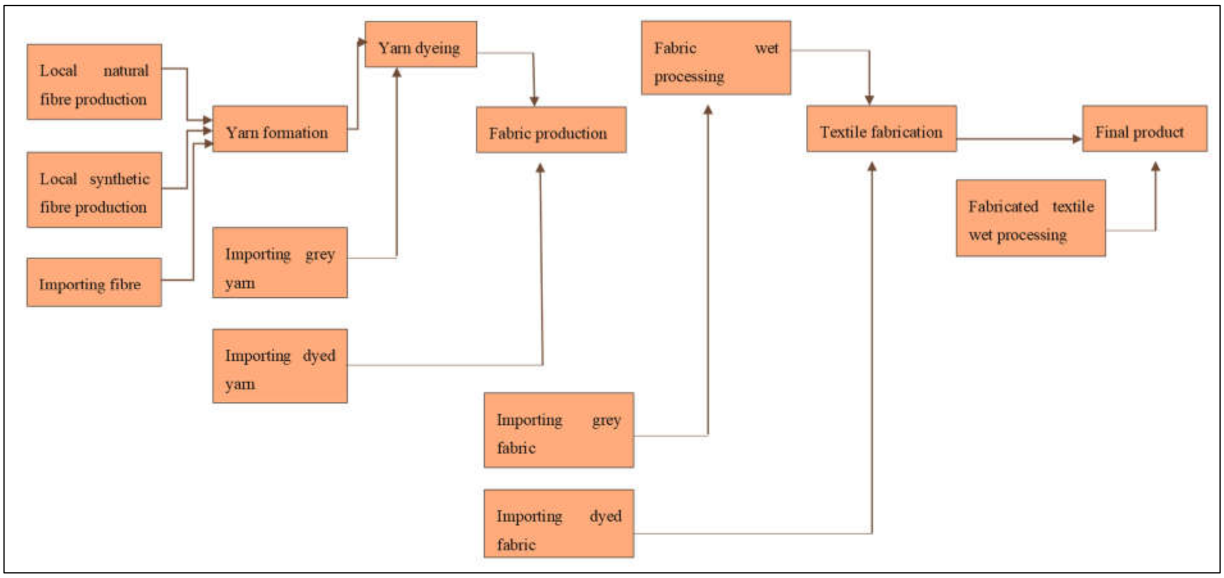


Figure 5.1 Flow of key manufacturing processes within textile industry of Bangladesh
Source: Prepared by author with information from Masum (2016), DoT (2017) and import data by OEC (2019)

ii) Structure of textile industry of Bangladesh based on size and target market

National Industrial policy 2016 defined the manufacturing units within the country by their size of assets and employment (i.e., **cottage, micro, small, medium and large**), which also applies to the units with textile industry (table 5.4). Statistics of these units for textile industry is shown in section 5.1.2. However, there is inconsistency in definitions set by different agencies. Bangladesh Small & Cottage Industries Corporation (BSCIC) considers units with less than 0.5million BDT worth of asset and 10-20 workers as cottage industry, which contradicts the definition in national industrial policy (below 1 million BDT). On the other hand, Department of Environment (DoE) (1997b) defines cottage industry as "industrial units producing goods or services in which by full-time or part-time labour of family members are engaged and the capital investment of which does not exceed Taka 5 (five) hundred thousand[52]" and exempts them from requirement of Environmental Clearance Certificate (ECC) or any kind of environmental assessment.

Textile and apparel units of the country serve in both domestic and international markets. With limited resources, it is understood that the **cottage units** cannot aim for international market on their own, neither can they serve other industrial units requiring mass production. Also, one

[52] 0.5 million BDT or 5952 USD

of the entrepreneurs mentioned, handmade products cannot bring uniform finishing (interviewee #19). Therefore, according to researcher's understanding, the cottage units of textile industry of Bangladesh mostly serve the domestic market. **Non-cottage units (micro, small, medium and large)** may serve both domestic and international (export oriented) market, depending on their resources. Labowitz & Baumann-Pauly (2015) have categorized the export-oriented units within textile industry of Bangladesh.

According to Labowitz & Baumann-Pauly (2015), the export-oriented textile units can be divided into two broad groups: formal and informal, and further based on the connection with international buyers (i.e., brands): direct and indirect. According to their definition there are three categories[53] of textile units in Bangladesh: direct formal units, indirect formal units, indirect informal units (Labowitz & Baumann-Pauly, 2015). The **direct formal units** are registered with government and national trade unions of export manufacturers and receive direct orders from buyers. While indirect units can be either formal or informal. The **indirect formal units** are enlisted with government and trade unions, but they do not have direct connection with buyers. On the other hand, the **indirect informal units** are neither registered with government nor the trade unions. However, the indirect ones are sub-contracted by direct formal units and mostly contribute to the seasonal fluctuations in order. At least 91% of the informal units have been producing for export in some manner (Labowitz & Baumann-Pauly, 2015). Quoting Labowitz & Baumann-Pauly (2015, p.04),

"Indirect sourcing is key to Bangladesh's high-volume, low-cost model of garment production"

However, these units mostly provide low-skill and discrete production processes e.g., cut-and-sew production or washing and dyeing (Labowitz & Baumann-Pauly, 2015). The World Bank (2014) suggests, major share of wet processing units in the country is informal in nature. Therefore, even if the informal units are involved in polluting processes, they remain unregulated being unlisted. According to researcher's understanding, the non-cottage units serving the domestic market might also belong to the category of indirect formal or indirect informal units and contribute to international market. Alongside, some direct formal units with primary aim of international market may also produce for domestic market (figure 5.2).

[53] They did not identify indirect formal units for textile industry in Bangladesh

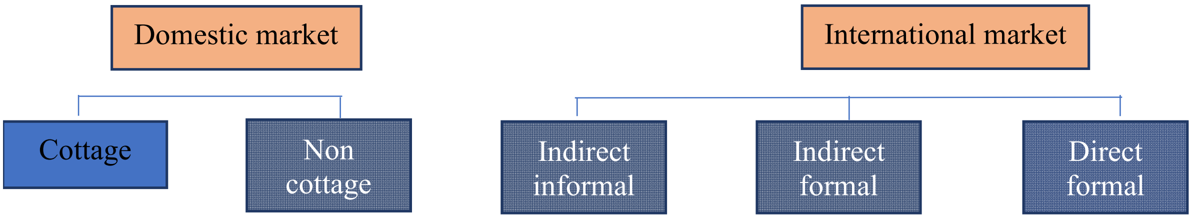


Figure 5.2 Categories of textile units in Bangladesh based on target market

Source: Prepared by author with information from Labowitz & Baumann-Pauly (2015)

The cottage textile units of the country are dependent on manual production process (figure 5.3, 5.4), while the formal textile units are equipped with modern machineries (figure 5.5, 5.6).

Figure 5.3 Weaving (fabric manufacturing) by handloom in Bangladesh

Source: Dhaka Tribune (2019)

Figure 5.4 Hand dyeing in a cottage dyeing unit of Bangladesh

Source: Arabnews (2022)

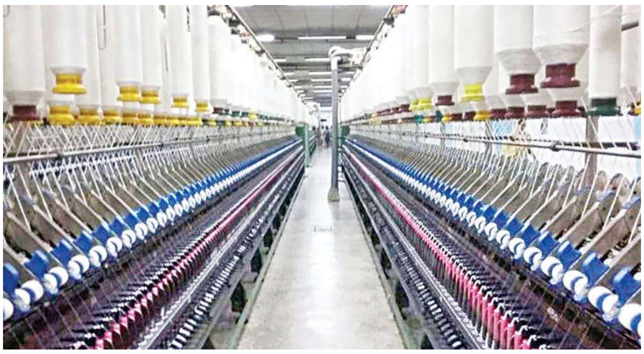


Figure 5.5 Spinning (yarn manufacturing) process of a formal textile unit in Bangladesh

Source: The Daily Star (2021)

Figure 5.6 knitting and dyeing sections of a formal textile unit in Bangladesh

Source : Islam (2018)

5.1.2 Existing statistics of units within textile industry of Bangladesh

In the duration of this study, the researcher was not able to get hold of comprehensive database or clear statistics of textile units in Bangladesh. The database of the existing factories by DoT are listed according to the main sectors within textile industry of Bangladesh. However, this database is incomplete and still in process of updating (interviewee #18). On the other hand, the database of the professional societies like Bangladesh garments manufacturers and exporters' association (BGMEA) and Bangladesh knitwear manufacturers and exporters' association (BKMEA) are dominated by apparel and knitted textile manufacturing units respectively. Therefore, those databases are not comprehensive either. On the other hand, the statistics for garment manufacturing units in Bangladesh vary greatly between the databases of BGMEA (2020) and DoT (2019). According to them, the number of units are 4371 and 1782 respectively. While other sources mention that, more than 5000 apparel manufacturing units exist within the textile industry of Bangladesh (2030 Water Resource Group, 2015). Therefore, inconsistencies exist not only among the definitions, but also for the statistics provided by different agencies on textile units of Bangladesh.

i) Statistics of textile units in Bangladesh according to manufacturing process

Even though Bangladesh Bureau of Statistics (BBS) has some sort of statistics (table 5.4), none of the agencies have comprehensive information on variety of textile units in Bangladesh. Specially statistics from BBS and DoT vary greatly. Weaving i.e., fabric manufacturing and handloom falls under Orange A category units (see section 6.1.2 in chapter six for definition) defined in Environmental conservation rules (ECR) '97. number of such units varies widely between BBS and DoT's database (6860 and 89 respectively, see table 5.4). The same is observed for spinning (also known as yarn manufacturing) and readymade garments (also termed as manufacturing apparel). These two are designated as Orange B category units (See section 6.1.2 in chapter six). DoT's list (2019) contains 160 dyeing-printing- finishing units and 393 composite units which indicates 553 red category units (see section 6.1.2 in chapter six). BBS (2012) estimated this number as 900 (under the category "finishing of textiles"). On the contrary, the 2030 Water resource group (2015) claims this number to be 1700 (Labowitz & Baumann-Pauly, 2015). From the gaps in databases, it can be argued that a great number of unregistered textile manufacturing units exist in Bangladesh (table 5.4). While red category units are the most polluting units requiring detail EIA study for ECC, lack of their definite database is alarming.

Table 5.4 Comparison of statistics for units within textile industry of Bangladesh by manufacturing processes

Type of establishments by BBS		**Number of units**	**Type of establishments by DoT**	**Number of units**	**Category according to ECR'97**
Preparation and spinning of textile fibres (yarn manufacturing)		1516	Yarn Manufacturing (Spinning)	43	**Orange B**
Weaving of textiles (excluding handloom product) (Fabric manufacturing)		750	Fabric Manufacturing	89	**Orange A**
Finishing of textiles including dying, bleaching etc. (Washing-dyeing-finishing sector)		900	Textile Dyeing, printing, washing and Finishing	160	**Red**
Manufacture of wearing apparel, except fur apparel (Clothing sector)		4307	Readymade Garments	1782	**Orange B**
Other	Manufacture of handloom textile	6110	Composite Textile factories	393	Handloom is **Orange A**, Composite is undefined
	Manufacture of spooling and thread ball	181	Garments Accessories Manufacturing	151	Undefined
	Manufacture of knitted and crocheted fabrics	724	Other Textile factories	72	Undefined
	Manufacture of knitted and crocheted apparel	2314	-	-	Undefined
	Manufacture of made-up textile articles, except apparel	259	-	-	Undefined
	Manufacture of carpets and rugs	29	-	-	**Red**
	Manufacture of cordage, rope, twine and netting	112	-	-	**Green**
	Manufacture of other textiles n.e.c. (Goods designer)	80	-	-	Undefined
	Embroidery of textile goods and wearing apparel	355	-	-	Undefined
	Pressing and belling jute; Manufacturing jute textile and fur article	330	-	-	Jute mill is **Orange A**, others are Undefined
Total		17967	Total	2690	

Source: BBS (2012) and database of DoT (2019)

ii) Statistics of textile units in Bangladesh according to size

A survey by BSCIC estimated the number of total cottage units in the country to be 830,306. Within it, the number of textile and garment manufacturing units are 141,035 and 42,730 respectively (BSCIC, 2013). Garment manufacturing units have greater share of large units (table 5.5). Possibly owing to this reason, these units tend to be listed and their statistics from BBS (2012) and BGMEA are very close (4307 and 4371 respectively). From table 5.5 it is visible that major share of the textile manufacturing (yarn, fabric manufacturing and wet processing) units belongs to cottage, micro and small categories. Therefore, this segment of textile industry in Bangladesh is highly likely to remain unlisted and unregulated, even while being responsible for contributing to considerable pollution.

Table 5.5 Statistics of textile and garment manufacturing units in Bangladesh by size

Type of units	**Amount of investment (value of fixed assets in BDT excluding land and factory building** (GoB, 2016)	**No. of employed workers** (GoB, 2016)	**No. of textile manufacturing units**[54]	**No. of apparel manufacturing units**
Cottage	Below 1 million	less than 15	-[55]	-[56]
Micro	1 million to 7.5 million	16-30	5424	764
Small	7.5 million to 150 million	31-120	4064	1066
Medium	150 million to 500 million	121-300	1137	2402
Large	more than 500 million	more than 300	358	2752

Source: BBS (2012)

5.2 Environmental impacts of textile industry in Bangladesh

The expert from The World Bank interviewed by author (2020) suggested,

> "If the industrial units are environmentally sustainable then they will eventually get the economic competitiveness".

However, the Planning commission of Bangladesh (2014) recognizes that economic prosperity from industrial growth in the country is coming at the cost of environment and human health due to poor attention towards sustainable development. According to The World Bank (2018), Bangladesh has faced dramatic shift in environmental health risks in past three decades.

[54] Include yarn manufacturing, fabric manufacturing and wet processing units.
[55] 141,035 according to BSCIC (2013) but for asset worth 0.5million BDT and 10-20 workers
[56] 42730 according to BSCIC (2013) but for asset worth 0.5million BDT and 10-20 workers

Environmental performance index[57] (EPI) of Bangladesh shows that the country belongs to one of the lowest positions (173rd) among the 180 countries of the world (Sharpe, 2017).

> "Globally, Bangladesh is among the countries most affected by pollution and other environmental health risks". - The World Bank (2018, p. 08)

A study by Hossain (2016) found that, incidents of pollution induced diseases like dermatological diseases and asthma are respectively 15 and 19 times higher among the people residing within 1km radius of heavy polluting industrial area, compared to the regular urban area residents of Bangladesh.

Emerging industry of textile in Bangladesh is deemed responsible for increased environmental concerns in the country. The World Bank suggests that simultaneous growth of textile & garment manufacturing units, and the urban population is resulting in exposure of this population to environmental hazards (The World Bank, 2018). The country faces great challenge in managing industrial standards (The World Bank, 2014).

Majority of textile units in this country are clustered in few geographic locations, mostly adjacent to rivers (Sharpe, 2017). Their wastes and effluents discharged in river and farmlands are significantly affecting the livelihood of farmers and fisherman, alongside the health of surrounding community (Textile Today, 2008). Sharpe (2017, p.02) reported, the main impacts caused by this sector in developing countries are "use intensity of water resources, chemical use including toxic chemicals, wastewater discharges and lack of treatment processes, and energy use and carbon intensity of electricity".

The environmental impacts caused by textile industry in Bangladesh is discussed in light of two broad areas: i) resource consumption and use of chemicals, ii) waste generation and disposal.

5.2.1 Resource consumption and use of chemicals

Consumption of resources and resultant wastes are two of the major environmental concerns of textile industry (see section 3.3 in chapter three). Inadequate pricing of water and inadequate practice of using meter for groundwater extraction lead the water intensive industries like textile and leather in Bangladesh towards exploiting the resources and making water

[57] The EPI ranks indicate country's performance on high priority environmental issues: protection of human health from environmental harm and protection of ecosystems. – ILO, 2017

conservation difficult (The World Bank, 2018). Such practice is attributable to declination of groundwater at the rate of 2.5 meter every year in the areas with most textile units (Sarker, 2017; Raihana, 2015). Likewise, the use of water by the textile units in Bangladesh is two to threefold than the standard paractice around the world (2030 Water Resource Group, 2015). The World Bank (2014) suggested, such usage could be equivalent to the consumption of 12 million inhabitants of the capital city. Considering the projected growth at business as usual scenario, this industry will require water equivalent to the annual need of 60 million people by 2030 (2030 Water Resource Group, 2015). Excessive consumption of water by the industrial units is already responsible for upto 70 meters drop of ground-water level in several locations of the country. It is also causing the aquifer contamination by polluted surface water, increased price and reduced access to good quality water, thus increased manufacturing cost (The World Bank, 2014; IWM, 2007).

Usage of water also affects energy consumption (Hasan & Leonas, 2018). According to Haque, et al., (2021), every year textile sector of Bangladesh consumes about 1,500 million cubic meters (m^3) of groundwater using around 980 million Kilowatt-hour electricity for extraction, at expense of four billion USD. Such heavy energy demand by the industry also impacts the availability and cost of energy supply. Textile industry alone is responsible for 42.2% of total natural gas consumed by industries of Bangladesh. Share of total energy consumption by this industry is around 30%, which is highest among the key sectors (SREDA, 2015). Quality of production equipment is directly responsible for the water and energy consumption in manufacturing process (Kocabas, et al., 2009). Likewise, textile processing units of Bangladesh loss 20-32% of energy due to use of old mechanisms and equipment (Habib, et al., 2016). Restiani (2017)'s study indicated increased energy consumption can lead towards increased Greenhouse gas (GHG) emission. However, being largely Small and medium enterprize (SME) dominant, textile industry of Bangladesh have limited access to advanced knowledge base; which affects designing suitable improvement plans for diverse units within it (Hasan & Leonas, 2018; Hasanbeigi & Price, 2012). Also lack of investment capacity by small scale textile manufacturers; and lack of collaboration among multi sector stakeholder can affect water and energy conservation plans within the country (Hasan & Leonas, 2018).

The country lacks hazardous chemical management policy. Thus, implementation of Manufacturing estricted Susbstances list (MRSL) is voluntary for the proponents of the textile units (Interviewee #14, #15, #16). Use of harmful chemicals in this industry is causing toxincontaining-effluent dumping. These toxins include fabric dyes, formaldehyde, chlorine, heavy metals like lead and mercury, defoamers, bleaches, detergents, optical brighteners, and equalizers (Selim, 2018). They flow through waterbodies and end up in major rivers around Dhaka (Selim, 2018). Selim (2018) indicated, such incidents are responsible for Buriganga river being declared as ecologically dead in 2011. Specially large number of unregulated wet processing units (see 5.1.2) under textile industry of Bangladesh is a serious concern.

5.2.2 Waste generation and disposal

> "Industrial pollution accounts for 60% of pollution in the Dhaka watershed area, and the textile industry is the second largest contributor after tanneries." - (The World Bank, 2017, p. 01)

Majority of the studies relevant to environmental impacts by textile industry in Bangladesh are focussed on water pollution. Here, the experts agreed that discharge of untreated wastewater from this industry is causing serious pollution and intoxication of water resources and health of living beings (The World Bank, 2014; Dey & Islam, 2015; Hannan, et al., 2011; Restiani, 2017). The World Bank (2014, p. xvi) sums up the impact of textile industry of Bangladesh-

> "Heavy chemical usage, combined with water, has resulted in large volumes of untreated effluent being discharged, affecting potable drinking water supplies, fisheries, and agricultural productivity, and citizen's health and wellbeing".

Restiani (2017; p.13) warned about washing-dyeing-finishing (WDF) units within the industry,

> "The WDF textile units impose the largest environmental footprint of the industry due to intensive freshwater abstraction for washing, dyeing, and finishing; large volume of wastewater generation and discharge; large use of chemicals; and high energy use for heating of water and steam generation".

Therefore, intense use of chemicals is the key reason of hazardous effluent generation within this industry (The World Bank, 2014; Restiani, 2017). Studies have reported textile effluents exceeding acceptable limits in various areas of the country indicating its pollution potential and threat to aquatic system (Rahman, et al., 2008; Akhtar, et al., 2016; Selim, 2018; Islam, et al., 2011; Dey & Islam, 2015). Islam, et al. (2011), reported that their case study areas with high concentration of textile units were facing potential environmental degradation due to disposal of untreated industrial effluents. They also reported that the physical and ecological resources of their study area were experiencing negative impacts from textile dyeing industry. On the other hand, Restiani (2017) argued, textile wastewater is responsible for the declining quality of surface water in the major waterbodies around industrial clusters in Bangladesh. Dey & Islam (2015) suggested, poor quality of surface water can cause insufficient water supply for drinking, irrigation, and future textile processing. It can also spread pollutant through interconnected channels and degrade the health of aquatic life. Therefore, health of human and animals who consume fishes or water from these sources are also threatened (Dey & Islam, 2015). Water pollution in Bangladesh is responsible for two-third of the country's water borne diseases (Dey & Islam, 2015). Dey & Islam (2015) found following values of wastewater parameter from textile units in Bangladesh (table 5.6). The values indicate "present pollution scenario in Bangladesh with tremendous violation of laws" with respect to allowable limit of wastewater parameters set by ECR'97 (table 5.6) (Dey & Islam, 2015, p.15).

Table 5.6 Range of values of wastewater parameters from textile units in Bangladesh (2005-2014)

Wastewater parameters	**Value for textile units in Bangladesh from 2005-2014**	**Maximum allowable limit prescribed by ECR'97**
Temperature	25-65°C	40°C
pH	3.9-14	6.5-9*
TDS	90.7-5980 mg/L	2100mg/L*
DO	0-7 mg/L	4.5-8 mg/L
COD	41-2430 mg/L	200-400 mg/L
BOD	10 – 786 mg/L	150mg/L*
TSS	24.9 – 3950 mg/L	100mg/L*
EC	250-63750µS/cm	1200

Source: Dey & Islam (2015), DoE (1997b) ,

**Indicates the values prescribed in ECR'97 for wastewater from textile units, the rest is applicable to all industrial units*

It is required by law in Bangladesh for orange B and red category industrial units (see section 6.1.2 in chapter six for definition) to have Effluent Treatment Plant (ETP)s (DoE, 1997b). However, Restiani (2017) found only 61% of the formal textile units in Bangladesh were equipped with ETP, while only 29% among them were compliant. In fact, 11-51% of the units with ETP, had poorly designed or poorly operated ETP (Restiani, 2017). In year 2014-15, the largest share of industrial units fined by DoE was attributable to dyeing and washing units within textile industry of Bangladesh (30% and 38% respectively) for contributing towards water pollution. Highest value of fine was imposed on these units for having bypass drain and ineffective ETP (The World Bank, 2018).

However, the pollution from industrial effluent does not end after treatment. The treatment process itself generates large amount of sludge (Karim, et al., 2006). In year 2009, the textile industry of Bangladesh generated 36 Metric tonnes of sludge (Waste Concern, 2009). It is alarming since this sludge containing heavy metals, chemicals, dyestuff and process residues are often disposed without further treatment (Anwar, et al., 2018). Study by Islam, et al. (2009) reported that concentration of heavy metals like cadmium, Zinc, Copper and Manganese within the textile sludge exceeds the safe limits for agricultural soil. Heavy metals like Iron and Copper content found from textile sludge can be harmful for humans (Guha, et al., 2015).

A study on 50 textile units of Bangladesh found, that their total emission of CO_2 increased by 22% just within two years. On average the units were responsible for around 1,163 tonnes of CO_2 in the year 2015 (Fayez , et al., 2017). Excessive use of energy by this industry is positively related with GHG emission (Hasan & Leonas, 2018) (see section 5.2.1). The World Bank (2014) suggested, textile sector is deemed responsible for GHG emission and local air pollution in Bangladesh. Quoting Selim (2018, p.25) “The WDF segment requires extensive generation of hot water and steam, thereby contributing to greenhouse gas emissions”.

Apart from these, textile units can potentially pose threat to the health of workers through the intense use of dangerous chemical components and exposure to noise, especially due to manual handling and heavy machinery (Islam, et al., 2011; Islam, 2013). Islam (2013) expressed concern that these chemicals are harmful for skin and respiratory system, while hearing damage can be caused by longer exposure to factory noise. Even the dust induced from textile fibres and cotton, pose threat to the respiratory system of the workers (Islam, 2013). Furthermore, Islam (2013) questioned the safety of the RMG production units referring to 12 fire or building collapse incidents in history of Bangladesh between 2005-2013.

5.3 Existing environmental policy instruments in addressing environmental sustainability for textile industry in Bangladesh and relevance of EIA

As discussed in section 4.3.2 in chapter four, environmental sustainability intent to enhance human welfare through regulating the use of raw materials and waste assimilated (Goodland,1995). Thus, to address environmental sustainability of textile industry, the environmental policy instruments need to focus on raw material usage and waste discharge of this industry. Although the term “environmental sustainability” has not been clearly defined in Bangladesh context, environmental policy instruments have been formulated to serve the purpose. In Bangladesh, all the major environmental policy instruments (i.e., regulatory, economic and voluntary & information based) are applicable to the existing textile units (figure 5.7). Standard limit of effluent parameters, incentives for standard equipment ensuring process optimization (i.e., optimum use of raw material and reducing waste), are some of the examples of relevant regulatory and market based environmental policy instruments. These aim at delivering environmental sustainability within the textile industry in Bangladesh.

The regulatory instruments for environmental protection are formulated and enforced by DoE in Bangladesh. These instruments include requirement of ECC for industrial units and standards for environmental and effluent parameters (DoE, 1997b). These instruments are enforced under Environmental Conservation Rules (ECR) 1997. Textile units of Bangladesh are classified into four categories (i.e., Green, Orange A, Orange B and Red) according to their environmental impact (see chapter six). Likewise, the extent of environmental assessment required for their ECC application is prescribed in regulation (see section 6.1.2 in chapter six). Without ECC, the units are not permitted to start operation. Effluent parameters specific for textile units are also designated under this rule (DoE, 1997b). For red category units, the ECC renewal takes place every year, conditioned with their compliance to environmental parameters and ECC conditions (interviewee #1). There is also legal provision of fine for operating without ECC or failing to take mitigation measures (see section 8.1 in chapter eight) (DoE, 1995). Sometimes penalty is imposed on the spot by DoE magistrates if the units are found incompliant while inspection (interviewee #1). If disputes arise from such cases, there is provision of environmental court in the country established by Environmental Court Act (2010). However, its efficacy is still in question (see section 8.2 in chapter eight). On the other hand, cottage units enjoy exception from environmental permit, if their assets are not worth more than 0.5million BDT and all employees belong to the same family (DoE, 1997b). Therefore, existing regulatory provision are not adequately addressing their impacts. Statistics from BSCIC suggest there is a large number of cottage units belonging to this industry (see section 5.1.2).

The economic instruments for textile industry in Bangladesh exist in form of incentives and polluter’s pay supervised by financial organizations (e.g., banks) and DoE respectively.

Before approving loan, the banks ask for ECC document and examine if the industrial units meet Environmental and social due diligence (ESDD)[58] checklist (Bangladesh Bank, 2017) (see Appendix V). Monitoring the validity of environmental permit and performance in compliance to law and standards are also included within the condition of such finance (Interviewee #20). In 2011, a comprehensive green banking[59] initiative was launched by Bangladesh Bank. This initiative promotes environmentally responsible financing, issues assessment of loan proposals for environmental risk and encourages greening of processes for banking and financial institutes (Bangladesh Bank, 2020). Bangladesh Bank (2020, p.27) listed textile as one of the priority sectors for ESDD screening of units "through fulfilment of required work conditions & compliances of DoE and accordingly installations/introductions of Green Products/Machineries/Projects for reducing emission to a required extent". However small-scale industrial units can rarely utilize this finance due to lack of proper paperwork (Khan, et al., 2017). They are supported through the SME policy 2019 of Bangladesh that proposes "innovation fund", "incentive for establish climate mitigated industry or pollution free industry" and "link with larger industrial units for waste management" for small and medium scale industrial units (GoB, 2019). On the other hand, DoE applies the "polluter pays principle" through section 7 of ECA (1995, p.159) stating, "any act or omission of a person is causing or has caused injury to the ecosystem, the person may bound to compensate that". Requirements and efficacy of this provision discussed in detail in chapter eight (section 8.1.2). On the other hand, The World Bank (2018) suggests that current penalty system is not sufficient to reduce pollution and it lacks relevant fiscal policies like pollution tax or carbon tax for industries. Custom duties on cleaner products or technologies are also argued to increase the cost of clean production mechanism (The World Bank, 2018).

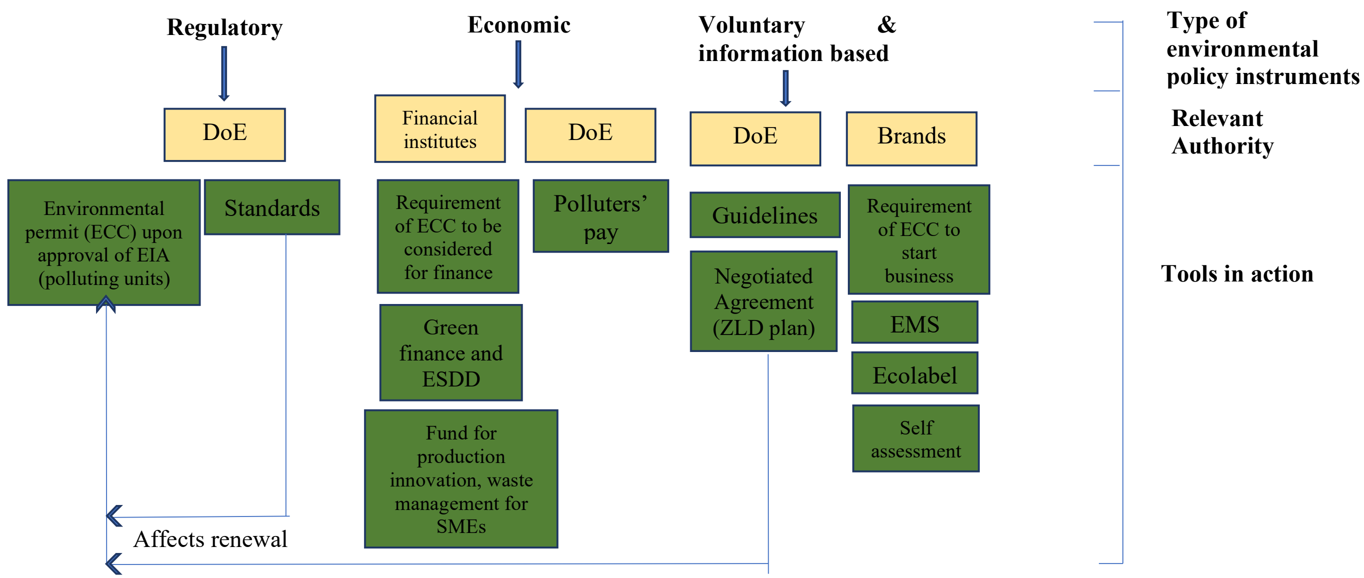
Voluntary and information-based instruments (VIBs) like guidelines and negotiated agreements are formulated by DoE for textile industry in Bangladesh. However, a significant share of textile units of Bangladesh being informal and small-scale have limited access to such information and resources for improvement (Hasan & Leonas, 2018; Hasanbeigi & Price, 2012).

[58] "Environmental and social due diligence involves the systematic identification, quantification and assessment/evaluation of environmental and social risks associated with a proposed transaction" - (IFC, 2021)

[59] Green Banking activities addresses five key work-streams - (i) Green Finance (ii) In-house green activities covering Carbon Footprint Measurements (iii) ESG (iv) Green Marketing/Awareness/Capacity Building (v) Reporting and disclosure on green issues - (Bangladesh Bank, 2020, p. 17)

On the other hand, the direct formal units are influenced by the international brands' demand of EMS, ecolabels, and self-assessment tools (interviewee #10, #14). This motivation is attributable to the fact that the brands communicate, audit and engage in business directly with them (interviewee #10). ISO 14001, Made in green, Standard 100 and Higgs index are some of the VIBs adopted by textile units in Bangladesh (interviewee #10, #14, #16). Also, the units are required to show their ECC before entering contract with the brands. The brands may require EIA to be done again even if the units had a prior ECC (Interviewee #14, #16). Indirect units are often subcontracted by direct formal units and lack influence from buyers (Labowitz & Baumann-Pauly, 2015). Thus, they remain less motivated to adopt environmental protection measures.

On the other hand, DoE has updated the EIA guideline for industrial units after 24 years in 2021. The current guideline instructs the EIA process until the report review. It lacks instruction for follow-up monitoring by DoE officials (DoE, 2021a). DoE also formulated a sector-wise industrial guideline (for textile units) in 1997 instructing in-plant pollution control through housekeeping, process modification, recovery of chemicals, substitution for harmful chemicals, water conservation, innovative technology (DoE, 1997c). This guideline further incorporates instruction for ETP operation processes but have never been updated for past 24 years. DoE undertook 3R strategy for the industries in year 2014 (see section 10.2.2 in chapter 10). It can be seen as a negotiated agreement.



Domestic market-based units	Cottage						
	Non cottage	✓	✓	✓	✓	✓	
International market-based units	Indirect informal units	✓	✓	✓ (applied)	✓ (applied)	✓ (applied)	
	Indirect formal units	✓	✓	✓	✓	✓	
	Direct formal units	✓	✓	✓	✓	✓	✓

Figure 5.7 Environmental policy tools applied to textile units of Bangladesh

Sources: Prepared by author with the help of information from DoE, 1997b; Labowitz & Baumann-Pauly, 2015; GoB, 2019; Bangladesh Bank, 2017; face-to-face interview and field visits (2020).

Role of EIA within textile industry of Bangladesh

National environmental policy 2018 of Bangladesh mentions “ensuring environment friendly economic development, sustainable production and consumption” and vests the responsibility on relevant ministries (MoEFCC, 2018). Bangladesh Bank formulated a guideline to evaluate environmental and social issues of the industrial units while assessing “Probability of Default” of credit/investments of banks and finance institutes to promote sustainable business practices in Bangladesh. Being a resource and pollution intensive industry, growth and sustainability of textile industry is largely dependent on how resource and pollution are managed (ILO, 2021). However, even after being the most important industry in the country’s economy, there is no specific environmental management policy or dedicated regulation for addressing environmental sustainability within the textile industry of Bangladesh. Although several key policies have included generic environmental issues within their statements (e.g., industrial policy 2016, textile policy 2017, seventh five-year plan), they lack clear action plan for environmental consideration within the textile industry. These policies frequently referred ECR’97 or EIA process for integrating environmental consideration within industrial units. For example, the National environmental policy (2013) of Bangladesh has emphasized on controlling pollution strictly in the industrial units through EIA process along with installation of ETP and provision of environmental auditing (MoEFCC, 2013).

As discussed in section 5.3, regulatory requirement of ECC for polluting textile units in Bangladesh is fulfilled by completion of EIA and submitting its report to DoE for approval. Although the first ECC is directly tied with EIA for polluting textile units, the same cannot be stated for the ECC renewals. DoE team pays annual visit for monitoring conformity to ECC condition and effluent parameters after the units start operation. Report from this visit influences decision on renewal of ECC. Conformity to regulatory standard of environmental parameters has influence on ECC renewal. Economic instruments are also conditioned with ECC. Alongside, the voluntary instruments like negotiated agreements are also tied with ECC renewal. In addition to this, the only sectoral guideline for environmental considerations within textile industry in Bangladesh is produced as support document to regulation relevant to EIA. Moreover, the major brands also ask the textile manufacturing units to have EIA and receive ECC before starting business with them (interviewee #10). According to ILO (2021; p.31),

> “EIA presumes that industries will install waste/pollutant treatment plants, conform to environmental standards, report incidents and have plans for remedial actions in place if these are required”.

Thus, the most appropriate environmental policy instrument relevant to environmental control and management of textile industry in Bangladesh appears to be EIA. The next chapter would provide insight into existing system of EIA in Bangladesh.

Chapter summary

The textile industry is the most prominent industry in the economy of Bangladesh. However, industrial growth in this country is coming at the cost of environment and human health. Studies indicate that the textile units within the country are causing significant water and air pollution. While this industry occupies a significant share of manufacturing establishments, the country lacks comprehensive list and statistics of existing textile units. In addition to this, there is no dedicated environmental management policy or regulation for textile industry in Bangladesh. Textile units of Bangladesh are regulated using the umbrella regulation of ECR’97. According to this regulation, mandatory EIA should be performed in order to acquire ECC for polluting textile units of the country. ECC is also a prerequisite for initiating business with international brands and loan application to financial organizations within the country. For textile industry in Bangladesh, market instruments like loan approval from financial institutes and business agreement with international brands are conditioned with completion of EIA and receiving ECC. Voluntary and information-based instruments like EMS, ecolabelling has already EIA embedded in themselves. This should also be noted that EIA exists in Bangladesh as a regulatory instrument for last 25 years. Therefore, EIA appears to be the most relevant policy instrument for environmental control and management within textile industry of Bangladesh.

Chapter Six: Environmental Impact Assessment (EIA) in Bangladesh: EIA system for textile industry, previous literature, and relevant stakeholders

This chapter presents discussion on EIA system of Bangladesh relevant to textile industry. Accordingly, this chapter is divided into three major sections. The first section provides understanding on EIA system requirement, administrative arrangement and procedure with specific attention to textile industry of Bangladesh. The second section provides brief discussion on previous literature relevant to EIA and textile industry in Bangladesh. The final section describes the role of relevant stakeholders for delivering environmental sustainability for textile industry of Bangladesh. This is predominantly a literature review chapter. However, notes from face-to-face interviews supported the literature on EIA system and understanding the role of the relevant stakeholders. This chapter accomplishes the last part of first objective and supports tailoring the framework of analysis (the second objective) for this research. Information from this chapter is utilized in understanding the findings from third and fourth objectives and, finally in formulating recommendation (fifth objective).

6.1 EIA in Bangladesh

Bangladesh started journey as an independent country in the December of 1971. The world conferences like Stockholm Conference 1972, World Earth Summit 1992 influenced the design of many of the significant environmental policies of the country (Netherlands Commission for Environmental Assessment, 2013). A brief timeline of the country's environmental concerns and relevant policies are shown in Appendix VI. The initiation of EIA in developing countries primarily came as response to pressure from development assessment agencies, while for developed countries local demand for better environment was the main driving factor (Wood, 2003; Ci, 2008). Similarly, the idea of EIA came into Bangladesh through donors in 1980s, but donors performed EIA only on the projects undertaken by them (Ahammed & Harvey, 2004). In 1992, for the first time, EIA guideline for water sector was published (Momtaz & Kabir, 2013). Year 1995 was the year when first step towards institutionalizing EIA was taken by Government of Bangladesh (Momtaz & Kabir, 2013). Section 12 of Environmental Conservation Act (ECA) 1995 (p.161) mentions "No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General [of DoE]". For carrying out the purpose of this act, Environmental Conservation Rules (ECR) 1997 was formulated and an agency named Department of Environment (DoE) was designated. ECR'97 assigns categories to the industrial units or projects according to their environmental sensitivity and prescribes the level of environmental assessment studies required (see section 6.1.2 within this chapter) to submit for their Environmental Clearance Certificate (ECC) application (figure 3.1). Today, EIA is embedded into the system through the ECR 1997.

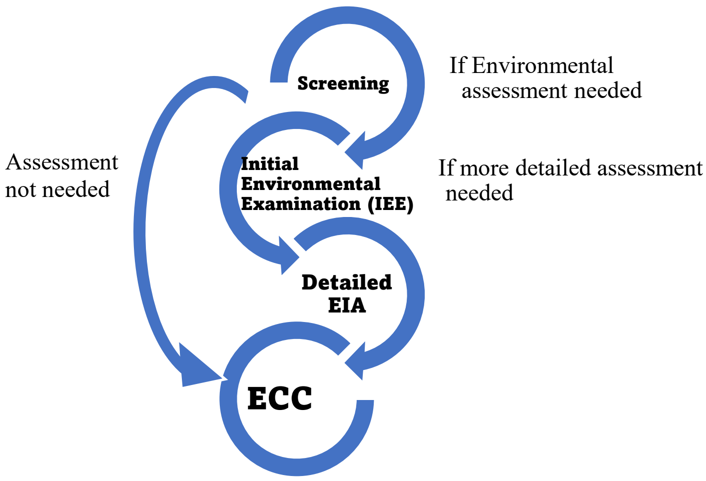


Figure 6.1 Simplified stages for Environmental approval process in Bangladesh
Source: Adapted from DoE (2021)

6.1.1 Aim and objectives set for EIA in Bangladesh

The guideline on EIA for industries states both short and long-term aim and objectives of EIA in Bangladesh (DoE, 2021a).

The immediate aim for EIA in Bangladesh is "to inform the process of decision-making (both Project Proponents and authorities), by identifying the potentially significant environmental effects and risks of development proposals". – DoE (2021a, p. 25)

Immediate objectives listed for attaining this aim are listed as-

- To improve the environmental design of the proposal.
- To ensure that resources are used appropriately and efficiently.
- To identify appropriate measures for mitigating the potential impacts of the proposal; and
- To facilitate informed decision-making, including setting the environmental terms and conditions for implementing the proposal

The long-term aim of EIA for Bangladesh is listed as "to promote sustainable development by ensuring that development proposals do not undermine critical resource and ecological functions or the wellbeing, lifestyle and livelihood of the communities and peoples who depend on them." – DoE (2021, p. 25).

Long term objectives include-

- To protect human health and safety.
- To avoid irreversible changes and serious damage to the environment.
- To safeguard valued resources, natural areas and ecosystem components; and
- To enhance the social aspects of the proposal. – DoE (2021, p. 25)

Strategic environmental assessment (SEA) (for policy, plan and program), cumulative/regional environmental assessment are still not mandated by law in Bangladesh (Islam & Zhang, 2018). However, the current guideline for EIA in Bangladesh suggests assessing the regional and cumulative impacts in the EIA process of projects, wherever necessary (DoE, 2021a).

6.1.2 EIA system in Bangladesh

i) Legislative requirements

ECA'95 requires industrial units in the country to get ECC before starting operation. For proceeding without ECC, there is a provision of imprisonment not exceeding 3years, or fine not exceeding 0.3million BDT (3571 USD) or both (DoE, 1995).

ECR 1997 lists industrial units of the country into four main categories: Green, Orange A, Orange B and Red. All these units require no objection certificate (NOC) from local government in the process of application for ECC to DoE (figure 6.2). For green category units, Environmental assessment (EA) studies are not required and ECC will be granted directly. None of the units within textile industry falls within the green category. Orange A category units do not require EA studies either, however a locational/site clearance will be required prior to application for ECC. Weaving and handloom units fall under this category. Orange B category units require Initial Environmental Examination (IEE) (for new units) or Environmental management plan (EMP) report (for existing units only) for obtaining site clearance. Upon reception of site clearance, they can apply for ECC. Spinning mill, garment and sweater production, fabric washing and power loom within the textile industry fall in orange B category. On the other hand, red category units initially require submitting IEE and a term of reference (ToR) for EIA to get a site clearance. After receiving the site clearance, they can apply for ECC by submitting detailed EIA report (including Effluent Treatment Plant (ETP) design) based on approved ToR (figure 6.2). When the ECR’97 came into action, the then red category units were exempted from detailed EIA but required to submit EMP. Textile dyeing and chemical processing units fall under the red category. Site clearance allows for land development and ETP installment for orange A and B category units. Even for the red category units, site clearance allows land development. But prior to getting ECC, connection to utilities and production is not permitted. The green category units require to renew ECC every three years. On the other hand, ECC validity period is one year for the other types of units (DoE, 2021a). DoE’s decision on rejection of site or environmental clearance can be appealed against, within 30 days of issuance of notice, order or direction (DoE, 2021a). The sections within ECR 97 is intended for ECC, rather than the EIA process. Therefore, the key stages of EIA are not established by regulation in Bangladesh (Ahmed & Ferdausi, 2016; Kabir & Momtaz, 2018).

The ECR 97 prescribes the forms and supporting documents to be accompanied with ECC application, along with duration of decision making and process of appeal.

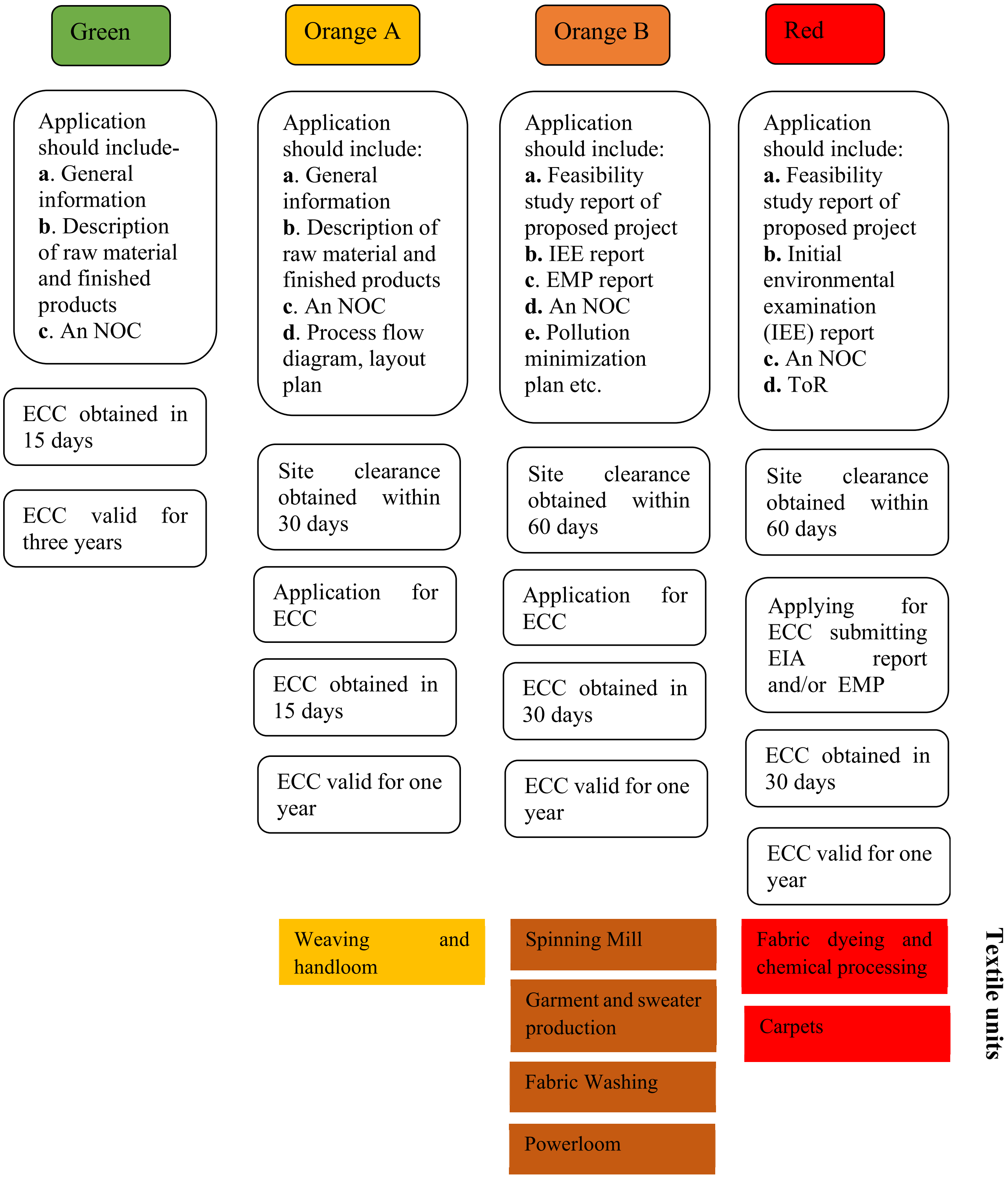


Figure 6.2 Sequential stages of obtaining ECC for textile units under Green, Orange A, Orange B and Red Category industrial units in Bangladesh

Source: Prepared by author from DoE (1997a; 1997b)

ii) Administrative arrangements

"DoE is the only institution in Bangladesh with a mandate for environmental protection and has been given wide powers under the 1995 ECA". – The World Bank (2018; p.22)

Therefore, DoE under Ministry of Environment, Forest and Climate Change (MoEFCC) of Bangladesh is the designated organization for carrying out the provisions of ECA 1995, thus the regulator of EIA system. DoE administers the EIA system starting from consulting on rules, collecting and reviewing reports, providing ECC, monitoring the industrial unit's environmental compliance to asking for compensation[60] or even directing closure of industries if seem appropriate (figure 6.3) (DoE, 1995; 2016). Quoting from DoE (2021, p. 96) "The DOE was given mandate to review and give the final decision on approving the IEE and EIA report. In addition to reviewing and approving/ rejecting EIA reports, the DOE also is responsible for the administrative procedures such as formulating EIA guidelines and guidance documents." The activities of DoE are overseen by a Director General. This organization operates through a head office and seven Divisional offices located in Dhaka, Chittagong, Khulna, Bogra, Barisal, Sylhet and Mymensing. Under these divisional offices, there are some district offices as well. Currently DoE has around of 44 offices with total 735 position for staffs (DoE, 2022; The World Bank, 2018).

The head office of DoE has around ten different departments leading natural resource management, waste & chemical management, ECC, monitoring & enforcement, air quality management, climate change & international convention along with some other administrative (e.g., planning, IT, law) departments. Director of ECC department is the chairperson for the Environmental assessment committee (EAC) of DoE, which is responsible for decisions on ECC (interviewee #1). EAC sits in the head office of DoE and serves the final decision on EIA reports of red category units from all over the country (interviewee #1, #4). The regional offices of DoE have very less numbers of staff, while some even run with as few as only five staffs (DoE, 2022).

[60] alternatively known as fine or polluters' pay

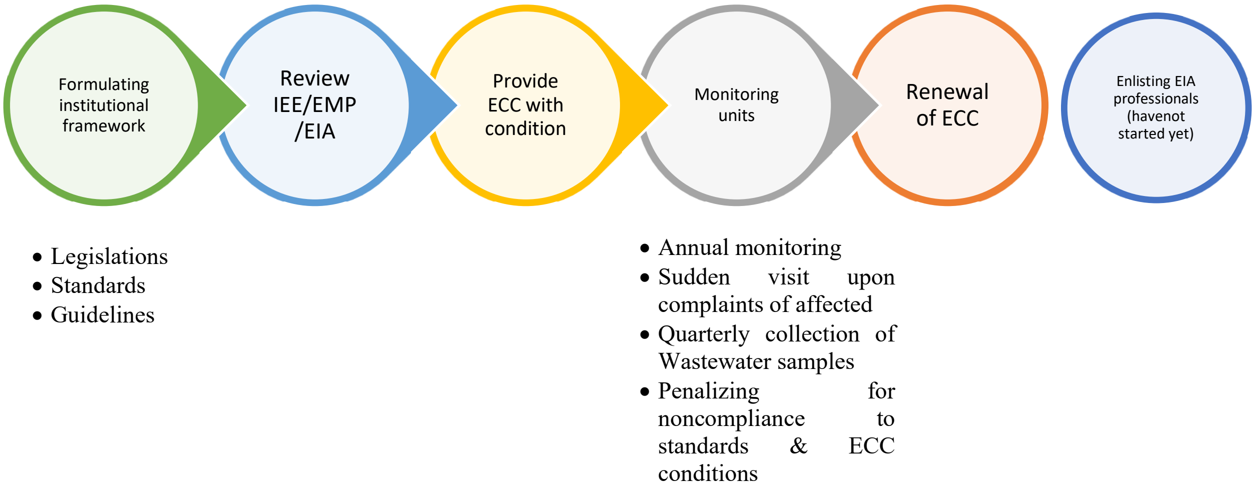


Figure 6.3 Responsibilities of DoE in EIA system of Bangladesh

Source: DoE (2021) and face-to-face interview by author (2020)

iii) EIA procedure for red category units

In 1997 a generic guideline of EIA for industries was published with ECR'97 (DoE, 1997a). Alongside, sector specific industrial guidelines were also proposed for key economic sectors of the country (e.g., cement industry, natural gas sector, textile industry, pharmaceutical industry, coal mining) (DoE, 2010b). The generic guideline has been recently updated (in 2021) and provides more detailed directions for the steps of EIA, contents of EIS, review of EIA report. However, the sector specific industrial guideline has never been updated since 1997.

Both versions of the EIA guidelines suggest that EIA process of Bangladesh comprises of six key steps. These are: screening, scoping, baseline data collection, impact assessment, mitigation measures and EMP (figure 6.4) (DoE, 1997a; 2021a). This section describes the EIA process based on the latest guideline since it reflects the objective of regulators at this instant. Guideline relevant to public participation in EIA remains same for all categories of industrial units (DoE, 2010a). Although the red category units require detailed EIA, there is no additional requirements for public participation for such units. According to the guideline, public participation has been suggested to take place as early as site selection in the screening process and continuing through assessment of impact significance to formulating mitigation measures in the latest guideline (DoE, 2021a). The latest guideline has a chapter dedicated on stakeholder participation within the EIA process and has also emphasized public participation in EIS review guideline (DoE, 2021a).

The framework of analysis in this research has consulted the previous guideline (DoE, 1997a), since the new guideline (DoE, 2021a) was published after data collection took place for this study. A comparative overview of both these guidelines can be found in chapter eight (section 8.3).

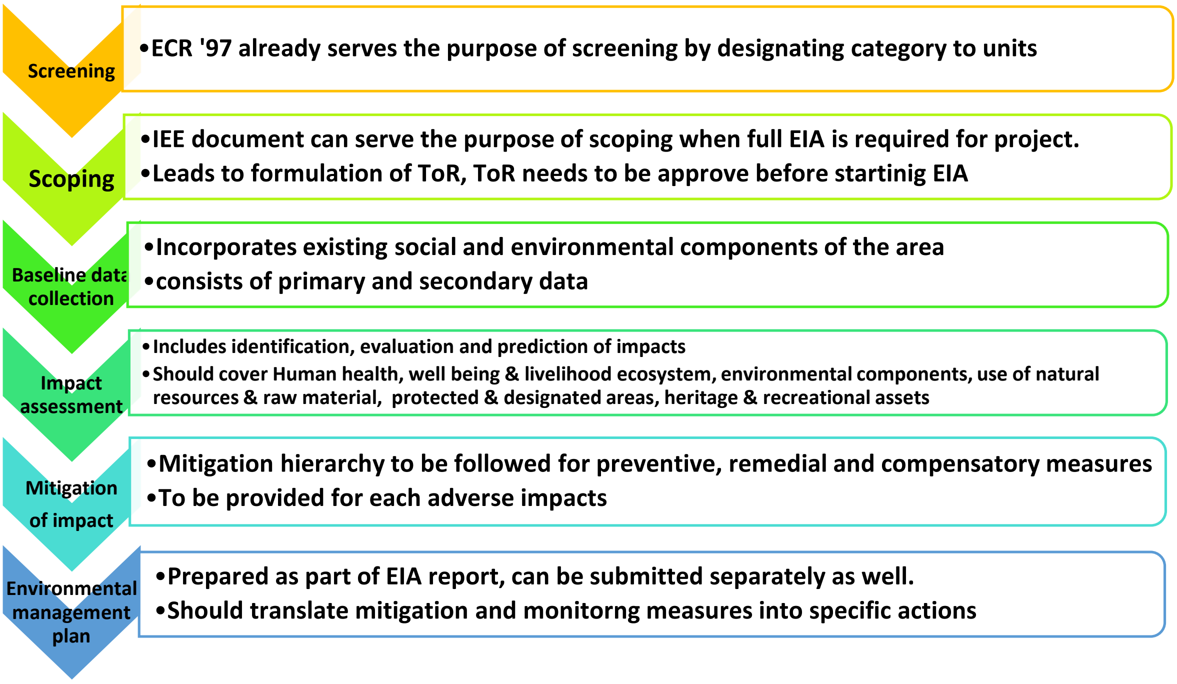


Figure 6.4 Key stages of EIA process in Bangladesh
Source: Adapted from DoE (1997a; 2021a)

a) <u>Screening:</u> The screening stage of EIA is established by law in Bangladesh. ECR'97 determines what extent of EA study required for the project based on its "environmental impact and site". Schedule 1 of ECR 97 provides this classification of the industrial units (discussed in (i) of section 6.1.2). However, other issues such as unit size, number of raw materials, ecological & cultural sensitivity of the project were not considered while designating these categories (Ahammed & Harvey, 2004). On the other hand, ECR'97 mentions all types of cottage units[61] to be outside of the purview of ECC, therefore no form of environmental assessment is required for them. Therefore, even if these units are polluting, no screening is performed, and they can start business without any assessment.

b) <u>Scoping:</u> Scoping exercise identifies effects of project on environment and social components, significance of the effects and issues of further attention, alternatives and

[61] with less than 0.5million assets and employees belonging to single family

mitigation measures to be considered for project proposal (DoE, 2021a). For Bangladesh, if the project requires full EIA, the IEE document can serve the purpose of scoping (DoE, 2021a). ToR for EIA can be formulated at the end of this stage and needs to be submitted to DoE for approval (see (i) in section 6.1.2). Three key tasks for scoping are shown in figure 6.5.

Guidelines suggest, scoping should include consultation from government authorities, related organizations (e.g., technical agencies) and public from community and general public (DoE, 1997a; 2021a).

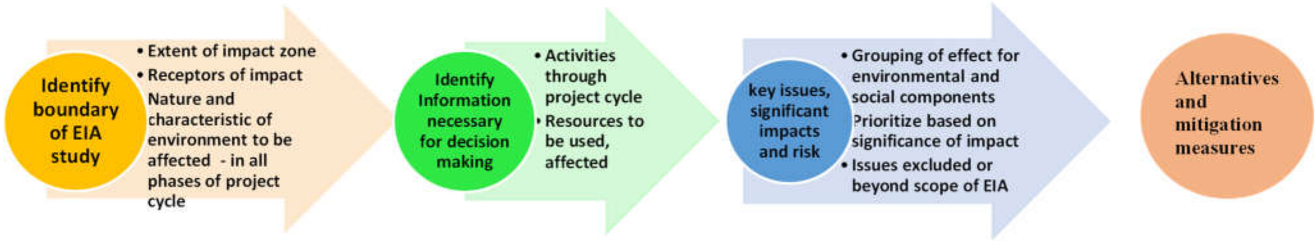


Figure 6.5 Key tasks in scoping within EIA process of Bangladesh
Source: Adapted from DoE (2021)

c) Baseline data collection: DoE (2021) suggests collection of baseline data should start as early as pre-feasibility stage of the study. Comprehensive availability and clear definition of data needs, data types and source can influence the scoping & ToR documents. Alongside they can also help avoiding redundancy (DoE, 2021a). Not only environmental information, project specific studies are also part of baseline studies (DoE, 2021a). DoE (2021)'s guidance on environmental baseline data collection is shown in figure 6.6.

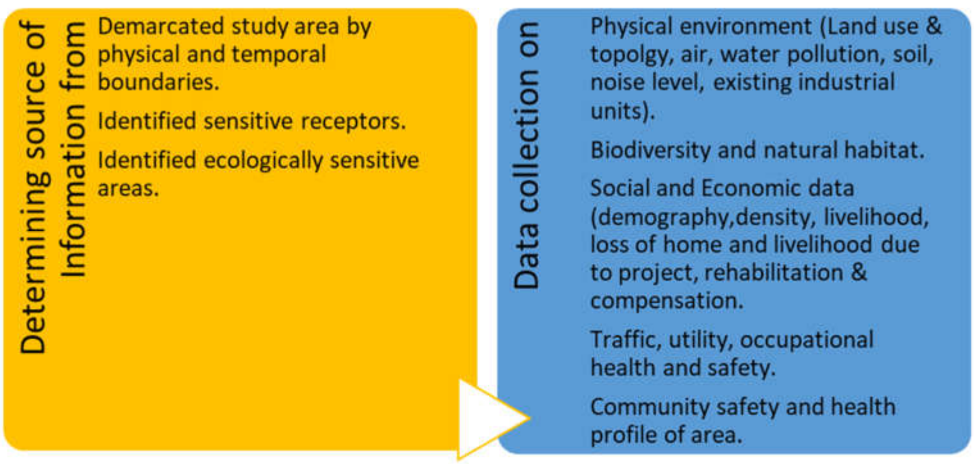


Figure 6.6 Process and components of environmental baseline data collection in EIA process

Source:Adapted from DoE (2021)

d) Impact assessment**:** DoE (2021) suggests impact assessment within an EIA involve three stages: i) identification of impacts resulting from phases of project activities; ii) predicting nature, magnitude, extent and duration of the main impacts and iii) finally evaluation or residual impacts.

While the impact is identified against social and environmental baseline, geographic extent[62] of the impact should be determined alongside. DoE (2021) further recommends consideration of indirect and cumulative impacts. Impacts can be identified on human health (using broader definition of human health and safety like community and occupation health & safety); flora, fauna, ecosystems and biological diversity; soil, water, air, climate and landscape; natural resources and raw materials; protected areas and designated sites of scientific, historical and cultural significance; heritage, recreation and amenity assets; and livelihood, lifestyle and well being (DoE, 2021a, p. 61). Hazard risk and occupational safety hazard risk identification and assessment are listed as two significant issues in EIA study (DoE, 2021a).

The guideline suggests common prediction tools (e.g., expert opinion, checklists, consultation & questionnaire, spatial analysis, risk matrices, network and system analysis, carrying capacity analysis or modelling tools) for impact prediction while understanding their suitability according to site and project's demand (DoE, 2021a). Assessment of significance can be performed against regulations, standards, government policy objectives, preset criteria or best practices while ensuring its acceptability to local community and experts consulted (DoE, 2021a).

Impact evaluation can be performed using combination of magnitude, risk and prevalence[63] of impacts; along with duration, frequency and importance[64] and finally requirement of mitigation (DoE, 2021a).

e) Mitigation measures**: "**Mitigation of impacts is a process in the EIA which determines the possible preventive, remedial or compensatory measures for the adverse impacts which have been evaluated as significant" – (DoE, 2021a, p. 75). The author has shown the mitigation hierarchy as a reverse pyramid in figure 6.7. It starts with avoidance (most preferred), then

[62] Global, local or regional

[63] Severity; probability of serious environmental issues; eventual extent of impact, e.g., cumulative impact respectively

[64] Value of a component at present state

minimization and finally compensation (less desirable) (DoE, 2021a). Practicing this hierarchy can reduce the practice of end of pipe pollution prevention approach (DoE, 2021a). The guideline suggests mitigation measures to be considered at all stages of project to reflect the linkage between activity and environmental impact (DoE, 2021a). Project proponents should be consulted regarding applicability of the measures and their ability to adopt those as proposed by EIA consultants (DoE, 2021a). DoE (2021a) recommends measurable results from application of mitigation measures, for simple verification of compliance. They also suggest reporting of results of mitigation measures should be captured in EMP (DoE, 2021a). Need of mitigation should be determined by i) appropriateness of measures in relation to the significance of impacts, ii) clarity and relevance to project, iii) disregarded narrative descriptions, iv) illustrated through pictorial depiction where possible (DoE, 2021a).

Acceptability of residual impacts and risks could be important determinant of project approval. If residual impacts are ascertained while implementation phase of project, post EIA monitoring should be applied to understand the effectiveness of mitigation measures (DoE, 2021a).

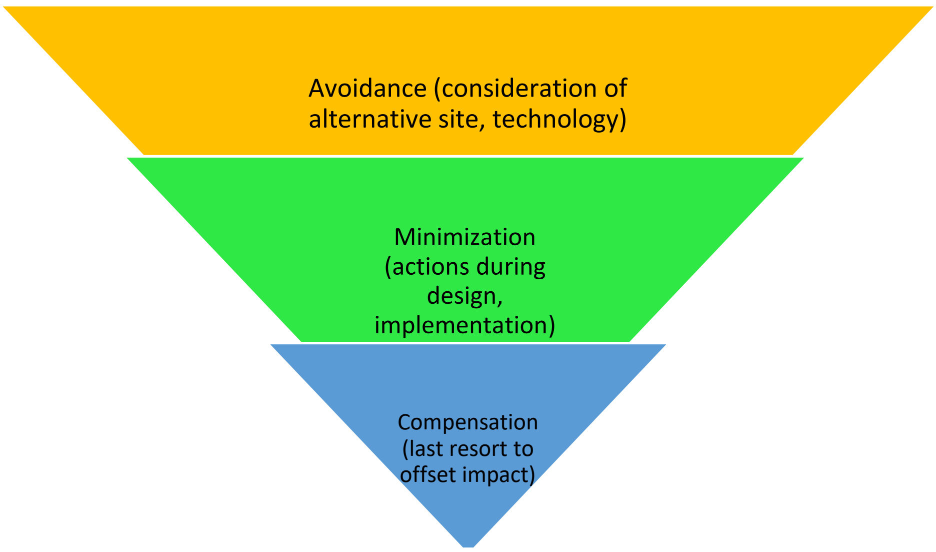


Figure 6.7 Hierarchy of mitigation measures in EIA process
Source: Adapted from DoE (2021)

f) <u>EMP</u>**:** "An EMP forms an essential part of the EIA as it translates recommended mitigation and monitoring measures into specific actions that will be carried out by the Project Proponent"- DoE (2021; p. 83). A well-structured EMP is expected to cover project phases from preconstruction until monitoring and auditing, while addressing major environmental issues and impacts. EMP should constitute technical schedule of activities tasks assigned to staff, supply & equipment available and cost estimations. Risk reduction and management, emergency response planning, post EIA monitoring and reporting are important components of EMP. Components of EMP document and their expected description are provided within the updated EIA guideline of Bangladesh (DoE, 2021a) .

g) Stakeholder participation is an integral part of EIA process (Jay, et al., 2007). Screening, scoping, impact analysis and mitigation, review of EIA report, and implementation and follow up are the key stages when stakeholder involvement can take place within the EIA process (DoE, 2021a). Although, the amendment of ECA'95 in 2010 somewhat mentions about incorporating public opinion (DoE, 2010a), clear direction on the stages requiring such participation is absent in the regulation (see section 8.3 in chapter eight for more) (DoE, 1997b). On the other hand, the latest guideline of DoE lists the stages and type of consultation for different groups of stakeholders (see DoE, 2021a; p.98) which was very vaguely addressed in previous guideline (DoE, 1997a).

h) **"**The EIA report is a primary document for communication and decision making" – DoE (2021, p.106). This report reflects the EIA process. It is expected to be adequate and complete in information, well organized, clear however concise (DoE, 2021a). Structure of the EIA report/ environmental impact statement (EIS) is prescribed in both guidelines (DoE, 1997a; 2021a). The structure prescribed in the recent guideline is more thorough than the previous.

The EISs reviewed in this study were prepared before 2021, therefore the old guideline (1997) was consulted while preparing the EIS review package for this study.

i) EIA report review**:** DoE is the formal authority for review and decision making on ECC. The project proponents of red category units receive site clearance from the regional offices (Interviewee #3, #4). However, for final ECC approval, submitted EIA report is forwarded to the head office. As mentioned earlier, EAC makes final decision on the ECC for the red category units from all over the country. The decision on the ECC application based on the submitted EIA report should be generated within 30 days (DoE, 1997b). In case of insufficient or unclear information the period of review is further extended for 30 more days from the date of submission of the additional information (DoE, 2021a). EAC meeting is held every 15 days. The committee is consisting of members representing different departments of DoE. However, no sector specific expert attends the review process, unless it is a significant national project (e.g., power station, metro rail). Project proponents are sometimes requested to present their EIA report and attend the queries raised by the committee. If the report is not satisfactory, proponents might need to submit the report repeatedly until the committee is satisfied. ECC is often provided with conditions regarding compliance to environmental standards. Currently, submission of 3R (Reduce-reuse-recycle) strategy or its annual progress for respective industrial units is also required to submit with ECC renewal application(interviewee #2, #4). The new guideline provides in depth guidance to the EIS review mentioning each component of the EIA process and their reporting (see section 8.3.2 in chapter eight) The EIS is also directed to be reviewed for information on effect monitoring and compliance monitoring. However, the direction on compliance monitoring for obligations in EMP and mitigation plan is intended for the project proponents (DoE, 2021a).

j) Monitoring and enforcement: DoE guidelines (1997a; 2021a) recognize project proponents as the primary responsible party for post EIA environmental monitoring. Although monitoring is a significant segment of the EIA process and DoE has a dedicated department for this purpose, the EIA guideline does not include guidance for the monitoring officials. However, after the units start operation, DoE arranges wastewater sample tests from red category units in every three months. Also, the officials from monitoring and enforcement department of DoE visit the units every year to check their compliance to environmental standards and ECC conditions. Report from annual monitoring visit and the lab result on discharged wastewater quality is reflected in the ECC renewal process. Due to limited resources, monitoring visits are often based on zones, rather than environmental sensitivity of units. Apart from this, DoE also pays unexpected visit to the units upon receiving complaints of environmental pollution.

6.2 Literature on evaluation of EIA system and EIA for textile industry of Bangladesh

Till date, several studies have been undertaken on effectiveness of overall EIA system in Bangladesh (Ahammed & Harvey, 2004; Ahmed & Ferdausi, 2016; Momtaz & Kabir, 2013; Shakil & Ananya, 2015). There is also a study on quality of EISs (Kabir & Momtaz, 2013).

However, there is only one report on EIA system for textile sector assessing the effectiveness of regulation (ILO, 2021).

The report by ILO (2021) provides a comparative assessment EIA for four developing countries including Bangladesh focussing on textile industry. The other three countries are Cambodia, Indonesia, and Vietnam. However, this publication primarily presents discussion on the legal requirements and administrative practice for EIA based on previous literature (ILO, 2021). Therefore, this discussion is rather concentrated on the overall EIA system of the country, than the sectoral assessment (ILO, 2021).

On the other hand, Ahammed & Harvey (2004) evaluated EIA procedure and practice in Bangladesh in their research. They explored the EIA legislation and institutional structure from ECA' 95, procedure of EIA based on ECR'97 and case studies from three large scale national level projects. On the contrary, Ahmed & Ferdausi (2016) used an established set of evaluation criteria from Wood (1995) and Annadale (2001) to understand the gaps in EIA system of Bangladesh. They assessed legal/administrative strength, preliminary and detailed assessment process in EIA, review of EIA study, decision-making, follow-up and administrative support with the help of EIA legislation and regulation in Bangladesh and administrative practice at DoE (Ahmed & Ferdausi, 2016). Kabir (2012)'s PhD research titled "A critical evaluation of the environmental impact assessment system in Bangladesh using a holistic approach" have led towards several publications on effectiveness of EIA system of Bangladesh. At least three peer review journal articles, three conference proceedings and a book discussing comprehensive view of EIA system of Bangladesh were published by himself and his PhD supervisor Salim Momtaz (Kabir, et al., 2010; Kabir & Momtaz, 2010a; 2010b; 2011a; 2011b; 2013; 2012; 2018). The key issue of Kabir's PhD research (2012; p. xx) was "comprehensive investigation of the EIA system covering institutional arrangements, the practice of EIA (i.e., the quality of EISs), and subsequent outcomes (i.e., the implementation of mitigation measures and monitoring)". Existing legislation, 30 sample EISs and case study on three large scale government and donor funded projects assisted in achieving the aim of Kabir's research (Kabir, 2012).

Shakil & Ananya (2015) explored the effectiveness of EIA system of Bangladesh against effectiveness categories proposed by Chanchitpricha & Bond (2013). Their evaluation is based on previous literature on EIA system of Bangladesh.

The criteria/indicators used by the abovementioned experts to evaluate EIA system of Bangladesh is further discussed in chapter seven (section 7.1.1). The findings of their study in comparison to this research is discussed in chapters eight, nine and ten.

6.3 Relevant stakeholders for EIA and textile industry of Bangladesh

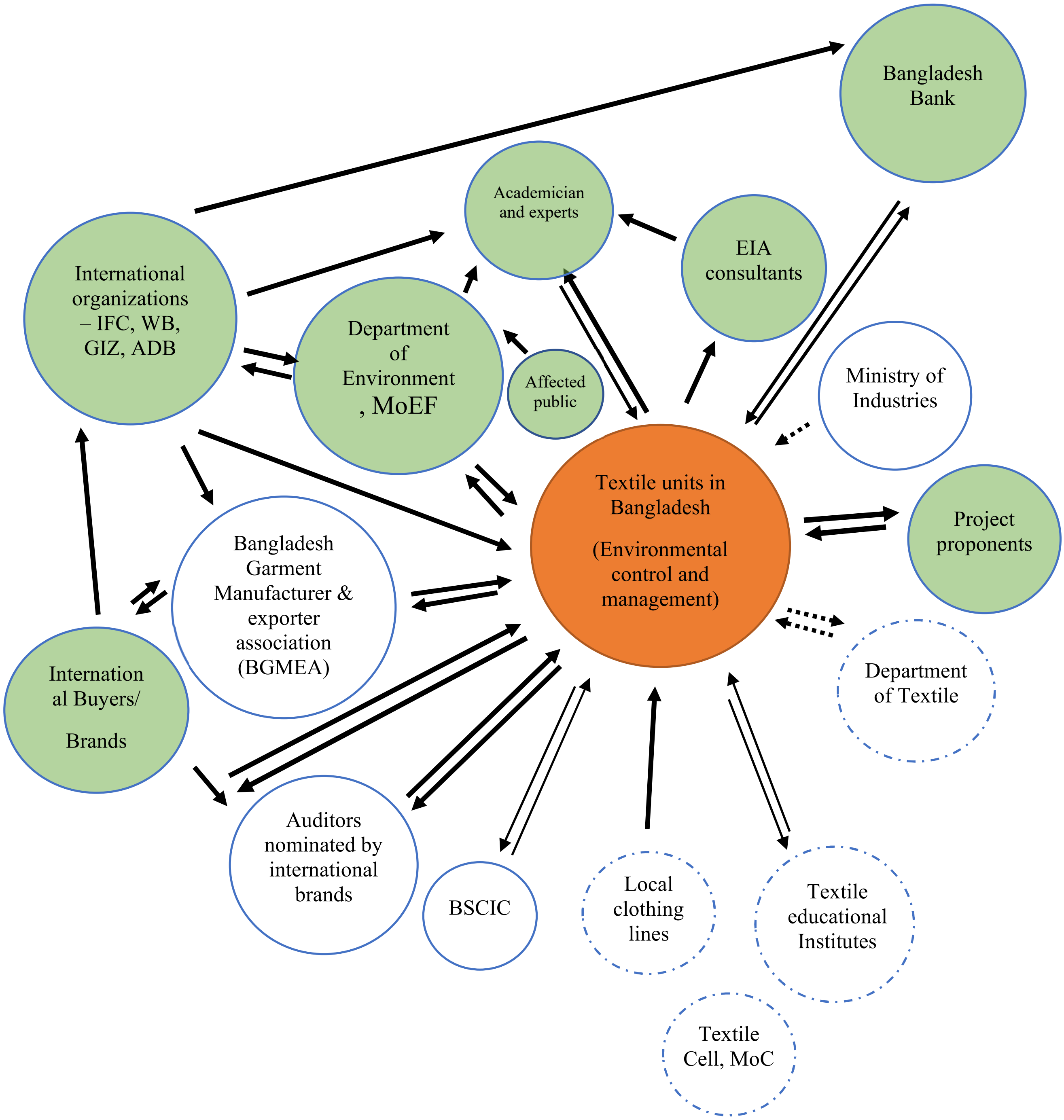
DoE (2021) lists project proponent and related project beneficiaries, EIA consultants, the government agencies, affected public and other interest groups (e.g., NGOs and the private sector) as the key stakeholders for EIA in Bangladesh. However, policy documents like Textile policy 2017, National industrial policy 2016, SME policy 2019 and field visit for this research indicated that wide variety of stakeholders are playing key role in environmental control and management of textile industry of Bangladesh (GoB, 2016; 2019; DoT, 2017).

The author has prepared a Venn-diagram illustrating the key stakeholders relevant to environmental control and management of textile industry of Bangladesh and interaction among them (figure 6.8). Here, the direction of arrows represents the direction of interaction. For example, two-way arrows between textile units in Bangladesh and international brands represent both way interaction between the parties. In this case, the units can reach out to the brands for resources (knowledge/business) to enhance their environmental performance, while the brands may also direct the units for expected environmental protection activity (e.g., EIA study or EMS plan). On the other hand, brands hire auditors for assessing the environmental performance of the units and the auditors reach out to the units – this interaction is shown using one-way arrows among three parties. The depth of arrow indicates depth of influence. For example, DoE and project proponents have rather significant influence on environmental control and management of units, compared to Bangladesh Bank. Alongside, the dotted circles around department of textile (DoT), local clothing lines indicate that they are not actively participating in environmental management of textile units yet[65], but due to their potential relationship with the industry itself, they can. The green circles represent stakeholders with direct or indirect connection with EIA for textile industry in Bangladesh. However, the size of the circles does not intend to carry any meaning for this diagram.

Followed by the Venn-diagram, table 6.1 discusses the role of these stakeholder for environmental protection within textile industry of Bangladesh. The table lists 16 stakeholders.

[65] Local clothing lines have lack of knowledge regarding the environmental compliance requirements and performance expected from the units (mostly domestic market oriented) producing for them (source: interview)

Majority of them (or their representatives) have been reached out by researcher and interviewed for enhanced understanding about their role. At least, nine out of these 16 stakeholders are actively participating in the environmental protection of textile industry (e.g., DoE, project proponents, auditors, international brands, international agencies). The rest are yet to understand their role (e.g., DoT, local clothing lines, textile cell).



- Arrow direction indicates direction of interaction
- Arrow depth indicates strength of interaction
- Green circles indicate stakeholders have direct or indirect connection with EIA/ECC
- Dotted Circle outline means little or no influence on environmental issues of textile, but direct have relation with textile industry

Figure 6.8 Venn diagram depicting interaction among key stakeholders for environmental control, management and EIA of textile industry of Bangladesh

Source: Prepared by author from face-to-face interview and DoE (2021); GoB (2019; 2016); DoT (2017)

Table 6.1 Role of stakeholders in environmental control, management and EIA of Textile industry of Bangladesh

Stakeholder	Role
i) DoE	Since DoE is vested with the responsibility of environmental quality control of the entire country, it is the most responsible organization for environmental control and management of textile industry as well. Role of DoE has already been discussed in section 6.1.2.
ii) Academicians and experts	Academicians can play role as EIA consultants assisting in preparation of EIA report or can consult DoE in preparation of policy documents. They can also be reached out by the units for assessment or auditing of environmental performance. Alongside, experts can influence the environmental concerns of the units by educating them with public opinion or newspaper articles (Interviewee #7, #9)
iii) Project proponents	Project proponents can be owner/share holder or their representatives for textile units. Their perception and knowledge on environmental compliance and pollution control affects significantly in the environmental performance and improvement plans of the industrial units (Jha-Thakur, 2011). Project proponent is also responsible for mitigating impact through good design and environmental management (IAIA, 2002a).
iv) EIA consultants	EIA consultants are reached by project proponents for EIA in three stages, firstly before the establishment, secondly in case of extension of existing factory and finally to satisfy buyer requirement after starting operation. Sometimes consultants take the responsibility of preparing EIA report and handling it back to the proponents. Sometimes, they can also take the responsibility until obtaining ECC from DoE (Interviewee #6, #7, #8).
v) Affected public	While the quality of environmental control and management by textile industry affects the public most, it appears that public themselves can have very little influence in environmental performance of the units, until they make complaints on the non-compliance of the units. Public participation in EIA process is also practiced in a very limited way (Kabir & Momtaz, 2018). General population of Bangladesh is still negligent of the environmental issues emerging from industrial pollution (ref). Nevertheless, the only plausible way of incorporating them within this study was to interview the surrounding people of the case study area regarding their knowledge on EIA for the case study. However, the people consulted during the EIA of the case studies were never listed within any of the EIA report. Therefore, it was difficult to identify them and verify the fact of public consultation. Apart from this, one of the consultants (interviewee #10) mentioned that due to their dependence on the industrial units for livelihood, the surrounding population rarely make negative remarks about the units. Therefore, this study excluded public as one of the stakeholder groups for interview.

Stakeholder	Role
vi) Bangladesh Bank and financial institutes	Through the green finance scheme, Bangladesh Bank is influencing the environmental practice of the industrial units. They not only check the Environment and Social Due Diligence (ESDD) before sanctioning loan, but also visit the units in operation to satisfy the justification of the loan provided by meeting expected environmental performance (Bangladesh Bank, 2017).
vii) International agencies (e.g., World Bank, IFC, GIZ)	"There will be rule for environment, but to comply with that, you must have the knowledge. International organizations like GIZ, Asian Development Bank (ADB), The World Bank are coming up with such capacity building."- interviewee (#11). The donor organizations like World Bank, ADB have been performing EIA in Bangladesh since 1980s as a condition to providing loans (Momtaz, 2002). World Bank, IFC, GIZ are some of the international agencies supporting the environmental performance of textile industry in Bangladesh through research works, projects, funding, and technical assistance (interviewee # 11, #12, #13). IFC is a sister concern of World Bank, while GIZ is a bilateral development agency originated by German government with the mandate to ensure environmental and socially sustainable textile production (interviewee #11). IFC and GIZ support the industry and DoE through research, projects and technical assistance. The World Bank can also provide funding. GIZ's projects aim at capacity building, while IFC aim at creating market for addressing development challenges (GIZ, 2020; IFC, 2020). List of the relevant projects initiated by these organizations in Bangladesh is provided in Appendix VI.
viii) International brands	Being the third largest supplier of garment in global market, formal textile units of Bangladesh have good communication with international brands. Although the buyers can also communicate the units through third parties. Demands of EIA, ECC, EMS, ecolabel and self-assessment schemes imposed by the brands are largely implemented by the textile units to keep clean corporate image. Therefore, they indeed have a great influence in environmental management of textile industry in Bangladesh.
ix) Auditors	International brands usually recommend national or international auditing firms for environmental and social performance auditing of the formal textile units. Also, there are independent local auditors, with accreditation on EMS (e.g., ISO 14000), or self-assessment schemes (e.g., Higgs index) who can provide certification to the units, which is internationally recognized.

Stakeholder	Role
x) BGMEA	Bangladesh garments manufacturers and exporters' association (BGMEA) is the society of export-oriented textile units. Currently BGMEA is entering into agreements with international organizations like UNFCC[66], GIZ, IFC, Water Resource Group 2030 including Bangladesh Government with the aim at reducing GHGs, water footprint reduction, energy efficiency, renewable energy, chemical management, sludge management for export-oriented textile units of Bangladesh (BGMEA, 2021).
xi) Department of Textile (DoT)	DoT under Ministry of Jute and Textile of Bangladesh aims at developing and expanding this industry through capacity building and producing expert manpower while acting as patroniser for the sector (DoT, 2019). DoT's responsibilities are more oriented towards growth of the industry, rather than its environmental improvement. Their responsibilities are: i) supervising (including formulating the curriculum) the public educational institutes offering textile sector oriented education in the country, ii) registering the new textile units and providing certificates to the old ones, iii) listing out changes in existing units (investment, production capacity, product category etc.), iv) provide clearance to foreign nationals to be employed in textile units of Bangladesh (DoT, 2022). The textile policy 2017 formulated by DoT includes very generic environmental goals for the industry without clear action plan. Being a dedicated department for textile industry of Bangladesh, DoT has potential to contribute towards its environmental performances.
xii) Bangladesh small and cottage industry corporation (BSCIC)	BSCIC is a government agency working as patroniser of the small, medium, cottage industry of Bangladesh aiming at their growth, quality improvement and capacity development. Alongside policymaking, BSCIC directly interacts with the small-scale units within the country and support them through funding, encouraging innovation, establishing industrial estates and encouraging facility of CETPs to unregulated cottage units sprawled through different parts of the country (BSCIC, 2022).
xiii) Textile Cell	There is a textile cell dedicated under Ministry of Commerce, however it's function could not be clearly identified in any resources.
xiv) Ministry of industries (MoI)	The Ministry of Industries (MoI), Bangladesh is mainly responsible for developing new policies and strategies for acceleration, growth and sustainable development of Industrial sector of the country (Ministry of industries, 2019). Industrial Policy 2016 by MoI lists "To assist and encourage ascertaining sustainable environment-friendly industrial development" as an objective and dedicates a section (Section 14). However, the action plans are vested on organizations like DoE, Bangladesh Bank, SME foundation (GoB, 2016). Therefore, the ministry has a comparatively weak link with textile industry.

[66] UN fashion industry charter for Climate Change

Stakeholder	Role
xv) Local clothing lines	Conversation with one of the leading local clothing lines of Bangladesh found that they lack knowledge and resource for environmental performance improvement of the textile units producing for them. They are mostly in business with small scale informal units, those lack environmental compliance. However, the interviewees have expressed willingness to receive knowledge on environmental concerns of textile industry in Bangladesh, so they can contribute.
xvi) Textile educational institutes	Bangladesh has good number of institutes offering different levels of degrees on textile. Currently there are seven government institutes offering undergraduate degree in textile engineering, six offering diploma in textile technology, 41 textiles vocational instates offering education on textile until tenth class. Environmental issues of this industry are still not effectively addressed in the curriculum of these institutes (interviewee # 9). However, GIZ in collaboration with Ministry of Education is now working on curriculum development of textile education in the country while including social and environmental aspects. If the students can be educated, they can bring positive changes in environmental performance improvement for textile industry of the country.

Source: Face-to-face interview and literature sources mentioned within the table

Chapter summary

EIA exists in Bangladesh for last 25 years as a regulatory instrument. The country has listed both short and long-term goals and objectives for the EIA system. The system has a legal basis and environmental agency named DoE to administer. Procedural framework for EIA has been established by the guidelines formulated by DoE. However, sector specific issues within EIA are not getting adequate attention in Bangladesh. The system does not incorporate sectoral experts for reviewing the report or oversee the system. In addition to this, sector specific EIA guideline does not exist in the country. Also, the legislative framework for EIA in Bangladesh is based on an umbrella legislation. Although the effectiveness of the EIA system of the country has been evaluated in few research, there is a lack of sector specific research. Author has identified 16 groups of stakeholders with potential role for environmental protection within textile industry of Bangladesh. Most of these stakeholders already play an important part in EIA and environmental management for textile industry of Bangladesh. For successful implementation of environmental measures and EIA for textile industry, role of other stakeholders should be utilized as well.

Section C: Evaluating the requirement of EIA system and its practice for textile industry in Bangladesh

Chapter Seven: Role of EIA in delivering environmental sustainability for textile industry: Developing a framework of analysis

Chapter seven describes the process of developing the framework of analysis to understand the role of EIA in delivering sustainability for textile industry in Bangladesh. Accordingly, this chapter is divided into three sections. The first section discusses the key determinants used by experts in evaluating performance of EIA globally, thus sets context for the three key components (i.e., institutional framework, pre-decision stage of EIA practice and post-decision stage of EIA practice) for the framework of analysis. The second section presents elaborated discussion on the criteria and sub-criteria selected within these key components for evaluation of EIA based on global good practice examples. The last section presents the final framework of analysis based on the discussions in last two sections. This chapter accomplishes the second objective of the research through extensive literature review and document analysis. The outcome of this chapter (i.e., the framework) is used in deriving the findings of third and fourth objective of this research.

7.1 Selection of key components for framework of analysis to explore the role of EIA in delivering sustainability for textile industry

Identifying and evaluating environmental impacts of developmental activities, followed by adoption of mitigation measures can assist in bringing environmental sustainability. EIA as an instrument is explicitly designed to serve the purpose of ensuring environmental sustainability of development projects (Biamah, et al., 2013). However, Ebisemiju (1993) suggests, EIA should not be considered only a tool for analysing environmental impacts, rather it should be used as a process to utilize those findings in supporting decision-making on policy, plan and investment. Lee and George (2000, p.177) also emphasize,

> “EIA as a process rather than an isolated event”.

Besides, EIA not only supports the decision making for the project, but extends beyond by continuing to implementation, operation and even informing into policy making (Lee & George, 2000). Experts perceive EIA as both legislative and management instrument (Sinha, 1998; Komínková, 2016; Yang & Percival, 2009). According to The International Association for Impact Assessment (IAIA, 2002b), EIA serves two substantial purposes: i) providing information on environmental impacts of a proposed project, thus aiding in decision making, ii) promoting sustainable development "through identification of appropriate enhancement and mitigation measures". The first could be noted as "the immediate aim" and the second as "ultimate goal" (Sadler, 1996). Clear and well-organized information on the environmental risks and consequences from development proposals assist in achieving these purposes (Sadler, 1996). However, Wood (2003, p.09) opines, that universally applicable EIA model does not exist, rather it should be designed in a manner that can consider potential actions behind environmental damage in local circumstances.

According to Article 31 of the constitution of Bangladesh-

> "Every citizen has the right to protection from action detrimental to the life liberty, body, reputation, or property".

Mohammad (2012) suggests, this right to life in the constitution of Bangladesh is extended to the right to healthy environment and has been reflected in public interest litigations (PIL) through countless discussion, debates and court orders. National Sustainable Development Strategy (NSDS) 2013 of Bangladesh envisions,

> "Achieving a happy, prosperous and enlightened Bangladesh which is free from hunger, poverty, inequality, illiteracy and corruption, and belongs completely to its citizens and maintains a healthy environment."

Five priority areas to achieve the vision of NSDS (2013) are: i) sustained economic growth, ii) development of priority sectors, iii) urban development, iv) social security and protection, iv) environment, natural resource and disaster management. While it is widely realized that accelerated industrial growth challenge environmental sustainability of Bangladesh (Planning Commission of Bangladesh, 2014; Chowdhury, et al., 2021; Bhowmik, et al., 2019). However, the policy documents of Bangladesh have not defined the specific term "environmental sustainability" yet. Department of Environment (DoE) (2021a, p.v) recognizes EIA as "one of the most useful analytical tools for fulfilling the objective of sustainable development" for development projects. EIA is a widely used environmental policy instrument for managing environmental impacts from polluting industries around the globe (Resta & Dotti, 2015). With the intent to control environmental pollution caused by industries in Bangladesh, EIA prevails in the system since 1997. EIA aims at "internalizing environmental costs and damages in industry consistent with polluters pay principle" (Sadler, 1995, p.15). Therefore, EIA is visibly an approach to understand and address the concern of environmental sustainability for textile industry of Bangladesh.

7.1.1 Key determinants used for evaluating performance of EIA in international and national studies

Global experts in this field have used nearly similar criteria to evaluate efficacy of EIA performance around the world. Kennedy (1988) suggested that EIA works best if it has a specific legal requirement, for which preparation of Environmental Impact Statement (EIS) is mandatory, and authorities consider the results of it while making decisions. Some of the basic components used by experts for evaluating the EIA system are: i) a basis of the EIA system (i.e. legal, administrative), ii) EIA procedure and performance, sometimes reflected through a physical element (i.e. EIS) and iii) implication of EIA in decision making including follow-up (see Appendix VII) (Sadler, 1996; Doyle & Sadler, 1996; Kennedy, 1988; Wood, et al., 1996). Wood, et al. (1996) also observed the influence of procedural changes on EIA practice, i.e., EIS in their case.

Following on, the experts have sometimes sub-divided the abovementioned components and explicitly designated them as key components in their studies for enhanced understanding and evaluation of the EIA system. For example: evaluation of EIA practice for Brazil, UK, Netherlands used i) environmental policies and regulations, ii) institutional and administrative framework, iii) EIA procedure, iv) role of key actors, v) EIA compliance monitoring and enforcement, vi) quality of EIS (Arts, et al., 2012; Glasson & Salvador, 2000). These components were similar to the ones proposed by Leu. et al. (1996), where he also considered availability of resources (see Appendix VII). However six control mechanisms noted by Ortolano (1993) imply that an operative EIA system should include: i) existence of legal system, ii) adequate administrative control of environmental agency, iii) decision making based on outcome of EIA, iv) adequate role played by project proponents and consultants, v) awareness and power of public to influence the agency and, vi) market instruments conditioned with EIA.

The experts also evaluated EIA contributing to industrial pollution control, however those studies are very rare. Hijri & Ortolano (1991) in their study evaluated five components of EIA to control pollution from a case study tannery project. Those are- i) compliance with procedural requirement, ii) adequacy of EIA documents, iii) utilizing appropriate methods to assess impacts, iv) influence on decisions at different levels of project and v) weight given to environmental factors in final decision. On the other hand, there are several studies on evaluating specific stages of EIA process e.g. follow up, or system requirements, or EIS for sectors like mining, oil, water (See section 4.4.2 in chapter four) (Gwimbi, 2014; Khosravi, et al., 2019a; Jha-Thakur, et al., 2009; Wifa, 2014; Ingelson & Nwapi, 2014).

EIA seems to exist in the system of developing countries for last 25-30 years (Environmental Law Alliance Worldwide, 2015). Therefore, experts from these countries have also performed evaluation of country's overall EIA system. Nadeem & Hamid (2008) used criteria namely i) legislative system, ii) administrative set-up and iii) EIA process and practice to evaluate EIA system in Pakistan. Jha-Thakur & Khosravi (2021) evaluated the 25 years journey of EIA system in India by expanding and amending the criteria previously used by experts from India (Valappil, et al., 1994; Rathi, 2017). For India, Jha-Thakur & Khosravi (2021) used i) stages in EIA process, ii) adequacy of guidelines, iii) transparency in decision making, iv) qualification of consultants, v) quality of EIS, vi) public participation, vi) compliance monitoring, vii) effective implementation of mitigation measures, among others. On the other hand, Annadale (2001) amended Wood (1995)'s components intro broad groups for evaluating EIA system in Republic of Maldives. Annadale (2001) used: i) legal/administrative backing, ii) preliminary and detailed assessment, iii) EIA review, iv) decision making, v) follow up, vi) administrative support. These components were further used by Ahmed & Ferdausi (2016) for evaluating EIA system of Bangladesh. One of the earliest evaluations of EIA system of Bangladesh was performed by Ahammed & Harvey (2004). They adopted the evaluation criteria from Leu et al. (1996). Shakil & Ananya (2015) explored the theoretical perspective of EIA effectiveness using four effectiveness categories adopted from Chanchitpricha and Bond (2013) (See Appendix VII). On the other hand, Kabir (2012)'s PhD research work on critical evaluation of EIA system of Bangladesh using holistic approach have generated several scientific articles (see section 6.2 in chapter six), including a book by himself and his PhD supervisor (Kabir & Momtaz, 2018). In this book, the experts have used three key determinants for evaluating the EIA system of Bangladesh: i) institutional arrangement, ii) quality of EIS, iii) post EIS stage of EIA (Kabir & Momtaz, 2018). Momtaz (2002)'s study on evolution and status of EIA in Bangladesh was evidently the first peer reviewed article on the EIA system of Bangladesh.

On the other hand, until May 2021, there had been no sector specific evaluation of the EIA system to understand its effectiveness for textile sector in Bangladesh. International Labour Organization (ILO) has very recently published a document on effectiveness of EIA system for textile industry in developing nations, including Bangladesh. They considered two components for EIA best practice: i) institutional and governance qualities of EIA process, ii) technical and supporting tools and aspects. However, it appeared that this report is primarily based on the findings from previous literature and focused on the institutional and procedural features of the EIA system rather than sector-specific components (ILO, 2021).

7.1.2 Theoretical and empirical dimensions to understand the performance of EIA system

Globally experts have explored both theoretical ground (legal, administrative framework) and empirical evidence (EIA report, observance of mitigation measures, monitoring-follow up practices) to evaluate the performance of EIA. Thus, EIA system can be viewed from two distinct dimensions. Firstly, the theoretical side that consists of the principles based on which it is designed to operate (Emmelin, 1998). Secondly, the empirical side that consists of the practice of how it operates (Emmelin, 1998). On the other hand, Khosravi, et al (2019b) defined the first as "systems level" (i.e., characteristics of EIA legislation) and second as "project level" (i.e., influenced by actors involved) of evaluation. Retief (2010) argues that achievement from EIA is strongly linked to: i) theoretical grounding (purpose of EIA) and ii) quality of EIA (way to conduct EIA through best practice, guideline, quality review, report etc.). Among these, Emmelin's (1998) definition, seems more relevant to this research considering the studies discussed in 6.1.1.

There have been several studies evaluating single component of the EIA system i.e. quality of EIS, or quality of EIS coupled with compliance to mitigation measures, EIA follow up or simply the regulatory framework (Barker & Wood, 1999; Gwimbi & Nhamo , 2016; Lee & Colley, 1993; Kågström, 2016; Poder & Lukki, 2011). Author in this study realizes, that evaluating theoretical and empirical dimensions simultaneously can draw a holistic understanding on the EIA system. Although, there is also scope of potential tension between independent theoretical requirements and actual field scenario (Almas, 1990).

7.1.3 Finalizing the key components and criteria of indicators for framework of analysis

Summarizing the discussions in section 7.1.1 and 7.1.2, it can be said that, to provide a holistic understanding on the EIA system, both EIA operating principles and its practice need to be evaluated. Globally, experts have evaluated EIA regulations, administration and EIA process to understand the framework (i.e. principles) of EIA operation (see section 7.1.1). On the other hand, to assess the practice, quality of EIS, compliance monitoring, role of actors, influence in decision making have also been evaluated (see section 7.1.1). In other words, the EIA practice can be evaluated before and/or after decision making stage. In order to establish a holistic understanding of a sector specific study such as this, the author adopted three key components for the framework of analysis for this research. These components are: i) institutional framework, ii) pre-decision stage of EIA practice and iii) post- decision stage of EIA practice. While the first component assesses the theoretical base i.e., EIA system requirements; the other two evaluates the empirical scenario i.e., EIA practice. The component "institutional framework" is sub-divided into three criteria: i) legislative framework, ii) administrative arrangement and iii) procedural framework of EIA system. The practice of EIA practice can be evaluated exploring i) the performance of relevant stakeholders in pre and post decision stage, ii) quality of EIS (pre-decision stage) and iii) performance of textile units in adopting mitigation measures (post-decision stage). A schematic diagram prepared by author on the components and criteria used in evaluation of ElA system for textile industry in Bangladesh is shown in figure 7.1.

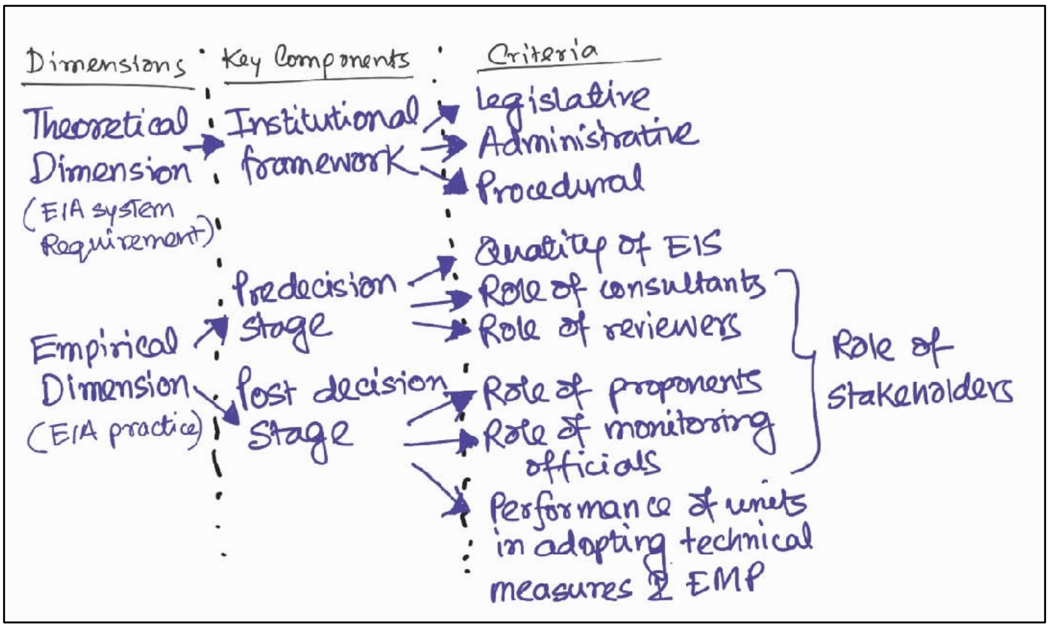


Figure 7.1 Schematic diagram of framework of analysis for this study
Source: Sktеched by author

Although the previously mentioned studies are focussed on evaluating the performance of overall EIA system, this research is focussed on EIA's role within a specific industry of Bangladesh. "Adequate operational competence" for EIA efficacy suggested by Sadler (1998;

p.36) might indicate sector specific considerations by requiring "application of best practicable science to the nature and scope of the issues and impacts" and "appropriate use of techniques and procedures". These can be translated into sector specific guideline and sectoral expertise required in different stages of EIA. Therefore, the sub-criteria within the framework of analysis for evaluating the EIA system is tailored by author to accommodate the consideration of textile industry in the following section (section 7.2).

7.2 Discussion on criteria and sub-criteria within the key components of framework of analysis

The three key components within framework of analysis for this research include:

i) Institutional framework;

ii) Pre-decision stage of EIA;

iii) Post decision stage of EIA.

Within these three components, criteria and sub- criteria were adopted. Together they formed the framework of analysis for holistic and sector specific evaluation of EIA in this study. These are discussed in the following sections:

7.2.1 Institutional framework

i) Legislative framework and administrative arrangement

Existence of clear legislation can make proponents comply with the EIA requirements and control their activity (Ebisemiju, 1993; Kabir & Momtaz, 2012). Specially projects with highly significant potential for environmental impact should definitely be assessed (Sadler, 1996; Wood, 2003). Wood (2003) emphasized EIA should extend beyond project, therefore significant programmes, plans and policies should also be covered by environmental assessment. Briffett's study (1999) on developing countries emphasized that absence of clear legislation or minimal penalty can cause general avoidance or abuse of the legislation. In addition to the legislative support, experts argue that strong control mechanism and administration are also required to make EIA work efficiently (Ortolano, et al., 1987; Ortolano, 1993; Ebisemiju, 1993; Hijri & Ortolano, 1991). Wood (2003) suggests a country's EIA potential is reflected through its legislative and organizational capacity.

Thus, responsible administration is one of the standard principles of well-established EIA system (Sadler, 1996). Environmental agencies are vested with the responsibility to administer the EIA process. Their mandates include providing institutional framework for EIA laws, regulations and policies; directing procedure for implementing EIA activity; and use the results of EIA in decision making (Sadler, 1996). To ensure the effectiveness of EIA system, the administration must operate with adequate resource and capacity (Kabir & Momtaz, 2012; Marara, et al., 2011). Marara, et al. (2011) and Khosravi, et al. (2019b) listed regulation, administration and procedural framework/process of EIA as three key elements of their research on the EIA system of East Africa and Iran respectively. Khosravi et al. (2019) realized that EIA process steps should be included within legislation, which was also expected by experts from Bangladesh (Kabir & Momtaz, 2018; Ahammed & Harvey, 2004; Ahmed & Ferdausi, 2016). Besides, Marara, et al. (2011) and Kabir & Momtaz (2018) recognize the need of competent judiciary body within the legal framework for EIA, coordination of competent authority with other lead agencies, specification of sectoral responsibilities within administrative system are some important criteria to evaluate an EIA system. Experts also emphasize the significance of independent review body for effective performance of EIA (Kennedy, 1999; Khosravi, et al., 2019a; Kabir & Momtaz, 2012; Sadler, 1996). On the other hand, Ebisemiju (1993) suggested, only analysis is not sufficient unless the result of EIA study is incorporated within project cycle to influence planning, design and decision making (Ebisemiju, 1993; Ortolano, et al., 1987; Morrison-Saunders & Bailey, 2000). Sadler (1996) added, integrity of EIA process within stages of decision making (i.e., project cycle) is an important determinant of its efficacy. UNEP (1988) also reminded, for EIA to have a real impact on project, it should be integrated in design and implementation of project in such way that it can provide useful information to decision makers at the right moment.

ii) Procedural framework for EIA

> "Quality information and products fostered by compliance with procedural guidelines and use of good practices is one of the necessary ingredients for effective application of EIA" - Sadler (1996, p. ii)

EIA guidelines usually serve the purpose of providing guidance on procedural matters in informal manner (Bates, 2002). They can support and enhance assessment framework and practice by clarifying methodological approaches and promotion of best practice, thus making proponents aware from the beginning of EIA (Waldeck, et al., 2012; Spooner, 1998). While evaluating the procedural framework of EIA, integration of EIA into project planning stages through screening, scoping, consideration of alternatives, public participation and follow up had been considered by experts (Wood, 2003; Kennedy, 1999; Khosravi, et al., 2019a; Marara, et al., 2011; Sadler, 1996). In addition to these, Wood (2003) emphasized EIA reports should meet prescribed contents and should be published for public review. Experts identify public participation as the most important method to introduce "procedural democracy" in decision-making process (Aschemann, 2007; Khosravi, et al., 2019a). Wood (2003) also suggested that EIA system should be monitored and amended over time. Amendment of EIA system can be reflected through amendment of the regulations and guidelines.

Summing up the discussion above, it can be said that a clear regulation is considered as one of the basic requirements for an EIA system to be successful. To carry out the purpose of such regulation, a dedicated organization with adequate capacity is equally important. Apart from these, a guideline to conduct EIA usually comes as supplement to the regulation, providing the proponents with the distinct idea on expectation from the EIA process. This guideline should reflect the international good practices and needs to be updated over time. However, for major yet polluting industries, sector specific EIA guidelines can contribute towards more successful application of EIA. Alongside, sector specific experts can add to success at different stages of the EIA process (i.e., EIA consultants, reviewers of EIA reports, monitoring personnel).

7.2.2 Pre-decision stage of EIA practice

From Arts, et al. (2001, p.176), "The pre-decision stage incorporates the early components of EIA prior to project implementation (for instance, project planning, screening, scoping, impact prediction, mitigation design and so on extending through to the decision itself)". Since the EIS reflects the stages of EIA process, it can provide understanding on the practice followed in EIA study. In addition to this EIS, role of relevant stakeholders like EIA consultants, project proponents and EIS reviewers can be assessed from this stage.

i) Quality of EIS

Emmelin (1998, p. 132) identified EIS "as a product where quality of the product determines its usefulness in decision making". EIS is a product reflecting EIA process and is also the source of decision making on a project's environmental sustainability. Therefore, careful review of the EIS is also an important stage of EIA. This review is greatly influenced by actors involved. According to Sadler (1996, p. 131),

> "Review of EIA reports are a key pre-decision quality control stage of EIA process".

Quality of EIS is recognized as one of major components reflecting the quality of EIA system (Emmelin, 1998; Wood, 2018; Sadler, 1996; Lee & George, 2000; Lee & Colley, 1993; Kabir

& Momtaz, 2012; Barker & Wood, 1999; Lee, et al., 1999). Selection of the EIS review package and method of evaluating EISs for this study is described below-

<u>Selection of the review package and method of evaluation</u>

In the year 1990, Lee and Colley developed an EIS review package as a part of the UK planning regulations. It was intended to be used by local planning authorities, developers, consultants and also other stakeholders with little amendment. This package was updated by the same authors in 1993. Simpson (2001) complimented the Lee-Colley EIS review package as quick, comprehensible and familier to the professionals in the same research field. This package has been widely used globally by researchers and experts (Simpson, 2001; Lee & George, 2000; Kabir & Momtaz, 2012; Glasson, et al., 1997; Barker & Wood, 1999) in UK, Ireland, EU countries and even Bangladesh for evaluating quality of EISs and performance of EIA with some amendment where required.

a) <u>Hierarchy of the review package:</u>

Lee-Colley's review package uses three tiers for assessment. The hierarchical order of the tiers is- i) Area, ii) Categories and iii) Sub-categories. The authors (Lee & Colley) named this hierarchy as the "assessment pyramid" (figure 7.2). This research uses same hierarchical order and terminology in its review package as Lee & Colley's.

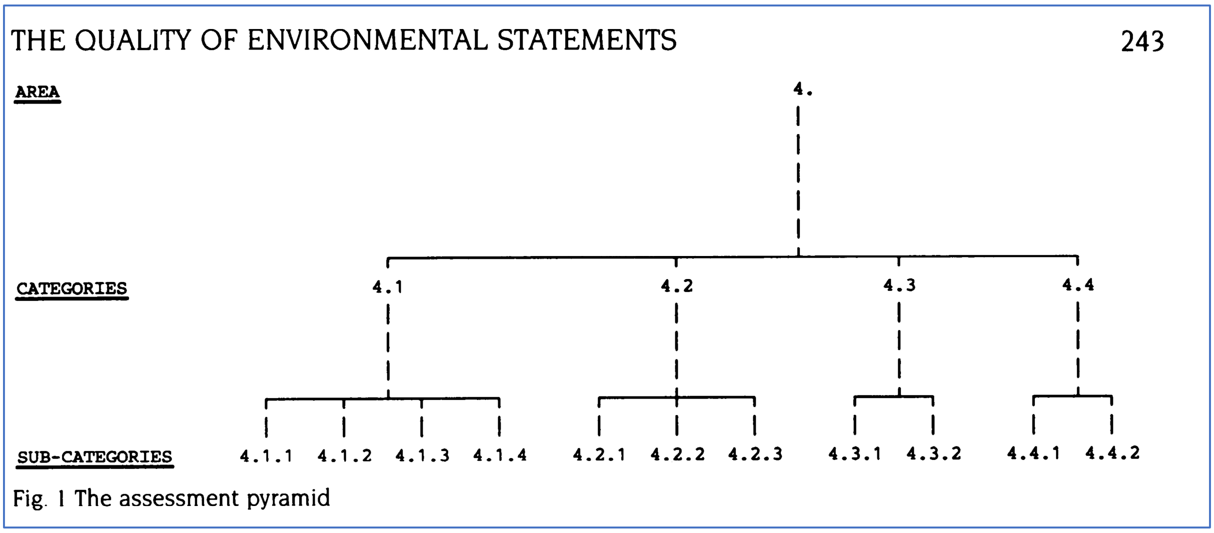


Fig. 1 The assessment pyramid

Figure 7.2 Assessment pyramid used to evaluate quality of EIS by Lee and Colley

Source: Lee & Colley (19993, p.243)

b) Amendment of the package for the study

"A good EIS is one which presents, in a form appropriate to its intended users, findings covering all assessment tasks employing appropriate methods of information collection, analysis and reporting". – Lee & George (2000, p.138)

In many cases, global researchers adjusted the package to fit the circumstances of their study area. For example: Sandham and Pretorius (2008) Badr et al. (2011) and Kabir & Momtaz (2018) amended the sub-categories within the package to suit to the South African, Egyptian and Bangladeshi context respectively.

Since this study involves review of EISs belonging to a specific sector, researcher here also needed to amend the original package. It was tailored considering contextual factors with specific attention to textile sector (e.g., relevant national policies like 3R strategy in Bangladesh). Therefore, both sector-specific and generic amendments were made. The amendments were made at the lowest tier (i.e., sub-categories) while the other tiers were kept unchanged. Some new sub-categories were introduced in the package, while some from the original package were simply enhanced (table 7.1).

The researcher modified the original package with the help from EIS checklist proposed by Environmental Protection Agency (EPA) of Ireland for textile industry, EIS review checklist by European Commission (since EC prescribes EIA for textile processing units), Environment-Health & Safety (EHS) guidelines used by IFC & The World Bank for textile units, environmental impact monitoring and evaluation guideline formulated by German government for textile industry, generic EIA guideline for industries formulated by DoE (includes guidelines for EIS) and sector-specific monitoring-compliance guideline formulated by DoE for textile industry (see table 7.1) (Ireland EPA, 2015; European Commission, 2001b; IFC & The World Bank, 2007; Government of Federal Republic Germany, 2013; USEPA, 1996; DoE, 1997a; DoE, 1997c). Emergence of National sludge management guideline and National 3R strategy in Bangladesh indicates the concern over hazardous waste pollution, which is also very relevant issue for the textile industry. Thus, amendment of this review package also reflects such national strategies of Bangladesh. In addition to these, some of the sub-criteria were newly formulated (e.g., 1.1.9 in Table 7.2), based on the researcher's knowledge gathered from the field.

Table 7.1 Information about the guidelines adopted in modification of EIS review package used for the study

Documents used for amending the EIS review package	**Summary of the contents**	**Influence in this review package**
1. Advice notes for preparing Environmental impact statements- 2015 by EPA-Ireland	Detail guideline for EIS contents for new development. Includes sector specific instruction on EISs including textile wet processing (or in other term pre-treatment) units	Inclusion of description of utility requirements, storage requirements for products, wastes and chemicals; associated developments (ETP) etc.
2. Guidance on EIA: EIS review by European Commission	Guideline for use by competent authorities, developers and EIA practitioners across Europe. Includes practical guideline on review and review checklist	Inclusion of indicators for effect prediction; prediction of effect for human health and sustainable development; indicators for identifying significance of impact; Risk assessment for handling hazardous material, spillage, fire/explosion, traffic accident, failure of process, exposure of project from natural hazards; description of monitoring and managing residual impacts; incorporation of alternatives, management practice apart from end of pipe treatment etc. in mitigation plan
3. Manual: Best management practices for pollution prevention in textile industry by USEPA	Pollution prevention guideline for processes and waste management in textile industry	Inclusion of description on chemical substitution; chemical Handling, storage; waste categorization; waste minimization; training and knowledge of staff regarding chemical and waste management etc.
4. Environment, health and safety guideline for textile manufacturing by World Bank-IFC	Technical reference document with industry specific examples of Good International Industry Practice. Includes environmental consideration and measures by processes within textile unit	Inclusion of description of reuse-recovery of chemical, waste and other material; management and substitution of hazardous material; safety plans and gears for safe handling and disposal of hazardous materials and chemicals etc.
5. Environmental Handbook: documentation on monitoring and evaluating environmental impact: Textile processing by Government of Federal Republic of Germany	Includes overview of potential environmental impacts and suggestions for environmental protection measures by processes within textile unit	Inclusion of assigning roles in emergency response plan and person in ETP operating; description of raw material used, and waste generated by processes etc.

Documents used for amending the EIS review package	**Summary of the contents**	**Influence in this review package**
6. Sector-wise industrial guidelines (textile): To Develop and Apply Sector-wise Industrial Guidelines and Standards and to Monitor Compliance by Department of Environment Bangladesh	Technical guideline including environmental protection alternatives and measures by processes within textile unit	Inclusion of description of ETP; management and substitution of hazardous material, reduce-reuse-recycle measures, process alternatives etc.
7. EIA guideline for Industries by Department of Environment Bangladesh	Generic guideline of EIA including detailed instructions for EIA process, structure of IEE-EIA-EMP report, EIA review	Inclusion of management and monitoring plan; emergency response plan; risk assessment, (also great extent of the review instructions overlap with the original review package)

Source: Ireland EPA (2015); European Commission (2001b); IFC & The World Bank (2007); Government of Federal Republic Germany (2013); USEPA (1996); DoE (1997a; 1997c)

Therefore, EIS review package in this study is modified primarily based on good practice principles formulated by leading experts and organizations of the world. This package can be further used globally by researchers and regulators intending to evaluate EISs for textile industry with necessary amendments. The final review package is shown in table 7.2. The italic fonts represent the amendments.

Table 7.2 Final Review package used for evaluating EISs of textile units in this study

Area	Category	Detailed Sub-category
1. Description of the development, the local Environment and the baseline conditions	1.1 Description of the development	1.1.1 Purpose and objective of development well explained
		1.1.2 The design and size of the development described including diagram, plan and maps
		1.1.3 Indication of prior development within environment
		1.1.4 Description of activities associated with construction work
		1.1.5 Description of production process and expected rate of production
		1.1.6 Described nature and quantities of raw materials needed in construction and operation phase by *processes within the industrial unit*,
		1.1.7 Plan for Handling and storage of chemicals
		1.1.8 Plan for storage of raw materials, finished products and wastes
		1.1.9 Description of staff and their expertise, their knowledge and training on safety plans and gears for safe handling and disposal of materials, chemicals etc.
		1.1.10 Description of associated development (ETP) (infrastructure, treatment processes and capacity) along with monitoring and maintenance plan (operator, cleaning etc.)
	1.2 Site description	1.2.1 land required for the development defined and shown in map
		1.2.2. Described expected use of land and demarcations by different uses
		1.2.3 Described different phases of project including decommissioning phase where suitable
		1.2.4 Description of expected new development (housing, road etc.) as result of project
		*1.2.5 Description of amount of utility required for the facility**
		1.2.6 Description of activities to be ceased as the result of the project
		1.2.7 Described numbers, access and transport used by users of the project area in different phases
		1.2.8 Means of transporting raw materials and products with quantities involved

Area	Category	Detailed Sub-category
	1.3 Waste generation and management	1.3.1 Type, *Toxicity and composition*, quantity, rate of generation of waste material, energy and residues *by processes within the unit*
		1.3.2 *Collecting, storing, treating, transporting and final disposal* of each type of waste *and residue (specially sludge)* along with route of disposal through environment
		1.3.3 Described methods of estimation of waste and residuals including uncertainties and confidence limits
		*1.3.4 Plan for reduce, reuse and recycle for efficient use and recovery of water, energy and chemicals or resource recovery from wastes**
	1.4 Environment description	1.4.1 Indication of environment to be affected with a suitable map
		1.4.2 *description of environmental components within project area (i.e., environmental parameters like temperature, humidity, air quality, noise etc for existing project*
		1.4.3 Define affected environment with significant impacts from immediate construction site
	1.5 Baseline conditions	1.5.1 Described components of affected environment, described investigative methods used for this purpose and their suitability according to the size and risk of assessment along with uncertainty,
		1.5.2 Utilizing existing data (used by local authorities, conservation agencies, research groups etc.)
		1.5.3 Local land use plan and policies consulted, and other data gathered to assess do-nothing scenario.
2. Identification and evaluation of key impacts	2.1 Definition of impacts	2.1.1 Description on any direct and indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects *associated with processes, raw materials extracted, used and waste generated*
		2.1.2 Effects and interactions should be investigated and described for human beings[67], flora-fauna *and biodiversity*, soil, water[68], air, *micro-climate*, *climate change and sustainable development*, landscape, material assets, cultural heritage

[67] *Primary or secondary impact on Health and wellbeing, demography, social (EC) (e.g., health effects caused by release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the project, changes in living conditions, effects on vulnerable groups)*

[68] *e.g., Water quality, quantity, course of waterstream*

Area	Category	Detailed Sub-category
		2.1.3 Conditions should be described for both operating and accidental situations. *Specially risk assessment needs to be carried out for handling hazardous material, spillage, fire/explosion, traffic accident, failure of process, exposure of project from natural hazards*
		2.1.4 Deviation from baseline should determine the impact (difference between do-nothing and with project scenario)
		2.1.5 Description of Emergency response plan (identification of all possible causes, assigning roles, list of actions to be taken)
	2.2 Identification of impacts	2.2.1 Systematic methodology to be used for impact identification (project specific checklists, matrices, panels of experts, consultations, etc. and Supplementary methods (e.g., cause effect or network analyses)
		2.2.2 Rationale and brief description of the impact identification methods
	2.3 Scoping	2.3.1 Genuine attempt to contact general public and special interest groups to inform them about project and its implications
		2.3.2 Opinion of those stakeholders should be collected through arrangement of public meetings, seminars, discussions groups
		2.3.3 Key impacts should be investigated in detail and other impacts should also be mentioned. Rationale needs to be stated for not investigating the later.
	2.4 Prediction of impact magnitude[69]	2.4.1 Sufficient amount of data should be used to estimate the magnitude (*Geographic extent, duration, frequency, reversibility, probability of occurrence*). Gaps (*Difficulties in compiling the data needed to predict or evaluate effects)* should be acknowledged where applicable, *their implication on results* and strategy to deal with that.
		2.4.2 Described method of predicting impact magnitude and its suitability according to size and significance of impact
		2.4.3 Quantitative means of expression for magnitudes to be used where suitable, qualitative ones should be adequately defined.

Area	Category	Detailed Sub-category
	2.5 Assessment of impact significance	2.5.1 Significance to affected community and society from impact magnitude *of each predicted effect* should be clearly described *(discussed in terms of the number, importance and sensitivity of people, resources or other receptors affected)*; significance after applying mitigation measures should also be discussed
		2.5.2 National and international standards to be taken into account while assessing significance. Also, magnitude, location and duration of impacts to be tallied against societal values
		2.5.3 Choice of standards used should be justified
3. Alternatives and mitigation	3.1 Alternatives	3.1.1 Alternative sites should be considered where practicable and available
		3.1.2 Alternative processes, designs and operating conditions should be considered and environmental impacts of such should be indicated
		3.1.3 Substitution plan for hazardous chemicals
		3.1.4 Reappraise rejected alternatives in case of severe impacts identified of previously selected ones
		3.1.5 Main reason for choosing the project, explained including environmental reasons for choice
	3.2 Scope and effectiveness of mitigation measures	3.2.1 Mitigation should be considered for all adverse impacts and specific measures to be proposed for significant ones. Residual impacts should be justified.
		3.2.2 Mitigation measures should include modification of the project, compensation and the provision of alternative facilities *(Alternative strategies or locations, changes to the project design and layout, changes to methods and processes, "end of pipe" treatment, changes to implementation plans and management practices*) along with pollution control
		3.2.3 Extent of effectiveness of mitigation measures should be indicated. Uncertainty should be discussed with appropriate data.
		3.2.4 Where mitigation of significant adverse effects is not practicable, or the developer has chosen not to propose any mitigation measures- the reasons are clearly explained
	3.3 Commitment to	3.3.1 Clear record of commitment to mitigation measure should be included. Strategy to implement the measures and performance timeline should be described

Area	Category	Detailed Sub-category
	mitigation	3.3.2 Monitoring measures (*Identification of parameters for monitoring and frequency of testing, plan of incorporating monitoring outcome, description of structural/research facilities within project or at least plan for it and description of in-house experts for implementation of mitigation measures and routine monitoring*), strategy to adjust measures to deal with unexpected adverse impacts to be discussed
		3.3.3 Plan for monitoring and management of residual impacts
4. Communication of result	4.1 Layout of report	4.1.1 Introduction with brief description of the project, the aims of the environmental assessment and strategy to achieve the aims
		4.1.2 Logical arrangement of information in chapters and indicating important data using ToC or index
		4.1.3 In case of detailed chapters, summaries to be provided indicating findings in phases of investigation
		4.1.4 Original sources of data should be always acknowledged.
	4.2 Presentation	4.2.1 Unnecessarily technical or obscure language should be avoided to make it understandable for non-specialists
		4.2.2 Technical terms, acronyms and initials should be defined
		4.2.3 Report/statement should appear integrated, cross referenced, data in Appendix properly referred in main body
		4.2.4 Clear description of the process followed
		4.2.5 All analyses and conclusions properly supported with data and evidence
		4.2.6 Consistent terminologies used throughout the document
	4.3 Emphasis on adverse impacts	4.3.1 Prominence given on the significant adverse impacts along with potential favourable ones.
		4.3.2 Statement should not lobby any point of view, thus remain unbiased
	4.4 Non-technical summary	4.4.1 Should be provided for main findings and conclusions, avoiding technical terminology
		4.4.2 Should cover a brief description of the project, the environment, proposed major mitigation measures, description of any significant residual impacts. A brief explanation of data collection method and their confidence limit should also be included.

Area	Category	Detailed Sub-category
		4.4.3 Discusses development consent process and role of EIA in the process

*The amendments were indicated using italic fonts

Source: Adapted from Lee & Colley (1993); Ireland EPA (2015); European Commission (2001); Government of Federal Republic Germany (2013); IFC-World Bank (2007); USEPA (1996); DoE (1997a; 1997c)

Number of subcategories in the final review package is 71. This implies that, EISs from five red category textile units gathered for this study (see section 2.4.1 in chapter two) would be evaluated against 71 detailed indicators.

c) Method of evaluation using the package

Lee & Colley (1993) used letters instead of numbers as symbol of evaluations. Each letter represents different levels of adequacy and performance of the contents in the EIA report (figure 7.3). Same method is used in this research.

Symbol	Explanation
A	Relevant tasks well performed, no important tasks left incomplete.
B	Generally satisfactory and complete, only minor omissions and inadequacies.
C	Can be considered just satisfactory despite omissions and/or inadequacies.
D	Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions and/or inadequacies.
E	Not satisfactory, significant omissions or inadequacies.
F	Very unsatisfactory, important task(s) poorly done or not attempted.
NA	Not applicable. The Review Topic is not applicable or is irrelevant in the context of this Statement.

Figure 7.3 Assessment symbols used in Lee & Colley package with explanation
Source: Lee & Colley (1993, p.243)

Lee & Colley (1993) suggested at least two reviewers should review each EIS to ensure an unbiased assessment. The reviewers should follow bottom-up approach, i.e., starting from the lowest tier representing simple tasks and gradually shifting towards compound ones. Thus, the two reviewers in this study would begin with evaluating the sub-categories using the symbols according to their explanation. The evaluation is performed in three stages:

i) Evaluating for minimum requirement;

ii) Evaluating for broad compliance;

iii) Evaluation of overall report.

In Lee-Colley's package, **minimum requirement** is designated according to the requirement stated in EC directive. Lee & Colley (1993) suggested, the minimum requirement is fulfilled by achievement of satisfactory evaluation((A/B/C) in pre-defined sub-categories. As researcher has amended the sub-categories for this research focussing on sectoral issues, some new sub-categories were also included within the minimum requirement list in addition to Lee-Colley's (table 7.3).

Table 7.3 List of subcategories designated for evaluation of minimum requirement in this study

Area	Sub-categories designated by Lee-Colley (1993, p.48)	Additional subcategories selected for this study
1	1.1.2, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.7, 1.3.2, 1.4.1, 1.4.3, 1.5.1, 1.5.3	1.1.7, 1.1.10, 1.2.5, 1.3.1, 1.3.4
2	2.1.1, 2.1.2, 2.4.1, 2.5.1, 2.5.2	2.1.3, 2.1.5,
3	3.2.1, 3.3.1	3.1.3, 3.3.2
4	4.4.1, 4.4.2	4.2.4, 4.2.5

Source: Amended from Lee & Colley (1993) by Author

Definition of **broad compliance** is kept same as the Lee-Colley package. It is defined through satisfactory (evaluated as A/B/C) evaluation in both

i) Minimum requirements and,

ii) Broad areas

Finally, reviewers would assign an **assessment symbol to the overall report**, like Lee-Colley's package users.

ii) Role of stakeholders in EIS preparation and decision making

Role of relevant stakeholders in pre-decision stage of EIA are described below-

a) Role of project proponents

IAIA (2002, p.302) lists four key responsibilities of project proponent: "avoid, minimise and remedy adverse impacts; internalise the environmental and social costs of the proposal, prepare plans for managing impacts, repair or make restitution for environmental damages." The enforcing agency would provide routine visit after long intervals to monitor proponents' actions and performance of the units. Thus, great responsibility is inflicted upon the proponents to make the ultimate goal of EIA process fruitful. Awareness and knowledge of project proponent plays important role in enhancing EIA process and better implementation of environmental protection measures (ILO, 2021; Jha-Thakur, 2011). Therefore, the project proponents are important stakeholder in both pre and post decision stage of EIA.

b) Role of EIA consultants

Marara et al. (2011) recognized availability of resources and expertise for conducting EIA are significant contextual factors affecting the quality of EIA. Also, assembling an appropriate interdisciplinary team is emphasized by Wood (2003) while preparing EIA reports. In developing countries, environmental assessment is mostly performed by consultants (Lee & George, 2000). Therefore, requirement of adequate scientific and technical base for a sound EIS (Kornov & Thissen, 2000) of specialized industries can be ensured by involvement of relevant sectoral experts within an interdisciplinary team. The consultants must also have access to updated guidelines for preparing EIS (Lee and George, 2000). Since qualification of the EIA consultants plays an important role in making this process worthwhile. For ensuring standard qualification of EIA consultants, accreditation, enlistment with environmental agencies with record of their expertise, organizational capacity can prove useful (Kabir & Momtaz, 2018). Otherwise, the proponents aiming for cost cutting may end up utilizing consultants with insufficient expertise (The World Bank, 1997). Many countries of the world emphasize qualification of EIA consultant to be reported within the submitted EIS (GOV.UK, 2020; Government of Canada, 1992).

c) Role of EIS Reviewers

When the EIS is reviewed for decision making, reviewer's sector specific knowledge aids critical analysis and decision making in an efficient manner. Effectiveness of EIS review is dependent on factors like: the expertise and extent of independence of the reviewers, availability of relevant documents for review (which could be guidelines), time and resources provided among others (Lee & George, 2000). Alongside, efficacy of the review is also reflected through the use of review findings in stages of project and EIA (Lee & George, 2000). Ideally, EIS review provides means for improved quality control and better practice and management (Sadler, 1998). Thus, review process contributes significantly to ensuring the quality of EIS following on to decision making of the project. It is only fruitful if the decision from review is reflected in the project decision making i.e., modification/alteration, adoption, cancellation of project. Lee and George (2000) suggested that successful incorporation of assessment findings in the decision making of planning and project determines the effectiveness of the EIA process. EIS review can assist the proponents in understanding the shortcomings and strength of their project in terms of environment, therefore results of review must be suitably communicated to them. Experts also emphasize for public access to the report; thus, their opinion can be adequately addressed in the development stages of project (Wood, 2003; Lee & Colley, 1993). EIA should provide the basis for environmentally sound decision making by clearly specifying terms and conditions to be enforced (Sadler, 1996). Sharing of EIA reports and review decisions are indicated as some of the factors influencing transparency in EIA by Jha-Thakur

& Khosravi (2021). Therefore, transparency in the decision making can be brought if the result of EIS review is published with case specific explanation and conditions for approval.

7.2.3 Post decision stage of EIA practice

As a part of impact management, mitigation measures are implemented and adjusted when required to respond to unanticipated impacts (IAIA, 2002a). These measures are integral for practical actions leading from EIA. Project proponent is responsible here for mitigating and monitoring impact through good design and environmental management (IAIA, 2002a). Regulators are responsible for compliance monitoring, reviewing consent conditions and management requirements (IAIA, 2022).

i) Performance of units in adopting mitigation and impact management

> "Mitigation is of little value if it remains as a series of proposals in an EIS" - Morrison-Saunders et al. (2012, p. 291).

Therefore, an excellent EIS from proponent's side even would not suffice, until the mitigation measures are implemented in practice. Wood (2003) mentioned that mitigation action on impacts at different stages of project is an important indicator to determine the performance of EIA. According to Kabir & Momtaz (2018), successful implementation of mitigation measures helps achieving the "Ultimate goal" (minimization of environmental impacts from a project) to a great extent. Mitigation measures implemented by local experts even have the potential to improve the practice of EIA (Kennedy, 1999). To follow up whether the measures are working as predicted, monitoring mechanism need to be set by the proponent too (IAIA, 2002a). EMP might need to be formulated for strengthening the management system of implementing mitigation measures (IAIA, 2002a).

DoE (1997a, p.29) defines EMP as "an implementation plan for mitigation, protection and/or enhancement measures which are recommended in EIA". IAIA (2002a, p.314) states,

> "EMP is prepared as part of EIA reporting. It translates recommended mitigation and monitoring measures into specific actions that will be carried out by the proponent".

Therefore, EMP is a part of EIA and is also included within prescribed contents for EIS in Bangladesh (DoE, 1997a). The definition used by The World Bank (1999) for EMP is 'the set of mitigation, monitoring and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels'. Therefore, management and monitoring both are considered as the key sub-criteria while evaluating performance of textile units in adopting EMP.

Since this segment is mostly technical, the sector-specific guideline formulated by DoE (1997c) would prove useful in determining the sub-criteria of the framework on technical measures, environmental management and monitoring of textile units. The technical measures proposed within this guideline (DoE, 1997c) were compared with international standard practices and found relevant (see section 10.3.2 in chapter ten). EMP being a part of EIS, the sub-criteria adopted for this segment of the framework used the literature relevant to amendment of EIS review package, and researcher's observation from field (Lee & Colley, 1992; EPA, 2015; EC, 2001; Government of Federal Republic Germany, 2013; IFC-World Bank, 2007, DoE, 1997a; 1997c) (See table 7.5 for more).

ii) Role of stakeholders in mitigation and monitoring

Role of relevant stakeholders in post-decision stage of EIA are described below-

a) <u>Role of project proponents</u>

see (ii) in section 7.2.2 within this chapter.

b) <u>Role of monitoring team</u>

To ensure whether the mitigation measures promised in the EIA report are practiced and showing results as expected, monitoring is necessary. Insufficient monitoring and enforcement can result in non-compliance (Ostrovskaya & Leentvaar, 2011). Therefore, provision of monitoring by environmental agency encourages proponents to comply to the mitigation measures. Quoting Ostrovskaya & Leentvaar (2011, p.01), "Monitoring and enforcement significantly impact environmental behaviour and environmental quality in developing countries". Wood (2003) used it as a performance indicator of EIA in developing countries. Regulators should be able to operate at adequate resource and capacity to support EIA system efficiently (Kabir & Momtaz, 2012; Marara, et al., 2011). Thus, Sadler (1996, p.126) warns,

> "Unless there is a minimum follow-up capability, EIA operates as a linear rather than iterative process and lacks continuity".

Sadler (1996) proposed two forms of monitoring: Enforcement monitoring and effectiveness monitoring. While the first ensures that mitigation measures are adopted in relation with EIS and conditions of approval; other one assesses the environmental effects attributable to mitigation activity (Sadler, 1996). Apart from these two, overall EIA system also needs monitoring to understand whether existing regulations, guidelines or enforcement are serving the purpose adequately, or needs to be amended to incorporate feedback of experience (Wood, 2003).

However, for keen observation of sector-specific details, sectoral expertise would be required by the monitoring officials along with adequate resources. However, for sectors like textile, proponents are also influenced by international brands for adopting such measures and management plans.

7.3 Final framework of analysis

Based on the discussion in the previous sections, the framework of analysis adopted for this research is shown using table 7.4. Furthermore, the source of these components, criteria and sub-criteria and final data collection method in the field is shown in table 7.5.

Table 7.4 Detailed components, criteria and sub-criteria for evaluation of EIA for Textile Industry in Bangladesh

Components	Criteria	Sub-criteria
Institutional framework	Administrative arrangement	• Separate environmental agency with adequate authority • Adequate resources available to environmental agency for implementing EIA in practice • Staff with sector-specific skills to overview sector specific EIA process • Adequate interagency co-ordination between DoE and other • Judicial control over EIA system
	Legislative framework	• EIA for environmentally significant projects (including polluting textile units) required by law • Visible linkage of EIA to decision making (e.g., environmental permit based on report submission) • Provision of penalty for proceeding without ECC • Provision of penalty for failure to take remedial measures for environmental pollution • Provision of penalty for non-compliance with ECC conditions or measures proposed in EIA reports • Detailed administrative procedure established by regulation • Procedural steps for conducting EIA established by law

Components	Criteria	Sub-criteria
		• EIA system applying beyond project (e.g., to significant programmes, plans and policies) • Provision of independent reviewers in regulation • Public consultation as legal requirement
	Procedural framework	• Integrated within project cycle • Guideline exists for conducting EIA • Existence of sector specific guideline • EIA process includes standard steps (see chapter eight for details) • Prescribed contents for EIS and requirement to meet those • Requirement of public sharing of report • Sector-specific guideline directs EIA process • Sector-specific guideline relates key environmental issues (e.g., chemical, effluent and emission, resource consumption) with stages of textile manufacturing • Sector-specific guideline include direction on standard environmental pollution control and management for textile industry by process (e.g., process alternatives, waste management, resource optimization, ETP operation) • Sector-specific guideline referring to international good practices (BAT, EHS) for textile industry • Sector-specific guideline include direction on standard environmental pollution control and management for textile industry by process (e.g., process alternatives, waste management, resource optimization, ETP operation) • Sector-specific guideline updated over time • Generic EIA guideline updated over time • Existence of guideline for EIA monitoring in Bangladesh • Sector-specific checklist followed in monitoring • Overall EIA system is monitored and amended (if necessary) according to feedback from experience
Pre-decision stage of EIA practice	Quality of EIS	Amendment of Lee and Colley (1993)'s EIS review package under these major areas of the original package- • Description of the development, the local

Components	Criteria		Sub-criteria
			Environment and the baseline conditions. • Identification and evaluation of key impacts • Alternatives and mitigation • Communication of results (See details in section 7.2.2 in chapter seven)
	Role of stakeholders	EIA consultants	• Existence of code of conduct and accreditation system for EIA consultants • Provision and practice of enlistment of consultants with environmental agency • Adequate capacity to prepare EIA report (Sector specific expertise, own lab etc.) • Have knowledge about and access to existing sector-specific guideline • Knowledge and use of international guidelines, if required • Have been able to influence proponents about adopting measures in favour of environment • Provision of Penalty (e.g., blacklisting, show-cause notice, cancellation of license, timeline bar for ECC approval) for the proponents or consultants providing falsified reports
		EIS reviewers (Review by DoE and approval of ECC)	• Adequate manpower and fund available for review in all the offices • Sector specific experts consulted in review committee • Adequate time provided behind each report in the meetings approving ECC • Sectoral industrial guideline is followed • Specific checklist or review method/package followed
			• Decision on ECC and the reasons for approval are published • Reasons on decision include an explanation of the EIA report and review influencing the decision • Review process influencing the decision • Conditions provided with ECC are relevant and specific to project
		Project proponents	• Realizing pollution potential of textile wet processing units • Recognizing existing policy measures in reducing the environmental impacts of textile units • Sufficient time and fund provided by proponents for conducting EIA • Utilizing or conforming to existing rule or policy measure (details in section 9.2 in chapter nine)

Components	Criteria		Sub-criteria
Post-decision stage of EIA practice	Role of stakeholders		• Have clean record in adhering to the existing rule (never penalized) • In compliance with the 3R strategy (ZLD plan) introduced by DoE in 2014 • Adopted environmental protection measures for their unit • Motivated to adopt environmental protection measures from environmental concern • Intent to accept support and knowledge to enhance their effort in pollution minimization from their units
		Monitoring officials	• Adequate role played by the environmental agency in successfully implementing the mitigation measures • Both implementation and impact monitoring take place • Regular monitoring performed since project inception • Monitoring takes place since project inception phase • Adequate resources available to monitoring team • Monitoring is prioritized for pollution intensive units • Monitoring is prioritized for factories belonging to major economic sectors • Adequate provision to find out factories skipping ECC or regular reporting or renewal for ECC • Regular interval between monitoring (visits) visible. • Adequate provision to determine the compensation and penalizing polluting factories
	Performance of units	In adopting technical measures	• Technical measures are adopted by processes (starting from sizing till finishing) in the core areas directed in sector specific industrial guideline of Bangladesh (Housekeeping, Process/equipment modification. Chemical recovery, Chemical substitute, Water conservation, Innovation technology) (See details in section 10.3.1, Chapter 10). • Technical measures for wastewater treatment are adopted as emphasized in the sector-specific guideline of Bangladesh (See details in section 10.3.1, Chapter 10).
		In adopting EMP	• Adequate management plans for chemical management, waste management and safety according to existing EIA guideline of

Components	Criteria		Sub-criteria
			Bangladesh and international good practices (See details in section 10.3.1 in Chapter 10) • Adequate monitoring plans for housekeeping, effluent & emission, provision of audits according to existing EIA guideline of Bangladesh and international good practices (See details in section 10.3.1 in Chapter 10) • Follow mitigation measures proposed in their own EIS or EMP document

Source: prepared by author for this research, Adapted from Marara, et al. (2011); Annadale (2001); Wood (1995); Sadler (1996); Lee, et al. (1999); Khosravi, et al. (2019b); Wood (2003); Kabir & Momtaz (2012); Lee & George (2000); Emmelin (1998) ; Ebisemiju (1993); Ortolano, et al. (1987); Briffett (1999); USEPA (1996); Ireland EPA (2015); European Commission (2001a); IFC & The World Bank (2007)

75 major sub-criteria have been mentioned in table 7.4 constituting the framework of analysis of this research. Some sub-criteria (e.g., the broad areas within EIS review package) have been further elaborated in respective chapters, as mentioned within the table.

Finally, the following table (table 7.5) shows sources of the adopted criteria and data collection method-

Table 7.5 Source of adopted criteria for evaluating EIA for textile industry and data collection method

Components	Criteria	Adopted from the sources	Data collection method used in this research
Regulation and institutional guidance	Administrative arrangement	Khosravi, et al. (2019b); Wood (2003); Annadale (2001); Sadler (1996); Kabir, (2012); Ahammed & Harvey (2004)	Document analysis and face-to-face interview
	Legislative framework		
	Procedural framework		
Preparation of EIS and decision making	Qualification of EIA consultants	Sadler (1996); Kabir & Momtaz (2018); Annadale (2001); Lee & George (2000); Wood (2003); Marara, et al. (2011)	Face-to-face interview and literature review for data validation
	Quality of EIS	Lee & Colley (1992); Ireland-EPA (2015); European Commission (2001a); DoE (1997a); DoE (1997c); Government of Federal Republic Germany,	Document analysis for case study and other units

Components	Criteria	Adopted from the sources	Data collection method used in this research
		(2013); IFC & The World Bank (2007)	
	Review by DoE and approval of ECC	Sadler (1996); Kabir & Momtaz (2012); Annadale (2001); Lee & George (2000)	Face-to-face interview and literature review for data validation
Adherence to mitigation measures and environmental management plan	Evaluating role of project proponents	IAIA (2002a), ILO (2021), Jha-Thakur (2011)	Face-to-face interview on site
	Adherence of factories to mitigation measures	DoE (1997c)	Checklist with help of consultation within case study analysis
	Adherence of factories to environmental management plan	Lee & Colley (1992); Ireland-EPA (2015); European Commission (2001); DoE (1997a); DoE (1997c); Government of Federal Republic Germany, (2013); IFC & The World Bank (2007); researcher's observation	Checklist (with help of consultation) and observation within case study analysis
	Monitoring by DoE	Wood (2003); Sadler (1996); Ostrovskaya & Leentvaar (2011)	Face-to-face interview and literature review for data validation

Source: Mentioned wihtin the table

Chapter summary

Upon extensive literature review, three key components and several criteria under have been adopted by author for framework of analysis in this research. The three components are- Institutional framework, pre-decision stage of EIA practice and post-decision stage of EIA practice. Institutional framework represent the EIA system requirement, thus the theoretical dimension of EIA. The criteria selected for evaluation within institutional framework are – legal requirement, administrative arrangement and procedural framework. Pre- and post-decision stage of EIA practice reflects the empirical dimension of the EIA system. Two major criteria selected for evaluation within pre-decision stage of EIA are- quality of EIS and role of relevant stakeholders. On the other hand, the role of relevant stakeholders and performance of textile industrial units in adopting mitigation and management measures are selected as the two major criteria within post-decision stage of EIA. Following on, the sub-criteria adopted for the framework is tailored suiting sector specific concerns of textile industry and contextual factors. More than 100 sub-criteria are adopted for the framework of analysis of this research.

Chapter Eight: Evaluation of the requirement of EIA system for textile industry in Bangladesh

This chapter evaluates the institutional framework (i.e., theoretical dimension) of EIA for textile industry in Bangladesh through legal framework, administrative arrangement and procedural framework. Accordingly, the discussion in this chapter is divided into three different sections. The first section evaluates the legal framework for EIA with specific attention to textile industry. The second section evaluates the administrative arrangement. Finally, the third section investigates the procedural framework guiding the EIA practice for textile industry in Bangladesh. All these sections start with the results of evaluation against the framework of analysis and then elaborates the discussion using international examples. The evaluation is predominantly based on the information from policy documents and previous literature. However, the notes from face-to-face interviews also proved useful in enhancing the outcome. This chapter accomplishes the third objective of this research and helps in formulating the recommendations (fifth objective).

8.1 Evaluating the legal framework of the EIA system for textile industry in Bangladesh

8.1.1 Results of evaluation of the legal framework

A visible linkage exists between decision making and EIA system of Bangladesh since Environmental assessment (EA) is a prerequisite for Environmental Clearance Certificate (ECC) of the polluting industrial units. All the new red category (see section 6.1.2 in chapter six) textile units i.e., dyeing, printing and finishing, are required to submit detail EIA report with their ECC application. Orange B category projects (see section 6.1.2 in chapter six) i.e., spinning, ready-made garment and sweater production, fabric washing under textile industry, EMP and Initial Environmental Examination (IEE) are the two key documents required to submit for ECC (DoE, 1997). For proceeding without ECC and failure to take remedial measures to mitigate environmental pollution, there is a provision of fine and imprisonment in the Environmental Conservation Act (ECA)'95 (DoE, 2010).

The submitted report for ECC is reviewed by Department of Environment (DoE) officials and likewise, decision on ECC is produced. There is no provision of independent reviewer in the system. Detailed administrative procedure (e.g., prescribed forms; supporting documents; stages of submission, approval and relevant activities) relevant to the process of getting ECC is also stipulated within Environmental Conservation Rules (ECR)’97. A guideline on EIA procedure for industries came as supplement to this rule (DoE, 1997a), which was later updated in February 2021. Although being a guideline, it is legally non-binding. Therefore, procedural stages of EIA are not mandated by law, nor are the components of the EIA report (Kabir & Momtaz, 2018).

While the requirement of EIA for environmentally sensitive projects was legally established almost 25 years back, strategic environmental assessment (for policy, plan and program) and cumulative/regional environmental assessment are still not mandated by law in Bangladesh (Islam & Zhang, 2018). However, they are somewhat addressed within the guidelines (discussed in section 8.3) (DoE, 1997a; 2021a).

Public consultation on EIA report is still not legally binding, however experts suggest that some form of survey and collection of opinion takes place as vaguely mentioned in the Act (Ahmed & Ferdausi, 2016; DoE, 2010) (table 8.1).

Table 8.1 Evaluation of the legal framework of EIA for textile industry in Bangladesh

Components	**Criteria**	**Sub-criteria**	**Findings**	**Remarks**
Institutional framework	Legal framework	EIA for environmentally significant projects (including polluting textile units) required by law	⊕	ECR’97 under ECA’95 asks for detailed EIA for most environmentally sensitive projects
		Visible linkage of EIA to decision making (e.g., environmental permit based on report submission)	⊕	ECC is received upon approval of Environmental assessment report
		Provision of penalty for proceeding without ECC	⊕	Imprisonment of 2 years, not exceeding 5 years or a fine of one lac BDT (USD 1190), not exceeding five lac BDT (USD 5952) or both (DoE, 2010, p. 9130)
		Provision of penalty for failure to take remedial measures for environmental pollution	⊕	For the first offense: Imprisonment minimum 1 year, not exceeding 2 year or a fine of minimum 50

Components	Criteria	Sub-criteria	Findings	Remarks
				thousand BDT (USD 595), not exceeding 2 lac BDT (USD 2381) or both. In case of each subsequent offence: Imprisonment of 2 years, not exceeding 10 years or a fine of two lac BDT (USD 2381), not exceeding 10 lac BDT (USD 11,905) or both. (DoE, 2010, p. 9130)
		Provision of penalty for non-compliance with ECC conditions or measures proposed in EIA reports	⊖	
		Detailed administrative procedure established by regulation	⊕	For processing ECC
		Procedural steps for conducting EIA established by law	⊖	Guideline exists but not legally binding
		EIA system applying beyond project (e.g., to significant programmes, plans and policies or beyond local area)	⊖	Does not exist by law. But suggested in the guideline to consider cumulative, regional level impacts where required.
		Provision of independent reviewers in regulation	⊖	Does not exist. Only DoE has authority to review.
		Public consultation as legal requirement	?	Mentioned in guideline but unclear in the legislation (Ahmed & Ferdausi, 2016)

Explanation of the symbols:

⊕ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*

⊖ = *Unsatisfactory,* ? = *Unclear*

Source: DoE (1997b; 2010); Ahmed & Ferdausi (2016); Face-to-face interview by researcher (2020)

From table 8.1, it can be observed that four out of 10 sub-criteria used for evaluation of legal framework for EIA in Bangladesh appeared unsatisfactory.

8.1.2 Discussion on the evaluation of the legal framework

Some of the major deficiencies existing within the legal framework are lack of legal implication for failing to implement mitigation measures, lack of independent review system, unclear legal basis for public consultation. The issues observed in legal provision for EIA in textile industry of Bangladesh are discussed in comparison with the international scenario-

i) EIA for polluting textile units is required by law

ECA'95 is the key legislation that established EIA as a legal mandate in Bangladesh (DoE, 1995). ECR'97 is the main regulation formulated under this act stating the relevant requirements (DoE, 1997b). Lee & George (2000) recognized Rio Earth Summit 1992 as an influential factor for emergence of mandatory and other EA procedures in developing countries, which is also assumed to be true for Bangladesh (Ahammed & Harvey, 2004). For the developing countries including Bangladesh involved in textile manufacturing ILO (2021, p.42) recognizes,

> "Textile and garment sector projects are usually classified as high risk and as requiring the most extensive versions of EIA – particularly if they are engaged in activities involving dyeing and wet processing".

Textile wet processing and relevant units (e.g., washing, dyeing chemicals) belong to the 72 different industrial units listed explicitly as red category (see section 6.1.2 in chapter six) units within ECR'97 of Bangladesh (DoE, 2017). However, developing countries mostly lack the widespread demand for better environmental protection like developed nations (Wood, 2003). Therefore, in developing countries like Bangladesh, EIA is largely criticised for serving as a short-term tool to achieve environmental permit and development approval, rather than a continuous and long-term commitment to mitigating environmental impacts (Kabir & Momtaz, 2018; ILO, 2021). Quoting Lee & George (2000, p.162),

> "Good international practice suggests that the environmental assessment process should proceed in tandem with the project cycle and link into a number of decision points at different stages in that cycle."

In addition to this, EIA in developing countries exists under a generic or umbrella legislation, like ECA'95 in Bangladesh (Sadler, 1996; DoE, 1995). On the contrary, several developing countries (e.g. China, Pakistan, Ghana, Kenya) formulated separate law or regulations for EIA at early 2000 or even at 1987 (Malaysia), similar to the developing nations of UK, EU, Canada, Japan (Government of UK, 2011; European Commission, 1985; Government of Canada, 1992; Government of Japan, 1997; Environmental Law Alliance Worldwide, 2015). The regulation relevant to EIA in Bangladesh has been amended seven times (latest being in 2017), but neither of the amendments included any EIA process related revisions (DoE, 2017). According to Ahammed & Harvey (2004, p.72),

> "Current regulations are not aimed at the EIA process, rather they are concerned with environmental pollution control".

Dedicated EIA regulation could have had better prospect for establishing EIA process strongly within the regulatory regime. For example: under Cambodia and Vietnam's Law on Environmental Protection, decrees were later formulated supporting the EIA process (ILO, 2021).

ii) Visible linkage of EIA to decision making (e.g., environmental permit based on report submission)

The extent of integrating the assessment finding in decision making determines the efficacy of EIA (Lee, 2000). ECC along with other documents like fire license, factory license is required to acquire building permit for industrial units in Bangladesh (BEZA, 2020). Section 12 of ECA'95 states, "no industrial unit or project shall be established or undertaken without obtaining environmental clearance from the Director General [of the DOE]". On the other hand, rather than to say 'yes' or 'no' to the development, EIA in Western Australia aims resolving 'how to' manage projects to ensure environmental protection (EPA, 1993, p. 05).

Experts realize that in Bangladesh, EIA does not affect the project planning satisfactorily (Ahammed & Harvey, 2004). Alongside, transparency of the approval process was also questioned (ILO, 2021). The review body (DoE) in Bangladesh does not have veto power over project approval (Ahammed & Harvey, 2004). Projects are not frequently modified as a result of EIA findings, nor the decision on projects are significantly affected by the EIA results (Ahammed & Harvey, 2004). Experts suggest this is a usual scenario in developing countries where incorporation of EIA findings in decision making is rare (Boyle, 1998; Briffett, 1999; Lee, 2000; Wood, 2003). Jay, et al. (2007, p.299) suggested that globally,

> "EIA's influence over development decisions is relatively limited and that it appears to be falling short of its full potential"

Sadler (1996) argues that decision making is a balance among economic, environmental, social and other criteria, therefore trade-offs are involved in this political process. While prioritizing economic growth in developing countries, environmental constraints of the projects are often ignored (Brito & Verocai, 1999), therefore EIA seldom results in project modification or cancellation (Kakonge, 1999; Mwalyosi & Hughes, 1997).

However, if the planning permission is conditional to the mitigation measures proposed within environmental impact statements (EIS)s, it might result in some modification to the project as observed in UK (Wood & Jones, 1997). Although after 25 years of commencement of EIA in UK, experts have agreed that "EIA was increasingly successful in influencing project design" (Jha-Thakur & Fischer, 2016, p. 23). However, there is still room for improvement regarding the influence on decision-making and impact monitoring (Arts, et al., 2012). When the ministerial condition of approval does not coincide with Environmental Protection Agency (EPA)'s recommendation in Western Australia, factors as public appeal or opinion of other regulatory agencies can influence (Morrison-Saunders & Bailey, 2000).

iii) Provision of sanction for proceeding without EIA or failing to observe conditions for approval and mitigation/management measures

Penalty or sanction on breech of conditions for environmental permit is common and mostly "essential" practice (Lee & George, 2000). This is usually defined by the legislation (Lee & George, 2000), as in case of Bangladesh, Indonesia or Vietnam (ILO, 2021). Among the industrial units receiving fine from DoE in 2016, textile units occupy 70% of the share (The World Bank, 2018). By regulation, there is provision of penalty for proceeding without ECC or not adopting overall mitigative measures to avoid pollution (table 8.1). However, penalty for voiding the terms of ECC or failing to comply to the measures promised in EIS is still not established by law in Bangladesh.

On the other hand, polluters' pay to environmental damage, is estimated based on cost avoidance principle in Bangladesh (interviewee #1). Even DoE officials agreed that this provision does not reflect cost of environmental damage (interviewee #2). A recent press release (30 November 2020) shows DoE charging up to 2.7 million BDT (USD 32,143) to a single textile unit for causing environmental pollution. Infact, for three such polluting textile units, the total fine was around 4 million BDT (USD 47,619) (DoE, 2020a). The mean value and standard deviation of such fine is often highest for passing untreated wastewater through bypass drain and ineffective Effluent Treatment Plant (ETP) (The World Bank, 2018).

Although a range of such fine is dictated by law (table 8.1), the method of estimating charge for the proponents is still arbitrary (The World Bank, 2018). ECA'95 also sets a rule for progressive fines for repeated violation (table 8.1), which is also deemed insufficient by experts since it ignores level of violations (The World Bank, 2018). Besides, less than 50% of such fines are actually collected (The World Bank, 2018). The World Bank (2018) perceives, fines are not high enough and hence not realized by the proponents. According to the Bank, "Even if the factory is fined twice a year, for an average of BDT 10,00,000 (approx. US$120,000), it would be more economical to pay the fine rather than run a wastewater treatment plant" (The World Bank, 2018, p. 27).

In addition to this, DoE can also shut down the operation of any units if they fail to comply repeatedly. Reports show practice of halting utility supply to polluting units (DoE, 2020b). Recently, DoE cancelled ECC for a knit composite unit alongside halting production and utility supply to it as a penalty of not paying out the previous fines (DoE, 2021b). In Indonesia, the breech of environmental license leads to loss of business license and even extreme measures like demolishing equipment (ILO, 2021). However, penalties like demolishing equipment are not visible for textile units in Bangladesh (DoE, 2020c). Since such units work largely with international brands, halting business license instead of charging arbitrary fine might bring better results towards environmental compliance.

iv) Detailed administrative procedure and procedural steps for conducting EIA established by law and includes public participation

Experts opine for Bangladesh "EIA system rest on detailed administrative procedures/guidelines" (Ahmed & Ferdausi, 2016, p. 01). This statement could be somewhat misleading. There is indeed generic procedural guideline for EIA since 1997, but it did not address technical issues, EIA procedure, review, appeal, monitoring, or SEA procedure adequately (see details in 8.3.1) and have not been updated for 24 years since inception (Ahammed & Harvey, 2004). On the other hand, being a guideline, it is legally non-binding. Therefore, the crucial stages of EIA including consideration of alternatives, public disclosure of EIA report are legally non-binding in Bangladesh (Ahmed & Ferdausi, 2016). These were also observed in the EISs reviewed by author and previous research by other experts (Ahammed & Harvey, 2004; Kabir & Momtaz, 2012). Assessment of alternatives, public participation beginning from the early stages of EIA are some of the factors responsible for increasing EIA's effectiveness in countries like Netherlands (Arts, et al., 2012). UK has also established contents of EIS, requirement of consideration of alternatives, stakeholder consultation mandatory by law (Government of UK, 2011).

Jay, et al., (2007) suggested, being a participatory environmental management tool, consultation and public participation are integral to EIA. Public participation has been identified as the most important method to introduce "procedural democracy" in decision-making process (Aschemann, 2007; Khosravi, et al., 2019a). Apart from strong legislative mandate and procedural guideline, mechanisms established for making public participation is of significant importance to make EIA effective (Momtaz, 2006). In case of Bangladesh, all these areas are falling short according to this study. While, consulting public opinion has been somehow mentioned in the amendment of ECA'95 (DoE, 2010), experts suggest that the practice is limited (Kabir & Momtaz, 2018; Ahmed & Ferdausi, 2016). ECA'95 (amendment 2010) of Bangladesh suggests ECR'97 should provide directions on surveying public opinion. But the latter has not been updated after 2002. Therefore, not having clear direction within the regulation for public participation in EIA of Bangladesh indicates a reluctant attitude towards incorporating this important factor within EIA process. Procedural guideline for public participation appeared inadequate until 2021. The previous guideline (DoE, 1997a) dedicated 0.5 pages regarding direction for public participation, while in the latest (DoE, 2021a), it is elaborated in 13 pages (see table 8.3 and section 8.3.1). While reviewing the EISs for five textile units in Bangladesh, such reluctance towards public participation was also observed. While there is a mention of involving people at the time of EIA study, no such list of community people, nor the date of consultation or the list of the items in discussion is incorporated within the reports reviewed. "Timely opportunities for public involvement and input at key stages" is an important principle for designing effective EIA (Sadler, 1996, p.22). Ahmed & Ferdausi (2016) noted for Bangladesh that, limited public consultation is performed during EIA preparation stages, but no evidence of such is found in the post decision stages. In most cases no provision of arrangement could be found to make complaints regarding impacts and addressing such the grievances (Kabir & Momtaz, 2011). The current legislation also does not have provision for disclosing EIA information or report for review by public (Ahmed & Ferdausi, 2016). Therefore, although the public is consulted at early stages of EIA, they are unaware of the issues related to EIA in the long run (Ahmed & Ferdausi, 2016). Similar experience was observed in Pakistan, India, Srilanka, Indonesia (Boyle, 1998; Nadeem & Hameed, 2006; Paliwal, 2008). Experts warn that the lack of public involvement can challenge the quality of EIA report in Bangladesh (Ahammed & Harvey, 2004). Such low practice of public participation was found attributable to the factors like reluctance of project proponents to include community, lack of encouragement from DoE and lack of awareness of people regarding environmental pollution in Bangladesh (Kabir & Momtaz, 2013).

According to Nadeem & Hameed (2008), the lack of awareness is the prime cause of limited public participation in EIA process of the developing countries. Iranian system rarely sees public participation in practice since it is not established by law or even procedural guidelines (Khosravi, et al., 2019a; Ahmadvand, et al., 2009). Indonesia, Vietnam, China, Philippine, Pakistan and India and developed countries like UK, Netherlands have established public participation in EIA through regulation (Government of UK, 2011; ILO, 2021; Nadeem, et al., 2014). Indonesia made EIA documents publicly available and engages public through written submission, and public hearing reported in newspaper, however the participation was still reported low (ILO, 2021).

Provision of adequate and appropriate opportunities of public participation essentially contribute towards accountability and transparency of the decision-making process (Kinhill Engineers Pt Ltd, 1995; European Union, 2014). According to Arts, et al., (2012) emphasis on public participation in UK appearing to be stronger than Netherlands is possibly due to the fact that, the regulations in UK are providing for less safeguards. EU EIA directive (2014, p.04) also recognizes effective public participation contribute towards "public awareness of environmental issues".

Normative rationale (i.e. decorated ideals) of successful public participation are: enhancing people's ability to influence a decision that affects their lives; exercising citizenship and empowering formerly marginalized group of individuals (Glucker, et al., 2013; O'Faircheallaigh, 2010; Hartley & Wood, 2005; Petts, 2003). The way public participation influence decision output is recognized as substantive rationale of public participation (Glucker, et al., 2013). Through public participation, decision making can be enhanced by harnessing local information and knowledge on environmental and social factors; knowledge based on experience and value system of locality and scrutinizing robustness of information gathered from third parties (Glucker, et al., 2013; Connelly & Richardson, 2005; Van den Hove, 2007; Morrison-Saunders & Early, 2008). Experts argue, public values not only supplement cognitive knowledge but also balance the rationalities of the proponent and decision-maker (Elling, 2008; Fischer, 2009). Finally, the instrumental rationale of public participation facilitates project implementation. Public participation assists by generating legitimacy in decision making; identify and resolve conflict before final decisions and thus facilitate project implementation (Morrison-Saunders & Early, 2008; Petts, 2003; Runhaar, 2009; Shepherd & Bowler, 1997). Participatory method for public engagement should be designed according to its intent (Glucker, et al., 2013). For example, to harness local knowledge, consulting selected number of people would suffice; while to enhance democratic capacity, it would require active involvement of general people into the EIA decision-making process (Glucker, et al., 2013).

On the other hand, it appears that the administrative procedure established by regulation in Bangladesh is intended for getting ECC, rather than EIA. Experts recommend defining and including stages of EIA within the legislation of Bangladesh to ensure proponents don't skip the requirements (Ahammed & Harvey, 2004; Kabir & Momtaz, 2018). Although this might be a common challenge in developing countries to provide adequate legislative and administrative support for EIA procedure (Arnold & Hanna, 2017). Besides, the stringency and enforcement of environmental regulations in Bangladesh was found to be second lowest among nine Asian countries (e.g. Japan, Malaysia, Indonesia among others) (The World Bank, 2018).Until the regulatory system itself functions effectively, it might be difficult to integrate EIA procedures within the command-and-control system (Lee & George, 2000; Khosravi, et al., 2019a).

v) ***EIA system applying beyond project (e.g., to significant programmes, plans and policies or beyond local area)***

> "In Bangladesh, the current EIA process suffers from a number of common and continuing problems that need to be addressed earlier at the strategic level" - (Alshuwaikhat, et al., 2007)

However, such environmental assessment for policy, plan or programs is not yet practiced in Bangladesh for higher-level decision-making (Islam, et al., 2020). The latest national environmental policy (2018) incorporated the term SEA within it (Islam, et al., 2020). The policy mentions ensuring EIA and SEA for 'required sectors' as one of its objectives (MoEFCC, 2018). However, the author couldn't get hold of any clear action plan related to its implementation nor there is any evidence of practice of SEA, cumulative or regional environmental assessment in current EA system in Bangladesh. Developing countries of Indonesia, Vietnam have already legally mandated SEA, while Cambodia is drafting the requirement (ILO, 2021). In other parts of the world, SEA emerged as early as in 2000 (Islam

& Zhang, 2019). SEA was introduced in South Africa (SA) around two decades ago, but never legally mandated (Retief, et al., 2021). However, even South Africa's voluntary SEA was compared well in numbers with other countries (Dalal-Clayton & Sadler, 2005; Wood, 2003). According to Jha-Thakur & Fischer (2016, p.24) the introduction of SEA in UK "has led to a better consideration of alternatives at strategic level".

vi) Provision of independent reviewers in regulation

Netherlands Commission of Environmental Assessment (NCEA) (2021) suggests "in most countries, review is the responsibility of the competent authority on EIA or the competent authority for decision-making on a proposed project". However, this process involves other government agencies or departments with required expertise (NCEA, 2012, p. 02). To ensure technical soundness of EIA, review can take form of "peer review" conducted by independent, technical experts (USEPA, 2000). In Bangladesh, DoE is the only entity entitled for EIS review. Seldom they may appoint experts if the project is high profile and of national importance. Although this is not very unusual, as review is generally given less importance in most of the developing countries (Wood, 2003). EIS review philosophy can be dependent on administrative structures and consultation procedures in developing countries (George, 2000). Even when they are subjected to independent review, they can still appear to be of a lower standard than many western countries (Lee, 2000).

Sectoral expert is absent in the existing EIA review committee of Bangladesh since the members are regular officials of DoE. The researcher also questions the objectivity of review decisions from employees who are part of government, especially in case of government projects. For example: Indonesia's review commission is not entirely independent of the government, however it is decentralized to a great extent (ILO, 2021). Vietnam has provision for independent reviewers for EISs. However, being domestic, they belong to a small pool that contains both EIA consultant and reviewer and thus remain in risk for conflict of interest (Clausen, et al., 2011). Wood (2003) emphasizes that initiative of independent advisory body has potential to overcome the issue of staffing shortage and thus can promote effective scoping and review. Independent review committee is a common feature in developed countries like Canada, Netherlands and UK (Wood, 2003; Rocha, et al., 2019). According to the Department of Environmental Affairs and Tourism (DEAT), South Africa (2004, p.07), "The additional cost of independent review is a small price to pay for the potential value that it can add to the EIA".

8.2 Evaluating the administrative arrangement of the EIA system for textile industry in Bangladesh

8.2.1 Results of the evaluation of administrative framework

DoE administers the EIA system of Bangladesh from consultation on relevant regulation, review of environmental assessment reports, approving ECC, monitoring industrial units & enforcing environmental compliance through compensation or closure of units where appropriate (see section 6.1.2 in chapter six) (DoE, 1995; 2016). Currently DoE is operating with around 60% of staff (431 against 735 posts) (The World Bank, 2018). Therefore, despite the level of power, "DOE is not adequately resourced in terms of manpower and money given the increasing number of EIA applications and their approval process" (Kabir & Momtaz, 2013, p.08). Lack of resources also hampers prioritizing and thorough the monitoring visits for key polluting industrial units. Currently monitoring visits are planned by zones (Interviewee #2).

On the other hand, experts suggest, DoE staff has appropriate skill to run the EIA system (Ahmed & Ferdausi, 2016), which is questioned by author in this study (see (iii) in section 8.2.2). Besides, experts imply that the interagency coordination required for effective EIA system is absent in Bangladesh (Kabir & Momtaz, 2013). The judicial control over the EIA system also appears weak (Kabir & Momtaz, 2018) since the affected people does not have direct access to court and can only apply via DoE (DoE, 1995) (table 8.2).

Table 8.2 Evaluation of the administrative arrangement of EIA system for textile industry in Bangladesh

Components	Criteria	Sub-criteria	Findings	Remarks
Institutional framework	Administrative arrangement	Separate environmental agency with adequate authority	⊕	Established by ECA'95
		Adequate resources available to environmental agency for implementing EIA in practice	⊖	Not sufficient staff (Kabir & Momtaz, 2013)
		Staff with sector-specific skills to overview sector specific EIA process (e.g., textile, pharmaceutical)	⊖	Staff have appropriate skill to manage EIA system (Ahmed & Ferdausi, 2016), however sector specific expertise is not required for review or monitoring of

Components	Criteria	Sub-criteria	Findings	Remarks
				industrial sector specific EIAs
		Adequate interagency co-ordination between DoE and other	➖	Inadequate according to experts (Kabir & Momtaz, 2013)
		Judicial control over EIA system	⊖	Though environmental court exist, still inadequate according to experts (Kabir, 2012)

Explanation of the symbols:

✚ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*

➖ = *Unsatisfactory,* ❓= *Unclear*

Source: Kabir (2012); Kabir & Momtaz (2013); Ahmed & Ferdausi (2016)

Therefore, from table 8.2, it can be observed that four out of five sub-criteria for evaluation of administrative framework of EIA system for textile industry in Bangladesh appear somewhat unsatisfactory.

8.2.2 Discussion on the evaluation of administrative framework

Comparison of the results of evaluation of the administrative framework for EIA system of Bangladesh with international scenario is discussed in the following-

i) Separate environmental agency with adequate authority

Lee & George (2000; p.51) said, "in some countries (e.g., Egypt) the competent authority for EA is the country's sole environmental agency. Approval of the EA may then serve as a composite environmental permit, covering pollution control as well as other potential impacts". This statement is true for Bangladesh too. DoE is the core environmental agency that have responsibility of "development and management of the EIA system" in Bangladesh (Ahammed & Harvey, 2004, p. 75). While the "existence of separate environmental agency for management of EIA system" is significantly important for EIA performance (Kabir & Momtaz, 2018; Ahammed & Harvey, 2004), author in this study argues that there are other factors responsible for characterizing the efficacy of such central environmental agency. First, being a government agency, it is not entirely free from political influence (Kabir & Momtaz, 2013) and secondly, it has other responsibilities apart from running the EIA system (see (ii) in 8.2.2 for details). Not being a constitutional body DoE is not able to take any legal action against other government agencies (Ahammed & Harvey, 2004). Therefore, if ECC is breached or EIA is falsified, DoE cannot act against government project initiators. On the contrary, Environmental Protection Agency (EPA) in Western Australia has two unique features- "statutory guarantee of independence from political direction; and the primacy of the environmental decision by the Minister for the Environment, combined with the legal status of any implementation conditions" (Morrison-Saunders & Bailey, 2000, p. 261). Existence of independent body is instrumental for quality control and transparency in key stages of EIS review and follow-up as seen from the experiences of Canada, Netherlands, Hong Kong (Arts et al., 2001; Wood, 2003). Therefore, although a separate body exists to manage the EIA system in Bangladesh, its independence and adequacy for EIA system is debatable.

ii) Adequate resources available to environmental agency for implementing EIA in practice

Manpower & resources (The World Bank, 2018) and dedication (Kabir & Momtaz, 2013) of DoE staff has been criticised previously by experts while assessing the EIA system of Bangladesh. Apart from that, lacking the requirement of sectoral experts in ECC approval and follow up of EIA is also questionable (discussed in (iii) of section 8.2.2). While DoE has the legal authority of environmental protection of the whole country, experts suggest it seems "ineffective" due to lack of capacity and resource (Ahammed & Harvey, 2004; The World Bank, 2018; Ahmed & Ferdausi, 2016). The World Bank (2018, p.22) reminds –

> "The volume of tasks undertaken by the DoE has increased manifold over the last two decades due to the scale of environmental issues and regulatory demand, and changing economic, population, and environmental conditions. However, its manpower has not increased nearly enough to accommodate this increase".

DoE applied for 1,222 additional staff to be hired in the year 2016 to meet its increasing load, while only 14% of this demand was met with the approval of new posts (The World Bank, 2018. DoE's website suggests, the regional offices (e.g., Comilla office) are sometimes operating with staffs as low as four (DoE, 2022). There is no variation in staff statistics considering the concentration of polluting industrial establishments or environmental sensitivity of the region. For example: despite having several designated ecologically sensitive areas within Coxs-Bazar, only eight DoE staff are assigned to this district (DoE, 2022). Districts like Narayanganj and Gazipur with heavy concentration of polluting units have eight DoE staffs in each (DoE, 2022). Similar observation was made by Jha-Thakur (2011) for India where she identified that regulating bodies within economically active regions are not equipped with adequate number of staffs. Such lack of manpower and physical resource also impedes DoE's ability to decentralize its activities (The World Bank, 2018).

Due to low number of staff in regional offices, it is difficult to segregate their responsibility or allow them the scope of developing expertise (interviewee #3). With a population of 6.5 million in 1997, Hongkong's environmental protection department had more than 1,500 staffs (Ahammed & Harvey, 2004). In the countries of Philippines and Mexico, where the population is close to Bangladesh (100 million and 127 million respectively against 161 million in Bangladesh), environmental agency has allocated staffs 2.5 to 22 times (1780 and 6593) compared to that of Bangladesh (735) (The World Bank, 2018). Even after such a smaller number of posts, 40% of these at vacant at DoE (The World Bank, 2018).

Experts added, DoE is also inadequately funded (Kabir & Momtaz, 2013; The World Bank, 2018). In the fiscal year (FY) of 2020-21, the Ministry of Environment, Forest and Climate Change (MoEFCC)'s total allocation was 12.47 billion BDT (148 million USD) in national budget, within which DoE's allocation was around only 6.6% (MoEFCC, 2020). For 2021-22 FY, MoEFCC was allocated BDT 12.22 billion (around 145 million USD) which is 0.20% of the national budget (6.03 trillion BDT) (Dhaka Tribune, 2021). This time, within the MoEFCC budget, 9.5% was allocated for DoE. In this financial year, DoE has been allocated more budget than Forest Department (FD) for the first time within MoEFCC, although DoE's mandate has always been broader (The World Bank, 2006). DoE's share for 'development budget' had been increased doubly this year, while allocation on 'operating budget' had rather decreased (MoEFCC, 2021). Therefore, it is still dubious if any part of the increased budget is dedicated to support the enforcement of EIA regulation. Kabir & Momtaz (2013) claimed, due to prioritizing budget allocation towards Forest Department over DoE in previous years, DoE's institutional capacity for implementation and monitoring of EIA remained weak.

iii) Staff with technical skills to overview sector specific EIA process (e.g., textile)

ILO (2021) identified that there is lack of technical skills and experience required to conduct and approve EIA in developing countries of Bangladesh, Cambodia, Indonesia and Vietnam.

Ahmed and Ferdausi (2016) suggested, every year around 5000-6000 Orange and Red category projects (see section 6.1.2 in chapter six for definition) receive ECC approval in Bangladesh, all of which is passed by Environmental Assessment Committee (EAC) of DoE. In year 2014, 290 red category projects received ECC (Ahmed & Ferdausi, 2016). Such volume of EIA reports from red category projects is not only burdensome to an understaffed review committee, but also the lack of specific expertise can result in approving poor quality EISs (The World Bank, 2018). On the contrary, Ahmed & Ferdausi (2016, p.02) suggested, “DoE has skills and expertise to review EIS, conduct monitoring”. This would be an appropriate statement if sector specific expertise is ignored. But author perceives that lack of emphasis in sector specific expertise for reviewing EISs and monitoring the EIA process can challenge the efficacy of the existing system. DoE headquarter has departments like administration, environmental clearance, legal affairs, IT, air quality management, planning, climate change and international convention, natural resources management, monitoring and enforcement (DoE, 2022). However, none of these reflect the requirement of any sector specific expertise. A recent job circular by DoE for national consultant asks for academic qualification of “post-graduate in environmental science/related subject” (govtjobcircular.com, 2021), which appears quite generic. ILO (2021, p.32) suggests for “industrial sector there is less experience and capacity within government agencies to support the EIA process”. It also added “Environmental issues continue to be seen as a low priority” in Bangladesh since environmental protection is not governed by specialists and inadequate resources are available for its execution (ILO, 2021, p.32).

DoE developed a sector-specific industrial guideline for the key industrial sectors (including textile) in 1997, but it has not been connected with EIA. Nor there is any formal requirement for sectoral experts to oversee the EIA process for respective industrial units. DoE officials might have developed expertise in management of the overall EIA system through experience, but specialized industries require specialized attention in different stages of EIA. An interviewee in Kabir’s (2012) study mentioned, “The lack of special knowledge and skills on EIA among the DOE officials affect review process of EIS, effective monitoring of impacts of projects those have environmental and social impacts. The special knowledge and skills are necessary for the DOE not only to play the role of an enforcer, but also to play a consultative role”. An interviewee (#11) in this research added-

> “Even though the international agencies support DoE in capacity development, they [DoE] are far understaffed to carry out the purpose”.

For the high-profile national projects, DoE already takes consultation from sectoral experts, however, there are very few such cases. Being the most important industry in country's economy, textile should also receive such consideration.

> "The major challenge facing EIA in developing countries is limited resources and technical knowledge." – Olugbile (2013, p.03).

Where political time horizons are short (on average four to five years), political leaders find little incentive to invest in the long-term task of building bureaucratic capability (McCullough, 2017).

iv) Adequate interagency co-ordination between environmental agency and other government agencies

Experts suggest, DoE has weak coordination with other governmental agencies (Ahammed & Harvey, 2004; Kabir & Momtaz, 2013) and no formal mechanism is established for this purpose (Ahammed & Harvey, 2004). In addition to this there are no EIA management units in participating agencies or provision of integrating interagency participation by DoE (Ahammed & Harvey, 2004). Also, the absence of national environmental council, contributes to such weak coordination (Kabir & Momtaz, 2013). Quoting Kabir (2012, p.128),

> "The weak coordination mechanism at national level between the MoEF[70] and other sectoral agencies often hinders the smooth operation and execution of the EIA regime".

Author realized that other government agencies (i.e., Department of Textile) are very keen to avoid any responsibilities with environmental issues. Likewise, they are excluded in discussion when different environmental management initiatives (e.g., PaCT) are planned for textile units, while textile as a sector is a vast consumer and polluter of water. On the other hand, not being a constitutional body, DoE lacks the authority to coordinate with other ministries (Ahammed & Harvey, 2004). Share of allocation for MoEFCC within national budget also indicate the level of priority set for this ministry with respect to other ministries. However, DoE is in good terms with donor and international agencies (e.g., World Bank, IFC, GIZ) and they often co-ordinate with DoE for capacity development or on relevant projects (interviewee #1, #10, #11), however the scenario might not be quite same with national agencies.

[70] Now known as MoEFCC

v) Judicial control over EIA system

Experts recognize establishing environmental court as a significant step toward making the EIA system effective in Bangladesh (Kabir & Momtaz, 2013). However, The World Bank (2018) feels, it has not been entirely implemented. Such statement makes sense when number of total cases filed and disposed are compared with other country's statistics. Among the 467 cases, Dhaka divisional environment court disposed 350 between 2003-2015, while 117 were pending. Chittagong divisional court had 250 cases pending among the 350 filed between 2003-2015 (The World Bank, 2018). On the other hand, Green Tribunal system established in India for cases relating to environmental protection and conservation disposed 33,168 among 35,558 files between 2010-2021 (National Green Tribunal, 2021). They also have a dedicated website, which is frequently updated.

According to 2010 Environment Court Act, "No Environment Court shall receive any claim for compensation under environmental law except on the written report of an Inspector of the Department of Environment (DoE)". Therefore, the performance of environment court in Bangladesh rests on support from DoE in filing suit and investigating while public access is limited (The World Bank, 2018). Even upon allowing direct access of public with complaints, technical support would be required by the people due to their limitation of knowledge (The World Bank, 2018). The World Bank (2018; p.31) identifies weakness in existing system since general public are "intimidated to file a lawsuit against polluters with potentially powerful economic and political connections without institutional support". However, Bangladesh has a pro-active environmental lawyers' organization, named Bangladesh Environmental Lawyers association (BELA). BELA has been working relentlessly to voice the public interest in environmental protection in the form of Public Interest Litigations (PILs). Some of BELA's listed achievements are mandating EIA for shrimp collection, inclusion of public opinion while conducting EIA in ECA amendment of 2010 (BELA, 2020). They have also started studying discrepancies within EISs of controversial projects (e.g., Banshkhali power project EIA report in 2020) with support from experts (BELA, 2020). However, EISs being widely unavailable made this work challenging (Dhaka Tribune, 2021). Although BELA is also getting success in court orders regarding petitions on environmental safety, protection, polluters pay; implementation of the court order appear to be very slow. A 2010 court order of relocating polluting tannery units from residential zones took around 10 years to implement, in fact after repeat petition in 2017 (The New Age, 2017).

Experts also suggest environmental court offer limited opportunity for EIA system as they can only address offence and claim compensation under ECA 1995, ECR 1997 and Brick Manufacturing and Brick Kilns Establishment Act of 2013 (The World Bank, 2018; Kabir & Momtaz, 2013). EIA's procedural stages not being established by law also makes it difficult to bring under this court. Ahammed & Harvey (2004, p.73) suggest,

> "It is not clearly specified whether the EIA non-compliance cases are liable to face trial in these environmental courts".

Apart from this, there is a provision of mobile court, led by government magistrates appointed on ad hoc basis at DoE. However, they work on specific sections of ECR 97 like 6A- polythene, 6B-hill excavation, 6C-pollutant discharge/hazardous waste, 6E-wetland fill up, 15- sound pollution, brick kiln, air pollution by construction material (interviewee #1). Thus, this court is apparently unable to address EIA non-compliance. Besides, it is operated by non-specialized government officers and verdict is given on spot (Interviewee #2).

In the meantime, judicial support appears very strong in India while controlling the pollution caused by industries. For example: in 1997-1998, 270 textile processing units were shut down in Tiruppur, India following the Chennai high court's order and Supreme court's support. Pollution control board of India enforced this order (Narayanan, 2018). This event has resulted in installation of Effluent Treatment Plant (ETP)s in almost all processing units in Tiruppur (Narayanan, 2018). Judicial system is so weak in Bangladesh that project proponents requesting injunction in court can cause significant delay in implementing the court orders affecting their interest (The World Bank, 2018). Therefore, although a strong environmental lawyer group exists and is active in Bangladesh, mere existence of judiciary provision would not suffice. It must be strong, effective and court orders required to be implemented at good pace.

8.3 Evaluating the procedural framework of the EIA system for textile industry in Bangladesh

8.3.1 Results of the evaluation of the procedural framework

A generic EIA guideline for industries in Bangladesh was published in 1997 and was updated for the first time after 24 years in February 2021. Although legally non-binding, the EIA consultants in the interview mentioned about following the guideline. This claim is also reflected in the EIS reports to some extent (see section 9.4 in chapter nine). The sector-specific industrial guidelines published in 1997 for four industrial sectors (including textile) were not widely circulated and have never been updated.

The EIA guideline for industries by DoE provides direction into the six key steps of the EIA process: screening, scoping, baseline data collection, impact assessment, mitigation and environmental management plan. A comparative overview of the extent of contents in both guidelines is shown in table 8.3. Although, experts expressed the concern that key procedural requirement of EIA should be established by regulation rather than only depending guidelines on the to avoid exploitation (Kabir & Momtaz, 2018).

Within the steps of EIA, screening is already established in the regulation (ECR'97) through the list of project categories and directing the extent of environmental assessment for them (table 8.4). Although its adequacy was questioned by Ahammed & Harvey (2004). This list is formed basing on environmental impacts of the projects, while project size, production capacity, raw material use, ecological and cultural sensitivity was ignored (Ahammed & Harvey, 2004). Scoping of EIA for red category (see section 6.1.2 in chapter six for definition) units are approved from DoE by submitting terms of reference (ToR) and IEE (DoE, 1997b). Consideration of "do nothing scenario" was suggested in previous guideline very briefly and alternative measures like consideration of change of site, raw material, process, equipment, design was also succinctly listed. On the other hand, consideration of alternative is noted as a "key component" in recent guideline and has slight elaboration on this regard (DoE, 2021a, p. 41). Components of EMP is discussed in both guidelines, however in much detail in the recent guideline (table 8.3).

Although public participation has been identified as an important part of EIA process in both guidelines, the latter has more emphasis and detailed direction on this matter. The previous guideline merely mentioned the public participation process, while the latest provides detailed description on the methods (DoE, 1997a; 2021a). It has a dedicated chapter on stakeholder participation within the EIA process and has also been emphasized in EIS review guideline (DoE, 2021a).

The new guideline provides thorough guidance to the EIS review enlisting the attributes and quality of the reporting expected. The EIA attributes are evaluated using two distinct groups in this guideline: "well addressed" and "deficient". For example, for the EIA attribute "The status of the proposed project is clearly described, in terms of any no-objection certificates, location clearances, local consultations and surveys, etc. that may have been issued or undertaken".

Well addressed response may include “full disclosure of all activities, discussions, approvals and such in the EIA document, with dates of each provided”. On the other hand, deficient response may include “Actual status of the project, at the time of EIA documentation, remains obscure” (DoE, 2021a, p.121). Such detail direction was absent in previous guideline (DoE, 1997a). Such detail direction was absent in previous guideline (table 8.3) (DoE, 1997a).

Table 8.3 Comparison of extent of discussion for contents in recent and previous EIA guideline for industries in Bangladesh

Contents		**Old guideline (1997)**	**Recent guideline (2021)**
Introducing and purpose of EIA		1 page	1page
Role and Responsibility of stakeholders			4pages
Description of relevant policies and legislations		-	18
Detailed Methodology for stages of EIA	Screening	1 (set by legislation)	1 (set by legislation)
	Scoping	Covered within IEE methodology (13 pages describing IEE)	8
	Background data collection	14	12
	Impact identification	2 pages + example of checklist in annex	1.5pages
	Impact assessment and prediction	5 pages (including IEE) + example of checklist in annex	15.5pages
	Selection of alternatives	Few sentences	1.5page
	Stakeholder and Public consultation	0.5pages	13pages
	Developing Mitigation measures	1pages+ examples of checklist in annex	8.5pages
	Follow up by proponent	2 pages	Included within EMP
Contents of EIS		3.5 pages	10
Description of EMP		2pages	12
EIS review process		6 pages	19
Follow up by agency		-	-
Other			General Stages of Cumulative Impact Assessment (CIA)
Total number of pages		94 pages (Spacing between lines and font size is also greater)	161 pages

Source: Adapted from DoE (1997a; 2021a)

On the contrary, although follow-up monitoring by DoE is a significant segment of the EIA process, none of the guidelines does not include any guidance regarding this, nor the regulation (DoE, 1997a; 1997b; 2021a). Such lack of effort in including the directions for monitoring within the legal and procedural guideline for EIA can make monitoring excluded from the EIA process. Although such practice is not quite unusual, according to Glasson, et al. (2012).

The sector specific industrial guideline by DoE identifies the key environmental issues like use of chemicals, energy and water consumption, air emission, wastewater and solid waste generation for textile industry (DoE, 1997a). The guideline traces back these issues to the manufacturing process. It provides directions for housekeeping, process and equipment modifications, re-use and recovery of chemicals, water conservation, possible chemical substitution relating to different processes of manufacturing within this industry. It also suggests design specifics and operational guidance for ETP in brief (DoE, 1997a). However, it does not guide the EIA process for the sector, neither connects the proposed environmental management mechanisms with the EIA process. This guideline also lacks proper reference to international best practice examples which can be attributable to the fact that it is quite old.

Table 8.4 Evaluation of the guidance and procedure of EIA for textile industry in Bangladesh

Components	**Criteria**	**Sub-criteria**		**Findings**	**Remarks**
Institutional framework	Procedural framework	Guideline exists for conducting EIA		⨁	Not mandatory since not part of legal framework
		EIA process includes	Screening	⊕	Pre-determined by regulation but lack several considerations
			Scoping	⨁	ToR approved by DoE which includes scope of the study
			Alternatives	⊕	Suggested very briefly by old guideline. But inadequately addressed in reports
			Environmental management plan	⨁	Required for Orange B category projects and projects existed before ECR'97 came into action. For other projects suggested by guideline and mostly included within EIS.

Components	Criteria	Sub-criteria		Findings	Remarks
			Public participation	⊕	Suggested by guideline. But very inadequately practiced
			EIS review	✚	Very briefly addressed on old guideline, performed by committee consisting of DoE officials
			EIA follow-up	⊕	Monitoring performed, but no guidance for agency in the formal guideline
		Prescribed contents for EIS and requirement to meet those		⊕	Suggested in guidelines. Not imposed by regulation
		Requirement of public sharing of report		⊕	According to the latest guideline, not imposed by regulation
		Sector-specific guideline directs EIA process		⊖	
		Sector-specific guideline relates key environmental issues (e.g., chemical, effluent and emission, resource consumption) with stages of textile manufacturing		✚	
		Sector-specific guideline include direction on standard environmental pollution control and management for textile industry by process (e.g., process alternatives, waste management, resource optimization, ETP operation)		✚	
		Sector-specific guideline refers to international best practices (BAT, EHS guideline) for textile industry		❓	Reference from these widely used documents were not found in the technical guideline of Bangladesh, may be because it is very old
		Sector-specific guideline updated over time		⊖	Have not been updated since inception
		Generic EIA guideline updated over time		⊕	Updated very recently (February 2021), after

Components	Criteria	Sub-criteria	Findings	Remarks
				almost 25 years since inception
		Existence of guideline for EIA monitoring in Bangladesh	?	Sector -specific guideline for "monitoring compliance" exists, but does not seem to be intended for DoE monitoring officials
		Sector-specific checklist followed in monitoring	−	Generalized checklist is used. Also lack of sector specific expert in monitoring team makes it impossible to address technical details
		Overall EIA system is monitored and amended (if necessary) according to feedback from experience	−	Never followed up or amended since inception in 1997

Explanation of the symbols:
+ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*
− = *Unsatisfactory,* ? = *Unclear*

Source: DoE (1997a; 2021a) ; face-to-face interview by researcher (2020)

From table 8.4 it can be observed that, the guidelines for EIA in Bangladesh seem to be covering the overall EIA system almost satisfactorily (seven satisfactory and six mostly satisfactory among 19 sub-criteria for evaluation).

8.3.2 Discussion on the evaluation of procedural framework

Section 8.3.1 elaborates the contents of the procedural framework for EIA in textile industry of Bangladesh, comparison of it with international scenario is given below-

i) Position in project cycle

Experts recognize that the current legal system of Bangladesh is reducing EIA's efficacy in project cycle (Ahmed & Ferdausi, 2016; Ahammed & Harvey, 2004). For example: the provision of site clearance allowing to initiate development on site before EIA study and ECC approval, challenges the core purpose of EIA (Ahammed & Harvey, 2004; Ahmed & Ferdausi, 2016). From Ahammed & Harvey (2004; p.74), "At this stage, an EIA can only justify a project and delay the project operation with an environmental clearance". Therefore, analysis of alternatives is also avoided in the EIA studies and reports, as found previously by experts

(Ahmed & Ferdausi, 2016) and author in this study. Also, consideration of alternatives for EIA process is not established by legislation in Bangladesh. On the other hand, even after being included within EIA directive, it is practiced reluctantly in Iran (Khosravi, et al., 2019a), where main reason is EIA being conducted at later project stage. While experts in Jha-Thakur & Fischer (2016)'s study recognize considering alternative sites is annulled by the practice of EIA being implemented after site specific decisions in UK. Four among the five EISs reviewed by author in this study undertook EIA after several years of operation, therfore consideration of alternatives was missing in those reports.

In addition to this, instead of considering EIA as a cyclical process (Glasson, et. al, 2005, p.03), the guidelines illustrate the stages of EIA in Bangladesh as a linear process (DoE, 1997, p.08; 2021a, p.05).

ii) Existence of guideline for conducting EIA and contents of EIS; guideline is updated over time

Guidance for good practice of EIA and continuous research can help establishing EIA (Jay, et. al, 2006). Resta & Dotti (2015) claimed, over 100 countries of the world have formal EIA system covering textile and apparel sector, but most of them follow generic EIA method rather than sector specific ones. The first EIA guideline for industries in Bangladesh was published in 1997, then updated after almost 24 years in year 2021. The 1997 guideline was 94 pages (including cover page) while the updated (2021) guideline is 161 pages. The internal contents of the recent guideline have been advanced compared to the previous one, however the outline seem very similar (discussed in detail in 8.3.1). For example: the steps in EIA process are listed as screening, scoping, baseline data generation, impact assessment, mitigation of impact and Environmental management plan (EMP) in both guidelines. Direction for review is also included in these guidelines in varied depth, but monitoring by agency is skipped in both (DoE, 1997a; DoE, 2021a). Experts opine EIA in Bangladesh aim at getting ECC (ILO, 2021; Momtaz, 2002), which is also reflected in the content of the guideline that ends at reviewing EIS.

On the other hand, the developed countries (e.g., UK, EU) seem to organize the guideline basing on the steps of screening, scoping, EIS preparation, planning application and consultation and finally decision making. They seem to focus more on controlling the contents (e.g. scoping, EIS) and quality (e.g. qualification of consultants, reviewers, basic requirements like public participation, consideration of alternatives) by mandating them by law (Government of UK, 2011; European Commission, 1985). Additionally, there are independent bodies like Institute of Environmental Management and Assessment (IEMA) with adequate expertise to formulate EIA guideline and provide consultation on EIA report when required. Bangladesh on the other hand, prescribes the EIA process until EIS review, where the effort for quality control of the EIA system appears very poor. Although the latest guideline seems to try in enhancing the quality of EIS by describing detail review process for each of its content (DoE, 2021a).

Elaborated guideline and legally mandating procedural stages of EIA process might be better suited for developing countries, considering shortage of expertise and the lack of transparency is the procedure.

iii) Existence of sector-specific guideline with standard contents and updated over time

Lee & George (2000) noted that provision of sector-specific guideline in Malaysia and other developing countries exists from 1990s. Although, many of these 'sector' represented large scale development projects (e.g., road, irrigation, industry in Nepal) instead of manufacturing sectors. In some countries there are specific guidelines for prominent industries (e.g., petrochemical, waste treatment, thermal power in Malaysia). However, manufacturing industry being a complex phenomenon can hardly be expected to suit a common EIA methodology (Resta & Dotti, 2015). While diversified processes belong within a single industry itself (e.g., textile, as discussed in chapter three), requirements of EIA would vary even according to its sub-sectors. In Bangladesh, the commonly identified 'sector-specific guideline' was formulated under a project named "To develop and apply sector wise industrial guidelines and standards and to monitor compliance" (DoE, 1997a). It is not a 'sectoral EIA guideline', since this document does not provide guidance on sector-specific EIA methodology for textile industry, rather focuses on standard environmental pollution control and management for textile industry by process (see section 8.3.1 within this chapter). It has never been updated since inception (1997) and hence does not include best technologies available worldwide (DoE, 1997b). Also, there is no evidence of it being used in any stage of EIA. The EIS reviewers do not use any checklist from this guideline (see section 9.3.2 in chapter nine), the monitoring officials use a generic monitoring checklist (see section 10.1.2 in chapter 10) and EIA consultants never had access to it (see section 9.1.1 in chapter nine).

On the other hand, the EIA guideline for mining industry in Malaysia consists of detail steps through the EIA process while designating the sector-specific methodology. This guideline lists sequential methodological steps for EIA process in mining sector as screening, scoping, site suitability assessment, study boundary, baseline data review, determining key project activities, identification of significant impacts and priority setting, selection of mitigation measures. It refers to existing legal base relevant to each stage of the processes involved in the industry, directs studies (e.g., Marine baseline traffic, hydraulic survey) required in EIA by type of project (e.g., quarry/mining). It also designates scope for environmental baseline studies, describes potential environmental impacts and issues of concern according to processes within mining and project activity stages. Besides it suggests prediction methods according to potential impacts from mining and expected parameters, provides reference to guidance document/legal base according to environmental impacts expected from the industry, proposes mitigation measures according to impacts, suggests environmental management, monitoring and audit plan according to the impacts expected from the industry. Apart from this, it also prescribes the expertise required in house for environmental management in project operation phase (Ministry of Natural Resources and Environment, 1995). Therefore, the guideline is specifically tailored for the sector with ample emphasis on the legal basis and impacts unique to the processes within the industry.

For textile industry, such tailored comprehensive EIA guideline could not be identified in national or international spectrum. However, there are several guidelines on components of EIS provided by different countries (discussed in chapter seven). Considering the EIA guidelines for other sectors and guideline on EIS for textile sector, author hereby lists the expected contents of standard textile sector guideline for EIA. It should incorporate scoping requirements and baseline studies relevant to the sector; impact assessment and prediction for raw material extraction, manufacturing processes and waste generation; mitigation measures, EMP and EMS relevant to manufacturing processes within the industry along with specific prescribed contents for EIS. Textile being resource and pollution intensive industry, specific emphasis should be given in natural resource management, resource recovery, chemical and waste management specially in EIS review and follow-up. Guidelines should also be updated frequently to accommodate the technological advancement. Considering the significance but lack of sector-specific EIA guidance for textile industry, Resta and Dotti (2015) developed an EIA toolkit for textile and clothing industry named SustainTex. This toolkit according to their words are “tools derived from standard EIA methods that have been adapted to the environmental, technological, technical and process characteristics of the textile and clothing sector” (Resta & Dotti, 2015, p. 159).

Legislation and organisational capacity are two of the criteria that can convince about a country's EIA potential (Wood, 2003). On the other hand, environmental degradation continues to be a major concern in developing countries even for those who have a good basis of EIA through guidelines and legislation (Briffett, 1999). Many of the deficiencies within EIA system requirement of Bangladesh coincide with that of Iran, Pakistan and India (Khosravi, et al., 2019a; Nadeem & Hamid, 2008; Paliwal & Srivastava, 2011). These countries show deficiencies in capacity of administration, EIA implementation, public participation and follow-up. Apart from this, developing countries also suffer due to inadequate EIA regulatory framework (Kolhoff, et al., 2009).

Chapter summary

Within the components of institutional framework, the procedural framework appears apparently satisfactory for the EIA system of Bangladesh. However, while the generic procedural framework might be satisfactory, sector specific procedural framework for EIA is entirely absent. The legal framework also has room for improvement at many levels. The deficiency in this framework is attributable to lack of independent reviewers, inadequate public participation, lack of legal status for procedural stages of EIA. On the other hand, the administrative system requires significant attention for effective implementation of EIA. The inadequacy in this component is mostly attributable to lack of resources and inadequate support from the system. However, even after existence of good legal and procedural basis for environmental degradation continues to be a major concern in developing countries. Therefore, the practice of EIA also needs to be evaluated to understand the comprehensive scenario.

Chapter Nine: Evaluation of the pre-decision stage of EIA practice for textile industry in Bangladesh

Chapter nine evaluates the pre-decision stage of EIA practice for textile industry in Bangladesh. In doing so, it intends to explore the role of relevant stakeholders and quality of EISs from textile units in Bangladesh. Accordingly, this chapter is divided into four main sections. The first three sections evaluate the role of relevant stakeholders (i.e., EIA consultants, project proponents and regulators) in the pre decision stage of EIA using the responses from face-to face interview. The fourth section evaluates the quality of five textile unit EISs through document analysis using Lee-Colley's review package (amended). Each section begins with the results of evaluation drawn from the framework of analysis, which is followed by discussion around the findings in comparison with the global scenario. This chapter accomplishes the first part of the fourth objective.

9.1 Evaluating the role of stakeholders: EIA consultants in pre-decision stage of EIA practice for textile industry in Bangladesh

Both the impact assessment system and people within it are the key elements being responsible for making the practice serve its purpose (Chanchitpricha & Bond, 2020). This study evaluates the role of stakeholders for both pre and post decision stage of EIA practice. For pre decision stage, roles of EIA consultants, project proponents and relevant regulators are evaluated. For post decision stage, role of project proponents and relevant regulators are evaluated

In Bangladesh, EIA for industrial and other projects are performed by consultants hired and paid by proponents (ILO, 2021). Therefore, EIA consultants play a vital role to uphold the quality of EIA process and EIA system. Researcher in this study interviewed representatives of three EIA consultancy firms. Snow-balling method was used to select them for this purpose. The consultants interviewed in this study are reputed and professional. They have 5-7 years of experience in EIA consultation.

The initial aim was to interview at least five EIA consulting firms. But one of them cancelled appointment within a very short notice and another could not be reached due to Covid-19 situation.

9.1.1 Results of evaluation of role of EIA consultants

The EIA consultants reported about charging around 150,000 to 500,000 BDT (USD 1786 to USD 5952) depending on the service to be provided. Apart from preparing EIS, the firms can also assist in getting Environmental Clearance Certificate (ECC) from Department of Environment (DoE) if the proponent demanded.

Till date, these consultancy firms have performed between 10 (interviewee #7) to 50 (interviewee #8) EIA studies for textile units in Bangladesh. However, none of them had access to the sector specific industrial guideline for textile by DoE, since it was never well publicized. For conducting EIA, the consultants consult international guidelines and standards from IFC, World Bank, Asian Development Bank (ADB), World Health Organization (WHO), European Union and United States Environmental Protection Agency (USEPA), when required. Two of the consulting firms have textile engineers in their team, while the third hires external experts when required. One of the firms have full-fledged laboratory, another partially depends on third partly, while the other uses third party laboratories for all their tests. The consultants reported considering process/machinery alternatives, waste minimization, substitution of chemicals, water preservation, compliance to effluent parameter, ETP operation technique while formulating mitigation measures (table 9.1). However, they have also agreed that the industrial units hardly implement the mitigation measures and management plans proposed within the EIS.

While interviewing, one of the participants suggested counterfeit EIA consultancy firms are “emerging like mushrooms” in Bangladesh (interviewee #6). They charge very low for an EIA study (i.e., 20,000-30,000 BDT or USD 238 to 357) and they don’t have in-house experts, manpower or laboratory services (interviewee #6). Interviewee #6 also mentioned that these firms are prone to produce falsified report. This could be largely attributable to lack of accreditation system for EIA consultants in Bangladesh and lack of provision of penalty for such offense . DoE does not have any requirement of standard qualification of EIA consultants or provision of their registration (The World Bank, 2018).

Table 9.1 Evaluation of the role of EIA consultancy firms in EIA practice for textile industry in Bangladesh

Components	**Criteria**	**Sub-criteria**	**Findings**	**Remarks**
Pre-decision stage of EIA	Qualification of EIA consultants	Existence of code of conduct and accreditation system for EIA consultants	➖	Though there is a provision at Bangladesh Accreditation Board for accreditation of bodies associated with providing certification of environment management system: ISO: 14000, but none could be found for EIA consultants
		Provision and practice of enlistment of consultants with environmental agency	➖	There is a mention of such provision in the sector specific EIA guideline for textile industry of Bangladesh, but not visible in practice
		Adequate capacity to prepare EIA report (e.g., Sector specific expertise, own lab)	❓	The authentic firms sometimes lack technical expertise, logistics or overall manpower, so they depend on third party. The counterfeit ones even run with two-three persons with no expertise. Since it is difficult to assume their share in the current market, this part would remain unclear.
		Have knowledge about and access to existing guideline	⊖	Most have knowledge about existence of sector-specific industrial guideline, but none had access to it
		Knowledge and use of international guidelines, if required	➕	All of them take help from international guidelines and standards
		Have been able to influence proponents about adopting measures in favour of environment	⊕	Proponents are interested if cost-benefit calculation is visible or if they are knowledgeable enough themselves.
		Provision of penalty for submitting falsifies report	➖	No evidence of penalizing (fine or blacklisting)

Explanation of the symbols:

➕ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*

➖ = *Unsatisfactory,* ❓ = *Unclear*

Sources: Face-to-face interview (2020) by researcher; The World Bank (2018)

From table 9.1, it can be observed that four among seven sub-criteria used for evaluating role of EIA consultants appear mostly unsatisfactory to completely unsatisfactory.

9.1.2 Discussion on the evaluation of role of EIA consultants

Regarding the challenges in this business (see interview questions in Appendix I), EIA consultants suggested that existing market is flooded with incompetent EIA consultancy firms. These firms perform EIA at negligible charge (e.g., 20,000-30,000BDT or USD 238-357), while the standard charge is 10 to 15 times (interviewee #6, #7). With such low charge they can attract large share of proponent who opt for EIA at a minimal cost disregarding its quality or ultimate aim (interviewee #6, #7). Interviewee #6 mentioned these firms are "challenging the ethics and aim of this profession and, jeopardizing business and integrity of the expert firms". The interviewee also expressed concern about the poor quality of EIA performed by these firms with lack of expertise and equipment, ending up with production of falsified reports (interviewee #6). Even one of the DoE officials somewhat supported the claim. However, there is no formal provision at DoE for penalizing or filtering out these firms (interviewee #2). While "Undertaking specialist work without sufficient knowledge or expertise" is considered as a professional misconduct of EIA professionals and is subjected to disciplinary action by National Environmental management Authority (NEMA) of Kenya (NEMA, 2015), similar policy is absent in Bangladesh. Jha-Thakur & Fischer (2016) indicate that size and experience of EIA consulting firms can affect appropriate use of EIA.

The EIA consultants are hired and paid by the proponents in Bangladesh. Since the country lacks provision for quality control, the proponents can potentially have great influence over the consultants. According to Kabir & Momtaz (2012), "consultants hired by the proponent often tend to serve the commercial interest of proponents", which was also identified by Jha-Thakur & Khosravi (2021) for India. Specially for private sector projects, consultants provide only marginal discussion within ElSs and supress the requirement of effective mitigation measures (Kabir & Momtaz, 2012). Also, lack of finance and trained human resources in developing countries can result in preparation of inadequate and irrelevant EIA reports (Clark, 1999; ILO, 2021).

NEMA, Kenya explicitly requires country's environmental assessment and auditing experts/consultants to be a member of recognized environmental expert professional body. They are also required to register with NEMA for annual practicing license (NEMA, 2015). Such practice can help enhancing their accountability (NEMA, 2015). On the other hand, lack of expertise and lack of accreditation for EIA consultants were identified as some of the reasons for poor quality EISs produced in Bangladesh (Kabir & Momtaz, 2012; Ahmed & Ferdausi, 2016). Furthermore, there are no codes of conduct governing professionals undertaking EIAs in Bangladesh (ILO, 2021; Ahmed & Ferdausi, 2016). Similar observation was made by Nadim & Hameed (2008) for Pakistan in 2008. However, Pakistan government took significant step towards changing it and made provision for registering the consultancy firms before they could undertake any EIA study, similar to Cambodia, Indonesia, India and Maldives (The Express Tribune, 2015; ILO, 2021; Quality Council of India, 2011; Ministry of Environment, Energy and Water, 2007). India recognizes that expertise affect the quality of EIA, thus have introduced mandatory scheme for accreditation of EIA consultants (Jha-Thakur & Khosravi, 2021). In Vietnam, EIAs are performed by independent consultant or KIBS[71] from a small pool of experts (ILO, 2021). This indicates that many developing countries have provision of accrediting EIA experts and their enlistment, which is still absent in Bangladesh.

On the other hand, the experts are not convinced about the skill of private sector EIA consultants in Bangladesh (Ahmed & Ferdausi, 2016). Since there is also lack of formal database of EIA consultants in Bangladesh, it is difficult to determine the quality, capacity or resources of the existing consultancy firms. According to the Express Tribune (2015) of Pakistan "individual members must have a master's degree in the relevant field with at least six years of working experiences or a PhD degree with three years of working experience in EIA work or he or she should be involved in EIA studies on a regular basis". UK Government emphasizes, for EIS to be of standard quality it must be prepared by competent experts (GOV.UK, 2020). Developed countries of UK and Canada require qualification of EIA Consultants' to be included within submitted EIS. Bangladesh lacks such provisions of quality control which is a major drawback for the EIA system.

9.2 Evaluating the role of stakeholders: Project proponents in pre-decision stage of EIA practice for textile industry in Bangladesh

ILO (2021) believes that proponents of industrial projects have a clear role in EIA process and therefore, environmental outcomes can be enhanced by their greater awareness. In this study, researcher interviewed representatives of project proponents from three formal textile units of Bangladesh to explore their role in EIA of textile industry. This interview helped understanding

[71] knowledge-intensive business services

their motivation and perception of environmental protection and management for respective units. Researcher also paid visit to these units and took them as case studies for this study (Case studies are denoted as CS1, CS2 and CS3 throughout this report, See section 10.2 and 10.3 of chapter 10 for detail discussion on case studies).

9.2.1 Results of evaluation of role of project proponents

All the proponents currently have updated ECCs for their units and they report back to DoE at regular interval (table 9.2). It indicates proponents' regard for the existing regulatory system at this instant. However, one of the project proponents (CS1) took eight years to apply for ECC, only after being influenced by their international buyers. Another (CS2) applied for the ECC recently (within past 5-10 years). Although CS2's operation started 13 years prior to the regulation coming into force. Hence, they only required to submit EMP while applying for ECC (DoE, 1997b). However, the management was not able to show their first ECC or the EMP to the author on the site visit. The third project proponent received ECC within two years of the commencement of construction work. These scenarios can direct towards the interpretation that majority of proponents have relaxed attitude towards EIA process. This statement was also supported by EIA consultants (interviewee #6, #7). The response from interview suggested that the proponents recognize ECC approval and renewal as part of regulation, alongside it being a requirement for starting business with the international brands. However, they seemed to be lacking the understanding of EIA being a process. The EIA consultants suggested that most of their clients from textile industry appointed them only after being influenced by international brands for performing an EIA for their units (interviewee #6, #8).

Interviewee #6 also opined that the proponents often allocate less fund and time behind EIA. She also noted that proponents prefer the consultancy firms charging less, disregarding the quality of EIA expected. The proponents also reported spending only 20,000 to 50,000 BDT (or 238 to 595 USD by CS1 and CS3 respectively) for EIA studies. It was also observed that none of the factory management from the cases were aware of the contents of their EISs or recommendations made by the EIA consultants.

Table 9.2 Evaluation of the role of project proponents (from case study textile units) in EIA practice in Bangladesh

<table>
<tr><th>Components</th><th>Criteria</th><th colspan="2">Sub-criteria</th><th>Findings</th><th>Remarks</th></tr>
<tr><td rowspan="6">Adhering to mitigation measures</td><td rowspan="6">Role of project proponents (proponents of formal textile units)</td><td colspan="2">Realizing pollution potential of textile wet processing units</td><td>⊕</td><td>The management don’t deny, but adequacy of initiatives from their side is still questionable.</td></tr>
<tr><td colspan="2">Recognizing existing policy measures in reducing the environmental impacts of textile units</td><td>❓</td><td>Majority of them consider ECC as a mere document for starting operation. They realize EIA as a prerequisite for starting factory operation and receiving orders from international buyers.</td></tr>
<tr><td colspan="2">Sufficient time and fund provided by proponents for conducting EIA</td><td>⊖</td><td>According to the consultants, proponents wouldn’t allow enough time or fund</td></tr>
<tr><td rowspan="3">Utilizing or conforming to existing rule or policy measure</td><td>ECC renewed on regular basis</td><td>➕</td><td>Currently all of them have ECCs which are renewed every year</td></tr>
<tr><td>Report back to DoE on regular basis</td><td>➕</td><td>Apply and submit fee to DoE at regular interval for wastewater monitoring sample collection</td></tr>
<tr><td>Have knowledge about mitigation measures proposed in their EIS</td><td>➖</td><td>Are not aware of the contents of their own EIA report</td></tr>
<tr><td colspan="6">Explanation of the symbols:
➕ = Satisfactory, ⊕ = Mostly satisfactory, ⊖ = Mostly unsatisfactory
➖ = Unsatisfactory, ❓ = Unclear</td></tr>
</table>

Source: Face-to-face interview (2021) by Researcher

From table 9.2 it can be observed that three among six sub-criteria for evaluating role of the project proponents appear mostly satisfactory to completely satisfactory.

9.2.2 Discussion on the evaluation of role of project proponents

While proponents in this research had updated ECCs for their units, experts indicated that this happens for very small fraction of units since many of them are not fully aware of the provision of ECC renewal (Ahmed & Ferdausi, 2016). Such unawareness has a potential to make the post EIA monitoring mechanism ineffective (Ahmed & Ferdausi, 2016). Since none of the relevant organisations (e.g., Department of Textile, Department of Environment) have a comprehensive list of textile (or other industrial) units, it is not also possible to identify the units avoiding ECC renewal. Although for textile units the scenario might be different since updated ECC is a prerequisite to continue business with international brands.

Although the units had updated ECCs, researcher sensed participants' relaxed attitude towards EIA. Several factors were responsible for such assumption. Firstly, only one of them had performed EIA before starting operation. Secondly, none of them had any idea about the contents of their EIS or EMP. Furthermore, the proponents were found spending one tenth of the standard charge for EIA study of their units (interviewee #6, #8). Momtaz & Kabir (2013) found that in Bangladesh, less than 1 per cent of the project budget is allocated for EIA activities, which is even lower for private sector industrial projects. This was also implied other studies (Ahmed & Ferdausi, 2016). The EIA consultants also reported the same for the time intended for EIA study. One of the interviewees in Kabir & Momtaz's study (2012) mentioned about proponents asking consultants to complete the study in weeks rather than months. Such attitude can often result in hiring counterfeit firms and accordingly submitting poor quality reports to DoE. These would have further impact on the time and effort behind the review of EISs. Momtaz (2002) realize that EIA is seen as impediment to development in Bangladesh.

Therefore, from the interviews, the researcher perceived proponents' disregard for EIA quality and its contribution beyond ECC. Experts suggested that proponents in Bangladesh often aim to prepare EIS for obtaining ECC, rather than preventing environmental impacts from the project (Kabir, 2012; Ahmed & Ferdousi, 2016). None of the proponents interviewed have any knowledge about the contents of EIS and EMP prepared for their units. While it is not unusual for a developing country (ILO, 2021), such ignorance can have great influence on effective implementation of mitigation measures and EMP (Kabir, 2012). Quoting from Jha-Thakur (2011, p.443) about India, "if the higher official himself is environmentally conscious or advocates and encourages good environmental practice, better implementation is possible".

Therefore, project proponents' perception and attitude can influence both pre and post decision stage of EIA practice. For project proponents' role in post decision stage of EIA, see section 10.2 in chapter 10.

9.3 Evaluating the role of stakeholders: Regulators (EIS reviewers) in pre-decision stage of EIA practice for textile industry in Bangladesh

> "Individual activities of regulators can make a difference to the implementation of policy and processes such as EIA" - Morrison-Saunders & Bailey (2009, p.285)

DoE is the sole regulator of EIA system in the country (The World Bank, 2018). Environmental Assessment Committee (EAC) by DoE approves ECC after reviewing the reports submitted by industrial units. Since there is only one EAC in the country (interviewee #4), two participants from the committee were interviewed in this study. Apart from them, three more participants from DoE were interviewed for other purpose (see (iii) in section 2.4.1, chapter two).

9.3.1 Results of evaluation of role of EIS reviewers

Although there is only one EAC at DoE, the composition of the committee remains same through the year. It consists of around 10 DoE officials from different departments (source: meeting minutes of the committee from DoE website). However, there is no evidence of them having any sector specific expertise. Due to limited budget, EAC cannot include external sectoral experts unless it is a high-profile national case like power plant or metro rail (interviewee #4).

Review meetings are called upon every two weeks. Each meeting reviews around 10 reports, 20-30% of which usually obtain approval at first chance (Interviewee #4). Individuals in the committee receive four to five working days before each meeting to go through the reports (Interviewee #5). In-depth analysis of technical issues (including sectoral concerns) while reviewing the EIA reports seem absent in the meeting minutes. Therefore, the ECC conditions appeared rather generic, lacking project or sector specific concerns (table 9.3).

Both DoE officials and EIA consultants indicated that quality of report submitted by the proponents has largely degraded in recent years due to incompetent consulting firms submitting falsified reports. This has impacted the time required for reviewing individual reports.

Table 9.3 Evaluation of the role of EIA reviewers in EIA practice for textile industry in Bangladesh

Components	Criteria	Sub-criteria	Findings	Remarks
Pre decision stage of EIA	Review process by DoE	Adequate manpower and fund available for review in all the offices	−	Though the head office is seeming equipped, zonal offices are not.
		Sector specific experts consulted in review committee	−	None of the committees include sector specific experts, unless it's a national high-profile project. They lack fund according to interviewee #4
		Adequate time provided behind each report in the meetings approving ECC	−	Highly unlikely, considering the burden of report and feedback visible in meeting minutes
		Sectoral industrial guideline is followed while reviewing	?	One participant responded yes to this question, however considering the time dedicated behind each report, this remains ambiguous
		Specific checklist or review package followed while reviewing	−	Not such method or package exists
	Approval of ECC	If the decision on ECC or EIA/EMP report are published	+	Decision on the report is published on the website
		If these reasons include an explanation relevant to EIA report	−	Detail reasoning is missing, no report specific explanation is included in the publications.
		Review process influencing the decision	?	Review process influences decision on ECC. ECC is pre-requisite to submit to relevant agencies for project/development permit.

Components	Criteria	Sub-criteria	Findings	Remarks
		Conditions provided with ECC are relevant and specific to project	➖	Conditions are very generalized, which is also agreed by EIA consultants.
Explanation of the symbols: ➕ *= Satisfactory,* ⊕ *= Mostly satisfactory,* ⊖ *= Mostly unsatisfactory* ➖ *= Unsatisfactory,* ❓ *= Unclear*				

Source: Face-to-face interview (2020) by researcher

From table 9.3, it can be observed that six among the nine sub-criteria for evaluating the role of EIA report reviewers appear completely unsatisfactory.

9.3.2 Discussion on the evaluation of role of EIS reviewers

Role of EIA report reviewers in the EIA practice for textile industry of Bangladesh appear largely unsatisfactory. Lack of standard review methodology, technical expertise or finance to hire experienced reviewers seem to be the key reasons impeding the quality of EIS review in Bangladesh. The reasons mostly indicate deficiencies in the system rather than the reviewers themselves.

Globally, different approaches are used in EIS reviewing. For example: environmental agency reviews EIA report in Australia, Planning authority in UK, inter-agency committee in USA, independent commission and panel of experts in Netherland & Canada respectively (IAIA, 2002b). In many countries of the world (e.g., Canada), interim review on the quality of the report is performed by the responsible authority. After being satisfied with the requirement, the authority forwards the report to the independent reviewers (IAIA, 2002b). The review performed by responsible authority or government agency in known as internal review, while review by independent authority separated from government agency is known as external review (IAIA, 2002b). Internal review is debated for lack of transparency, discretionary guidance and lack of documentation of results from reviews, against the advantage of being low cost (IAIA, 2002b). While external review can be performed by experts independently, methodically with appropriate documentation and transparency (IAIA, 2002b). When the review mechanism is weaker, it tends to demoralise the consultants to prepare good quality reports (Rathi, 2017).

Therefore, the nature of EIS review in Bangladesh is internal. The importance of independent reviewers for quality control in EIA system has already been discussed under section 8.1.2 of chapter eight. For Bangladesh, Ahammed & Harvey (2004, p.74) noted,

> "With no public involvement and an independent review body, ensuring the quality of the EIA document seems to be difficult".

The World Bank (2018) suggests outside experts for EIA review can supplement DoE's limited internal capacity for review of reports and approval of ECC. However, while asked, interviewee #4 noted, DoE lacks financial resources for that purpose (see questions in Appendix I). Developing country of Vietnam has a pool of experts contributing to preparing EIA reports and reviewing. Being a small pool, it also becomes challenging to avoid conflict of interest (ILO, 2021). However, their effort of have establishing an independent review system still praiseworthy.

Zonal offices of DoE neither have dedicated manpower nor expertise for reviewing detail EIA reports. Also, they are over-burdened with multiple duties (interviewee #3 and #4). Accordingly, zonal officers rarely get the opportunity to develop expertise (interviewee #2 and #3). Therefore, irrespective of sectors, one review committee at head office (EAC) is responsible for reviewing all red category (see section 6.1.2 in chapter six) EIA reports from around the country, alongside IEE and EMP reports from the capital city. The committee is composed of DoE officials from different departments (e.g., Planning, Natural resource management, Air quality management and ECC) of Head office (DoE, 2021b), where sectoral expertise is not required. According to interviewee #4, the expertise of this committee is developed through experience. Lack of technical expertise, burden of reviewing such long log of reports along with other decision-making issues are meant to affect the efficacy of the review. On the other hand, in India, separate "Expert Appraisal Committees (EAC)" are formed based on groups of industries. For example, there are different committees for coal mining sector, non-coal mining sector, industry group I (e.g., steel, cement), industry group II (e.g., distillery, power plant) (PARIVESH, 2022). These committees consist of scientists, engineers, academicians along with government officials from Ministry of Environment, Forest and Climate Change and other relevant government agencies of India (PARIVESH, 2021).

According to ECR'97 of Bangladesh, after submission of EIA report for a red category unit, the decision on ECC must be given within 60 days (DoE, 1997b). While asked interviewee #4 commented that the review committee (EAC) sits every fifteen days and make decisions on around 10 reports in each meeting (see interview questions in Appendix I). However, the researcher has critical observation on this matter. From the numbers of orange and red category projects submitting ECC application between 2010-2014, it can be noted that around 6000 orange and red category projects (see section 6.1.2 in chapter six) apply every year (Ahmed & Ferdausi, 2016) and EAC sits about 24 times in a year (Source: interviewee #4). If we assume hypothetically[72] that 5% of those 6000 projects are red category, EAC will have to go through 12-13 reports in each meeting (hypothetically), not to mention some reports are required to submit repeatedly due to the quality. EAC meeting minutes of 14 November, 2021 shows discussion on 57 ECC approval, six land use clearance, two zero discharge plan approval, two ETP design approval, three ECC renewal, 11 rejections of ECC and land use clearance applications (DoE, 2021b). This indicate how little time must be dedicated behind the review of EISs from red category units of the country.

The directions for EIS review within 1997 guideline for EIA of industries in Bangladesh is very brief, generic and lack specific directions like the ones by European Commission or Ireland EPA (European Commission, 2001b; Ireland EPA, 2015). Interviewee #4 claimed existing guidelines (e.g., the 1997 guideline for EIA of industries and 1997 sector specific industrial guideline) are followed while reviewing. This claim is questionable with such huge log of EISs, lack of staff, lack of sector-specific knowledge and very limited time available for reviewing each report. Also, interviewee #5 contradicted this statement by informing that no checklist is developed or followed in the review process. The outcome of EIS review in Bangladesh can be easily perceived considering these shortcomings (discussion of EIS quality can be found in section 9.4 in this chapter).

ILO (2021) argues that transparency and accountability is largely absent in the approval process in Bangladesh. A part of it is reflected in the review committee decisions published in DoE website. The explanation on review decision is generic, lacking technical and report specific details. The conditions for approved ECC rarely reflect project specific conditions and are very generalized (also supported by Interviewee #6). In 2001, Annandale observed the same for Maldives' EIA report review system alongside lack of direction for EIS contents, provision of public review of report or publication of decision on report (Annandale, 2001). However, Maldives formulated "Regulation on the Preparation of Environmental Impact Assessment Report" in 2012 where many of these shortcomings were addressed. On the other hand, the

[72] Based on the share of red category units granted ECC between 2010 to 2014 (Ahmed & Ferdausi, 2016)

meeting minutes from specialized EACs of Impact Assessment Division of India contain detail discussions (PARIVESH, 2022). The minutes contain technical comments from experts mentioning section, page number and paras of respective EIA reports (PARIVESH, 2021). The minutes also contain project specifics (e.g., location, presence of environmentally sensitive zones, estimation of raw material use and production among others) (PARIVESH, 2021). Such elaborated meeting minutes not only can guide the future applications but can also assist general population in understanding impact of the project. Rocha, et al., (2019) identified Portuguese environmental agency is more transparent compared to the one in Brazil, since they disclose more information about the review process. For the first, disclosed pages on EIA report review appeared five times voluminous and detailed than the later (Rocha , et al., 2019). Quoting from Chanchitpricha & Bond (2020), "in order to gain a higher level of legitimacy, effective communications in the IA process are required to mitigate trust and conflict issues".

9.4 Evaluating the quality of EISs belonging to textile units of Bangladesh

For this research, five EISs belonging to red category textile units of Bangladesh were collected. Lee-Colley's original EIS review package was amended and then used for evaluating these reports (see section 7.2.2 in chapter seven). Four of the reports belong to knit composite units (see chapter five for definition) and the fifth belongs to a sweater dyeing unit. One of these reports is available on internet, two were collected through personal connection and two belong to the case studies. The case study EISs are denoted using case study codes: CS1, CS3 and rest of them are denoted as EIS1, EIS2, EIS3. The researcher was not able to collect any other EIA reports even after several attempts.

9.4.1 Results of the review of EISs from textile units of Bangladesh

The EISs were reviewed using Lee and Colley's (1993) methodology. Accordingly, the review process started with evaluation of the sub-criteria, which is the lowest tier. The contents of the report were evaluated against all 71 sub-criteria by two reviewers. The outcome of the evaluation is shown in table 9.4. The highlighted cells denote the evaluation of five EISs in the minimum requirement sub-criteria (31 among the 71) designated for this study.

Table 9.4 Evaluation of sub-criteria within EISs according to amended Lee-Colley review package

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
1. Description of the development, the local Environment and the baseline conditions	**1.1 Description of the development**	1.1.1 Purpose and objective of development well explained	E	E	E	NIA[73]	C
		1.1.2 The design and size of the development described including diagram, plan and maps	C	D	C	NIA	D
		1.1.3 Indication of prior development within environment	A	C	A	NIA	B
		1.1.4 Description of activities associated with construction work	D	N/A[74]	N/A	N/A	C
		1.1.5 Description of production process and expected rate of production	C	E	B	D	A
		1.1.6 Described nature and quantities of raw materials needed in construction and operation phase by processes within the industrial unit	E	F	D	F	C
		1.1.7 Plan for Handling and storage of chemicals	F	A	F	F	F
		1.1.8 Plan for storage of raw materials, finished products and wastes	F	E	F	F	F
		1.1.9 Description of staff and their expertise, their knowledge and training on safety plans and gears for safe handling and disposal of materials, chemicals etc.	C	C	D	E	D
		1.1.10 Description of associated development (ETP) (infrastructure, treatment processes and capacity) along with monitoring and maintenance plan (operator, cleaning etc.)	C	F	F	F	B
	1.2 Site description	1.2.1 Land required for the development defined and shown in map	D	D	D	NIA	B
		1.2.2 Described expected use of land and demarcations by different uses	C	F	F	NIA	F
		1.2.3 Described different phases of project including decommissioning phase where suitable	E	F	F	F	C
		1.2.4 Description of expected new development (housing, road etc.) as result of project	F	F	F	F	C

[73] NIA= No information available
[74] N/A= Not Application

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
		1.2.5 Description of amount of utility required for the facility	A	A	B	NIA	A
		1.2.6 Description of activities to be ceased as the result of the project	C	F	F	F	F
		1.2.7 Described numbers, access and transport used by users of the project area in different phases	F	F	C	F	F
		1.2.8 Means of transporting raw materials and products with quantities involved	F	F	B	F	C
	1.3 Waste generation and management	1.3.1 Type, Toxicity and composition, quantity, rate of generation of waste material, energy and residues by processes within the unit	F	F	E	F	D
		1.3.2 Collecting, storing, treating, transporting and final disposal of each type of waste and residue (specially sludge) along with route of disposal through environment	F	D	F	F	D
		1.3.3 Described methods of estimation of waste and residuals including uncertainties and confidence limits	C	F	F	F	E
		1.3.4 Plan for reduce, reuse and recycle for efficient use and recovery of water, energy and chemicals or resource recovery from wastes	D	E	F	F	F
	1.4 Environment description	1.4.1 Indication of environment to be affected with a suitable map	F	D	D	F	F
		1.4.2 Description of environmental components within project area (i.e., environmental parameters like temperature, humidity, air quality, noise etc for existing project	N/A	A	A	E	N/A
		1.4.3 Define affected environment with significant impacts from immediate construction site	D	D	D	NIA	C
	1.5 Baseline condition	1.5.1 Described components of affected environment, described investigative methods used for this purpose and their suitability according to the size and risk of assessment along with uncertainty	D	D	C	E	D
		1.5.2 Utilizing existing data (used by local authorities, conservation agencies, research groups etc.)	C	C	C	D	E
		1.5.3 Local land use plan and policies consulted, and other data gathered to assess do-nothing scenario.	F	F	F	F	F

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
2. Identification and evaluation of key impacts	**2.1 Definition of impacts**	2.1.1 Description on any direct and indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects *associated with processes, raw materials extracted, used and waste generated*	E	C	E	E	E
		2.1.2 Effects and interactions should be investigated and described for human beings, flora-fauna *and biodiversity*, soil, water, air, *micro-climate, climate change and sustainable development*, landscape, material assets, cultural heritage	E	D	C	E	C
		2.1.3 Conditions should be described for both operating and accidental situations. *Specially risk assessment needs to be carried out for handling hazardous material, spillage, fire/explosion, traffic accident, failure of process, exposure of project from natural hazards*	E	E	E	D	D
		2.1.4 Deviation from baseline should determine the impact (difference between do-nothing and with project scenario)	E	E	E	E	D
		2.1.5 Description of Emergency response plan (identification of all possible causes, assigning roles, list of actions to be taken)	D	D	B	D	B
	2.2 Identification of impacts	2.2.1 Systematic methodology to be used for impact identification (project specific checklists, matrices, panels of experts, consultations, etc. and Supplementary methods (e.g., cause effect or network analyses)	E	B	C	E	F
		2.2.2 Rationale and brief description of the impact identification methods	E	C	F	F	F
	2.3 Scoping	2.3.1 Genuine attempt to contact general public and special interest groups to inform them about project and its implications	B	F	D	E	B
		2.3.2 Opinion of those stakeholders should be collected through arrangement of public meetings, seminars, discussions groups	B	F	E	E	B
		2.3.3 Key impacts should be investigated in detail and other impacts should also be mentioned. Rationale needs to be stated for not investigating the later.	F	E	D	E	C
	2.4 Prediction of	2.4.1 Sufficient amount of data should be used to estimate the magnitude (*Geographic extent, duration, frequency, reversibility, probability of occurrence*). Gaps (*Difficulties in compiling the data*	F	F	F	F	F

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
	impact magnitude	*needed to predict or evaluate effects)* should be acknowledged where applicable, *their implication on results* and strategy to deal with that.					
		2.4.2 Described method of predicting impact magnitude and its suitability according to size and significance of impact	F	E	F	E	F
		2.4.3 Quantitative means of expression for magnitudes to be used where suitable, qualitative ones should be adequately defined.	F	E	F	F	F
	2.5 Assessment of impact significance	2.5.1 Significance to affected community and society from impact magnitude *of each predicted effect* should be clearly described *(discussed in terms of the number, importance and sensitivity of people, resources or other receptors affected)*; significance after applying mitigation measures should also be discussed	E	E	D	E	E
		2.5.2 National and international standards to be taken into account while assessing significance. Also, magnitude, location and duration of impacts to be tallied against societal values	D	D	B	D	C
		2.5.3 Choice of standards used should be justified	F	F	F	F	F
3. Alternatives and mitigation	**3.1 Alternatives**	3.1.1 Alternative sites should be considered where practicable and available	N/A	N/A	N/A	N/A	F
		3.1.2 Alternative processes, designs and operating conditions should be considered and environmental impacts of such should be indicated	E	D	F	F	E
		3.1.3 Substitution plan for hazardous chemicals	F	F	F	F	F
		3.1.4 Reappraise rejected alternatives in case of severe impacts identified of previously selected ones	F	F	F	F	F
		3.1.5 Main reason for choosing the project, explained including environmental reasons for choice	F	F	F	F	F
	3.2 Scope and effectiveness of mitigation measures	3.2.1 Mitigation should be considered for all adverse impacts and specific measures to be proposed for significant ones. Residual impacts should be justified.	E	D	C	D	D
		3.2.2 Mitigation measures should include modification of the project, compensation and the provision of alternative facilities *(Alternative strategies or locations, changes to the project design and layout, changes to methods and processes, "end of pipe" treatment, changes to*	E	D	D	F	E

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
		implementation plans and management practices) along with pollution control					
		3.2.3 Extent of effectiveness of mitigation measures should be indicated. Uncertainty should be discussed with appropriate data.	F	F	F	F	F
		3.2.4 Where mitigation of significant adverse effects is not practicable, or the developer has chosen not to propose any mitigation measures- the reasons are clearly explained	F	F	F	F	F
	3.3 Commitment to mitigation	3.3.1 Clear record of commitment to mitigation measure should be included. Strategy to implement the measures and performance timeline should be described	D	C	F	D	B
		3.3.2 Monitoring measures (*Identification of parameters for monitoring and frequency of testing, plan of incorporating monitoring outcome, description of structural/research facilities within project or at least plan for it and description of in-house experts for implementation of mitigation measures and routine monitoring*), strategy to adjust measures to deal with unexpected adverse impacts to be discussed	C	B	D	D	B
		3.3.3 Plan for monitoring and management of residual impacts	N/A	N/A	N/A	N/A	F
4. Communication of result	**4.1 Layout of report**	4.1.1 Introduction with brief description of the project, the aims of the environmental assessment and strategy to achieve the aims	E	D	C	D	C
		4.1.2 Logical arrangement of information in chapters and indicating important data using ToC or index	D	C	C	D	C
		4.1.3 In case of detailed chapters, summaries to be provided indicating findings in phases of investigation	N/A	N/A	A	N/A	N/A
		4.1.4 Original sources of data should be always acknowledged.	D	D	E	D	E
	4.2 Presentation	4.2.1 Unnecessarily technical or obscure language should be avoided to make it understandable for non-specialists	B	B	B	B	B
		4.2.2 Technical terms, acronyms and initials should be defined	A	A	A	A	F
		4.2.3 Report/statement should appear integrated, cross referenced, data in Appendix properly referred in main body	E	C	D	F	D
		4.2.4 Clear description of the process followed	F	D	E	E	E

Area	Criteria	Detailed Sub-criteria	EIS1	EIS2	EIS3	CS1	CS3
		4.2.5 All analyses and conclusions properly supported with data and evidence	E	E	D	E	C
		4.2.6 Consistent terminologies used throughout the document	B	B	B	B	B
	4.3 Emphasis on adverse impacts	4.3.1 Prominence given on the significant adverse impacts along with potential favourable ones.	E	D	C	D	B
		4.3.2 Statement should not lobby any point of view, thus remain unbiased	E	E	A	E	B
	4.4 Non-technical summary	4.4.1 Should be provided for main findings and conclusions, avoiding technical terminology	D	F	C	D	F
		4.4.2 Should cover a brief description of the project, the environment, proposed major mitigation measures, description of any significant residual impacts. A brief explanation of data collection method and their confidence limit should also be included.	D	E	C	D	F
		4.4.3 Discusses development consent process and role of EIA in the process	D	D	C	D	F

*Italic fonts represent amended sub-criteria for this study
**Highlighted cells represent minimum requirement sub-criteria for this study

Explanation on evaluation symbols:

A	Relevant tasks well performed, no important tasks left incomplete.
B	Generally satisfactory and complete, only minor omissions and inadequacies.
C	Can be considered just satisfactory despite omissions and/or inadequacies.
D	Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions and/or inadequacies.
E	Not satisfactory, significant omissions or inadequacies.
F	Very unsatisfactory, important task(s) poorly done or not attempted.
NA	Not applicable. The Review Topic is not applicable or is irrelevant in the context of this Statement.

Source: Document analysis by reviewers in this study (2021) using Lee-Colley's (amended) review package

Following on, the broad areas of the five EISs were evaluated by the reviewers and an overall evaluation for the reports was also performed (table 9. 5).

Table 9.5 Evaluation of broad areas and overall EISs according to amended Lee-Colley review package

Broad areas	Evaluations				
	EIS1	EIS2	EIS3	CS1	CS3
1. Description of the development, the local Environment and the baseline conditions	D	E	E	E	C
2. Identification and evaluation of key impacts	E	D	E	E	D
3. Alternatives and mitigation	E	D	E	E	E
4. Communication of result	D	D	D	D	C

Overall Evaluation	D	D	E	E	D

Source: Document analysis by reviewers in this study (2021) using Lee-Colley's (amended) review package

i) Performance of the reports in Minimum requirement sub-criteria of the EIS review package

None of the EISs seem to fulfil the condition of being satisfactory at the minimum requirement sub-criteria. More than 80% of the minimum requirement sub-criteria appeared unsatisfactory for EIS1 and EIS2, which is around 60-70% for EIS3 and CS3 (figure 9.1). Although, CS1 has some missing information (five out of 31 minimum requirement sub-criteria) due to technical error, none of the rest of the minimum requirement sub-criteria appeared satisfactory.

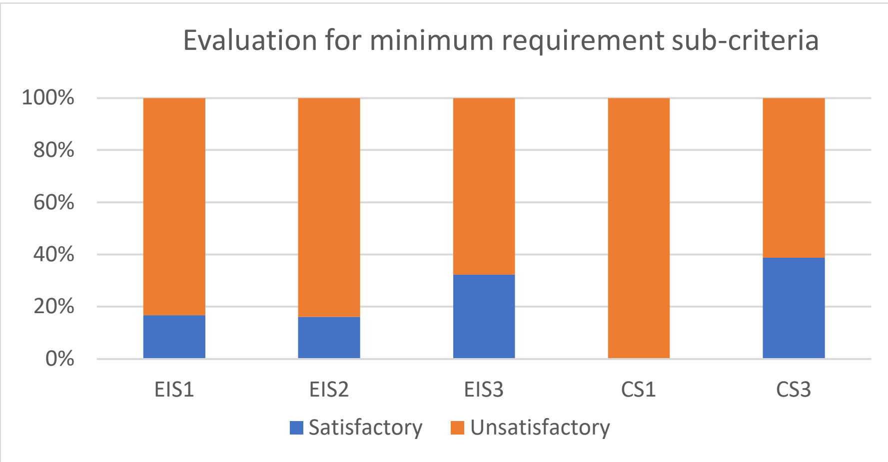


Figure 9.1 Evaluation for designated minimum requirement sub-criteria

Source: Document analysis by reviewers in this study (2021) using Lee-Colley's(amended) review package

ii) Broad Compliance of the reports according to EIS review package

Lee-Colley's methodology require both minimum requirement sub-criteria and broad areas to be evaluated as satisfactory to meet the broad compliance. Broad compliance has been identified unsatisfactory for all five EISs in this study, since,

i) None of the reports meet the satisfactory condition for designated minimum requirement sub-criteria (table 9.4 and figure 9.1).

ii) The broad areas in the reviewed reports mostly ranked from D to F, except CS3 (table 9.5). Even, while CS3 has two broad areas identified as satisfactory (graded C), it still received unsatisfactory grades for the rest. Therefore, CS3 also does not meet the condition of all four areas being evaluated as satisfactory for a report.

iii) Overall quality of Reports

Contents of at least three reports were found unsatisfactory for 87% of the minimum requirement sub-criteria. In fact, all the EISs have failed to report (marked as F) around 33% of these designated sub-criteria. This estimate (failure to report) varies from 28% to 38%, if all 71 sub-criteria within the review package is considered.

Only two within the 31 (6.5%) minimum requirement sub-criteria received satisfactory evaluation for majority of the reports (Table 9.4). This satisfactory evaluation was received for the sub-criteria regarding description of utility requirement (three reports received A, one received B) and proposal of monitoring measures (two received B, one received C). On the other hand, contents were unsatisfactory or absent for waste estimation and management (including reduce-reuse-recycle-recovery (3R) plan); systematic investigation for baseline environmental condition; development of do-nothing scenario using local plan; detail description of environmental impact; risk assessment considering source of impact; estimation of impact magnitude and significance; plan for management of hazardous chemicals, proposals for specific mitigation measure, use of evidence and data in establishing proposals among others.

Thus, the overall evaluation of the reports falls between D to E (table 9.5).

iv) Result of review of EISs for the case study units (CS1 and CS3)

Among the five EISs, CS1 has failed to report maximum number of sub-criteria. It received 27 Fs, among 64 sub-criteria (information on the rest was not available for evaluation), and 11 Fs among 26 minimum requirement sub-criteria. None of the sub-criteria reported received any satisfactory (A, B or C) grades for CS1. CS1 failed to provide information on significant issues that are specifically included within the review package to address sector specific concerns. These are relevant to information on storage, handling or substitution of hazardous chemicals; description on ETP; type-toxicity-quantity of waste generated; storage and handling process of wastes; estimation of magnitude of impact. Overall, for this report, three broad areas received E and one received D.

CS3 is the only report (from all the five) that received two Cs within the four broad areas (table 9.5). However, number of Fs received by CS3 was also very high (25 among 71 sub-criteria and 10 among 31 minimum requirement sub-criteria). On the contrary, it also received total 12 satisfactory scored out of 31 minimum requirement sub-criteria, which is the highest among all the reports. This indicates that CS3 received most satisfactory evaluation among the five EISs, even while there is significant deficiency in many parts of the report. For example: CS3 failed to provide information on significant sub-criteria like storage, handling or substitution of hazardous chemicals; estimation of magnitude of impact; layout map with use within the unit. On the other hand, information on production process and estimation of production; environmental impacts for associated living beings and environmental components; description of emergency response plan; record of commitment to mitigation measures appeared satisfactory for CS3.

9.4.2 Discussion on the review of quality of EISs from textile units of Bangladesh

Confidentiality is one of the issues with EIA reports in developing countries (Bisset, 1992). It was also identified as one of the limitations in this research. Author could avail only five EIA reports belonging to textile units of Bangladesh and could access only two units among them for field visit. All these EISs were found unsatisfactory in this research according to minimum requirement sub-criteria, broad areas and overall evaluation. In a previous study, 80% of the EISs from industrial sector found to be of lower quality in Bangladesh (Kabir & Momtaz, 2012). ILO (2021) reinstated this claim in a recent study. Experts identified several reasons behind poor quality of EIS in Bangladesh. Some of these are: lack of capacity of sectoral agencies to conduct EIA and prepare report, limited experience, and capacity of environmental agency to support the EIA process and, inadequate time and funding dedicated behind EIA, proponents' lack of interest and knowledge on environmental issues (Kabir & Momtaz, 2012). Inadequacy of baseline data, lack of consultants' independence, absence of legal provisions for quality control, inadequacy of best practice guidelines for EIS are also listed among the factors influencing the quality of EIS in Bangladesh (Kabir & Momtaz, 2012, p. 97). This is similar to the observations made by Nadeem and Hameed (2011) for Pakistan. The share of unsatisfactory EISs varied from 70% to 75% in Odessa (India) and Tanzania; while Malaysia had 77% of EIS evaluated in borderline and 15% of poor quality. The EIA reports of these developing countries were found weak on alternatives, scoping, impact prediction, magnitude and significance of impacts, effective proposals for mitigation measures (Ibrahim, 1992; Rout, 1994; Mwalyosi & Hughes, 1998). A study on EIS quality of eight developed countries by Barker and Wood (1999) found that between 1991 and 1996, share of satisfactory quality of EISs increased from 50% to 70%. The shortcomings identified were attributable to technical weakness, insufficient consideration of alternative and insufficient commitment by developer towards mitigation measures, biased reporting (Lee & George, 2000).

Discussion on the evaluation of EISs' quality from textile units in Bangladesh is presented in the next page -

i) Description of the development, the local environment and the baseline conditions (Area One)

The overall evaluation for this area appeared unsatisfactory (D and E) for four out of five EISs, except one of the case studies (received a C). Textile is a resource and chemical intensive industry alongside being responsible for noxious wastes (Sherburne, 2009; DEFRA, 2007; Resta, et al., 2016). On the contrary, the information unaccounted for most of the EISs in this study was relevant to chemical and waste management. Those were- plan for handling and storage of chemicals; plan for storage of raw materials; finished products and wastes; description of associated development like ETP infrastructure, treatment processes and capacity along with monitoring and maintenance plan; description and amount of waste, plan for 3R, waste sorting and transportation. Although, these sub-criteria were specifically adapted for this study considering the sector specific concerns (see section 7.2.2 in chapter seven), the EIA reports mostly failed to address them. In addition to this, the contents on description of development appeared very generic, avoiding sector specific environmental concerns. Besides, site description also had major deficiencies. For example: "identification of activities to be ceased due to proposed project" was not considered in majority of (four out of the five) reports. The 'do-nothing' scenario was never considered in any of the reports. Description on environmental and baseline conditions mostly received marginal scores (between C and D) in this study while those also contained some deficiencies. These deficiencies were also identified in a previous study on EISs of Bangladesh by Kabir & Momtaz (2013). Ahmed & Ferdousi

(2016) suggested, inadequate resource and time allowed by proponents are primary causes of poor quality of baseline data for EIA in Bangladesh. According to Nadeem & Hameed (2008), unavailability of data in concerned agencies is responsible for time and resource required for baseline data collection in Pakistan. This can also be a potential factor in Bangladesh. Also, collection of baseline data by individuals (i.e., EIA consultants) can make it unreliable (Nadeem & Hameed, 2008).

South Africa seemed quite advanced in this journey despite being a developing country where more than 80% of the EISs seemed to perform satisfactory in this area (Sandham & Pretorius, 2008). More than half of their EISs had satisfactory descriptions on waste management issues (58%) and baseline conditions (79%). On the other hand, 73% & 75% of EISs in Tanzania and European countries received satisfactory scores in this broad area respectively (Barker & Wood, 1999; Mwalyosi & Hughes, 1998).

ii) Identification and evaluation of key impacts (Area Two)

The reviewed EISs performed very poorly in this broad area with significant deficiencies (three of the EISs received E and two received D). Although the EISs enlisted the impacts, most of those were direct impacts with limited scope lacking depth and hardly been associated with production processes, raw material use, extraction, and waste generation. While most of the reports had separate sections on "emergency response plan", those lacked description on risks associated with industry specific hazardous material handling, spillage, failure of manufacturing process which were amendments considering sector specific EIA concerns for this study. Such insufficient coverage could be attributable to the lack of advanced hazardous materials management system in the country. World Bank (2018) found this regime (hazardous material management) is outdated and has scope of improvement. Alongside, the reports lacked substantial information on "Prediction of impact magnitude" and sufficient data to support the discussion. Description on impact magnitude prediction was absent and hardly any quantitative means was used for describing the magnitude. Significance of impact was very poorly described and choice of standards for assessing the significance was never justified in any EIS (four of the reports scored E). Experts suggest rather than limiting the assessment of environmental impacts of a project to its immediate environment, EIA should incorporate evaluations based on "concepts of environmental resources, capacities and limits", including climate change and biodiversity enabling cumulative impacts of development (Jay, et al., 2007; Wood, 2003). Apart from this, health impact assessment should also be incorporated for projects sensitive to natural resource, environmental quality, heath & wellbeing of community as practiced in Thailand (e.g. mining, petrochemical, , power plants, port, dams) within the EIA process (Ministry of Natural Resources and Environment of Thailand, 2010). Experts studying EISs of Bangladesh previously identified this broad area as "least well performed area" with omissions and deficiencies in impact identification, explanation of methods to predict and evaluate the impacts (Kabir & Momtaz, 2012). Previous studies questioned the adequacy of community consultation in the EIA process of Bangladesh (Kabir & Momtaz, 2018; Ahammed & Harvey, 2004), which was also identified in this research. In Bangladesh, EIA reports are not made available to public for discussion and decision making, nor there is any legal provision (Ahmed & Ferdausi, 2016; Ahammed & Harvey, 2004). However, interaction with public takes place in some form while EIA study is conducted (Ahmed & Ferdausi, 2016), which was vaguely visible in the reports reviewed. Although the reports mention of involving people while conducting the EIA, no such list of community people, nor the date of consultation or the list of the items in discussion is incorporated within the report. One of the interviewees (#6) in this research mentioned that, since the project appears as a prospect of employment to the surrounding population, they hardly make any negative comments. However, Director General of DoE still reserves the right to ask proponents to invite public comment and respond to that if found suitable (Ahammed & Harvey, 2004). Public participation in EIAs of developing countries mostly appear limited since people surrounding the industrial areas lack awareness about environmental and indirect socio-economic impacts (Nadeem & Hameed, 2008). If the communities and other stakeholders can receive environmental knowledge from EIA, it can have a greater influence on the future direction of development (Jay, et al., 2007). Public participation beginning at early stages of EIA can increase the efficacy of the process (Arts, et al., 2012). However. involving people in all stages of EIA process also has the possibility of increased project cost, which is a concern for developing countries (Nadeem, et al., 2014). Nevertheless, the benefit of mandatory participation in one to two stages of the EIA process appeared to have exceeded the cost in developed countries (Nadeem, et al., 2014).

Studies in developed countries also found this broad area "not so well performed" (Barker & Wood, 1999, p. 392) or "least satisfactory" (Lee & George, 2000, p. 141) which was attributable to "technical and other weaknesses in scoping, impact prediction and determination of impact significance" (Lee & George, 2000, p. 141) Deficiencies within the EISs in developed countries appeared quite similar to the ones identified in this research (Barker & Wood, 1999). Therefore, while this broad area is considered as the most important part of EIA report, both developing and developed countries seem to underperform in this area. The share of reports performing satisfactorily in this area is around 68-75% in developed countries (Barker & Wood, 1999; Lee & George, 2000). For developing countries this share is 40% or even less (Mwalyosi & Hughes, 1997; Kabir & Momtaz, 2012). However, the scenario for South Africa is quite similar to the developed countries, where around 70% of EISs performed satisfactory in this broad area (Sandham & Pretorius, 2008).

iii) Alternatives and mitigation (Area Three)

This broad area was found as the most poorly performed area in this study (four of the EISs received E and one received D). Consideration of alternatives or any such discussion was rarely visible in the EISs. Since four out of five reports performed EIA after starting their unit's operation, consideration of alternative site might not be applicable for them. However, alternative or modified design, production processes, or even substitute plan for hazardous chemicals (which is a key demand for textile industry) were also missing in all these reports. Similar observations were made by Ahammed & Harvey (2004) for their study on EISs for three large scale projects in Bangladesh. According to Ahmed and Ferdausi (2016), analysis of alternatives is undermined by existing regulation in Bangladesh itself (discussed in 8.3.2 in chapter eight). On the other hand, description on mitigation measures also appeared significantly unsatisfactory in the EISs. Specially detail description on effectiveness of mitigation measures, explanation on exclusion of mitigation measures were absent in all the reports. Plan of residual impacts, which was included within the package for the sectoral orientation of this study, were vaguely addressed while discussions primarily focussed on end of pipe treatments rather than alternative strategies. Commitment to mitigation measures (e.g., plan and schedule for monitoring) was somewhat mentioned in the reports but lacked detailed description on in-house experts responsible for implementation of mitigation measures and routine monitoring, plan of incorporating monitoring outcome and plan of research facilities within the project. Absence of elaborated discussion for mitigation measures may have a cause-effect relationship with commitment from proponent's side. Previous study by Kabir & Momtaz (2018) also identified omissions and deficiencies in similar sub-criteria within the EISs of Bangladesh.

The developed countries are faced with similar challenges. Lee and George (2000; p.141) mentioned this broad area as one of the least satisfactory areas within the EISs of developed countries "due to insufficient consideration of alternatives and insufficient commitment by the developer or promoter to the mitigation measures". Similar observations were made for South Africa and Sudan (Sandham & Pretorius, 2008; Ahmed & Abdella Elturabi, 2011).

Deficiencies within this broad area were observed in description of mitigation measures, details on their implementation and effectiveness, along with monitoring provisions for developed countries (Barker & Wood, 1999). Although only 25% of reports performed unsatisfactorily in this broad area for developed countries (Barker & Wood, 1999). While this share is 69% for Tanzania and less than 50% for South Africa (Mwalyosi & Hughes, 1998; Sandham, et al., 2013).

iv) Communication of result (Area Four)

Performance of EISs in this research was found at borderline for this broad area (Grade C for one and grade D for four EISs). Reports received satisfactory grades in logical arrangement of chapters, list of acronyms, consistency in terminologies throughout the report. Statement on aims of EIA received borderline evaluation. On the other hand, the reports failed in utilizing data and evidence while arriving at conclusion. Also, conclusions have mostly shown bias towards the project, which is not unexpected considering lack of accountability and transparency in the system. Non-technical summary of these reports also appeared unsatisfactory with the use of excess technical terminologies and inadequate contents. On the contrary, Kabir & Momtaz (2018) found 80% of the EISs performing satisfactorily in this area for Bangladesh. Although they noted nontechnical summaries being 'full of jargon and technical terms'. They also mentioned that the EIA reports written in English limit the scope of understanding by general public (Kabir & Momtaz, 2012), which is also realized by researcher in this study.

For Malaysia, South Africa and Odessa (India), EISs were found performing best to second best at this area (Ibrahim, 1992; Sandham & Pretorius, 2008; Rout, 1994). However, for Tanzania, the experts found the recommendations in EISs unclear to be used by project proponents (Mwalyosi & Hughes, 1998). For developing countries, this broad area was identified performing "better than average" (Lee and George, 2000, p.141) or "one of the better performed areas" (Barker & Wood, 1999, p.393). Unsatisfactory segment for EISs of developed countries were attributable to biased reporting and inadequate nontechnical summaries within this broad area (Lee & George, 2000; Barker & Wood, 1999).

Summarizing the discussion within this section it can be said that this research has found quality of EISs from all five textile units unsatisfactory. Here, four out of five reports received D and the fifth received grade C in area four. In the other three broad areas, at least three among five EIA reports received grade E. This evaluation makes area four (communication of results) as the ‘best performed area’ for the sample reports from textile industry of Bangladesh although all the EISs scored at borderline in area four. Area three (alternatives and mitigation) is the worst performed area within EISs of textile industry in Bangladesh according to this evaluation.

Chapter summary

The results and discussion presented in this chapter has identified the practice of pre-decision stage of EIA for textile industry in Bangladesh unsatisfactory to a great extent. Among the stakeholders with great potential to impact the EIA practice at pre-decision stage, regulators (EIS reviewers) seemed to be lagging the most. Although most of the drawbacks can be directly linked to the system deficiencies e.g., lack of resource, sectoral expertise for EIS review, clear legal provision, quality control, transparency, sectoral guideline, efforts need to be made from stakeholders’ sides too. Alongside, quality of EIA reports belonging to textile units in Bangladesh appeared very poor considering Lee-Colley’s review package which was amended for this research. Especially the evaluation of environmental impacts, consideration of alternatives and proposals for mitigation measures are very poorly addressed within the reports. Lack of system for accreditation of EIA consultants, sectoral guidelines for preparing and reviewing EIS; lack of knowledge & commitment from proponents’ side can be identified as some of the factors affecting the quality of EIA reports.

Chapter Ten: Evaluation of the post decision stage of EIA practice for textile industry in Bangladesh

Chapter ten evaluates the post decision stage of EIA practice for textile industry in Bangladesh. Subsequently, this chapter evaluates the role of relevant stakeholders in post decision stage of EIA and performance of case study textile units in Bangladesh. The chapter is divided into three main sections. First two sections evaluate the role of relevant stakeholders (i.e., project proponents and monitoring & enforcement officials from DoE) for post-decision stage of EIA practice. The information for this evaluation is gathered from author's face-to-face interview with these stakeholders. Following on, the third section evaluates the performance of textile units in adopting technical measures and environmental management plans. The information in the third section is gathered from the checklist filled up in the site visits. Each of these sections begins with results of the evaluation drawn from the framework of analysis, which is followed by discussion around the findings in comparison with the global scenario. This chapter establishes the second half of the fourth objective of this research.

10.1 Evaluating the role of stakeholders: Regulators (monitoring and enforcement officials) in post decision stage of EIA practice for textile industry in Bangladesh

Department of Environment (DoE) is known as "the country's primary environmental regulatory authority" (The World Bank, 2018, p. 22). Therefore, they reserve the role of EIA regulator. The officials from monitoring and enforcement department of DoE visit the industrial units at regular interval for the purpose of monitoring. Researcher interviewed two monitoring and enforcement officials (one from head office, another from zonal office), to understand the stated practice of DoE. Due to Covid-19 situation and lockdown, researcher was not able access other participants from rest of the zonal offices.

10.1.1 Results of evaluation of role of monitoring and enforcement officials

Apart from the regular annual visit by DoE, sample collectors also visit red category units quarterly for collecting wastewater samples. For this purpose, these units are required to apply to DoE with fee every three months. Report from the annual visits and quarterly wastewater sample test results are consulted during ECC renewal (interviewee #2). However, DoE still does not have an automated system to follow up whether the factories are applying for renewals or quarterly wastewater sample collection within due time (table 10.1) (The World Bank, 2018). It can only be verified by checking the documents on the annual monitoring visits (Interviewee #2).

In their monitoring visits, the officials fill up a checklist and verify the compliance to the conditions provided with ECC. Same checklist accompanies monitoring visit to all types of factories (see Appendix VIII). The officials suggested, compliance to the mitigation measures promised in respective EIS/environmental management plan (EMP) report is hardly substantiated in these visits (see Appendix I for interview questions). There is no provision of checking EIA reports on site. The visits extend for around one hour according to monitoring officials of head office and officials from zonal office report visiting two to five factories in a day, depending on their size (interviewee #2 and #3).

No sector specific expert accompanies the monitoring team to these visits, therefore making technical notations appear tricky on site (interviewee #3). It can also elongate the duration of monitoring visits (interviewee #3).

The polluters' pay for not conforming to the rule or standard parameters is calculated based on cost avoidance principle (interviewee #2), which can be identified as "ad-hoc basis of polluters' pay principle" (The World Bank, 2018, p. 04).

Table 10.1 Evaluation of the role of DoE monitoring and enforcement department

Components	**Criteria**	**Sub-criteria**	**Findings**	**Remarks**
Post-decision stage of EIA practice	Role of Stakeholders (Monitoring & enforcement officials)	Adequate role played by the environmental agency in successfully implementing the mitigation measures proposed by factories	⊖	Without technical experts in team, it is difficult to identify this discrepancy in monitoring visits. Especially the zonal offices face great challenges.
		Both implementation and impact monitoring take place	⊖	Operation and effluent parameters of Effluent Treatment Plant (ETP) are prioritized in monitoring visits, so impact monitoring exists in some manner. Mitigation measures proposed in EIA get little or no attention, although ECC

Components	Criteria	Sub-criteria	Findings	Remarks
				conditions are checked. Thus, implementation monitoring is often ignored.
		Regular monitoring performed since project inception	⊖	Only one visit before providing ECC
		Adequate resources available to monitoring team	➖	Lack of technical experts, logistics and overall manpower
		Monitoring is prioritized for factories belonging to major economic sectors	➖	Sudden Monitoring visit is performed based on complaints/reports, regular visits are performed annually based on zones due to lack of logistics.
		Monitoring is prioritized for pollution intensive (Red category) factories	➖	
		Adequate provision to find out factories skipping ECC or regular reporting or renewal for ECC	➖	No visible provision of record keeping it can only be verified through site visit
		Regular interval between monitoring (visits) visible.	⊕	Quarterly sample collection is scheduled. but not always possible due to lack of logistics. Annual visit is performed
		Adequate provision to determine the compensation and penalizing polluting factories	➖	Compensation is calculated based on cost avoidance principal and environmental cost is not incorporated.

Explanation of the symbols:

➕ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*

➖ = *Unsatisfactory,* ❓= *Unclear*

Source: Face-to-face interview (2020) by researcher; The World Bank (2018)

From table 10.1 it could be observed that eight out of nine sub-criteria used for evaluating role of the monitoring & enforcement officials are identified as unsatisfactory.

10.1.2 Discussion on the evaluation of role of monitoring and enforcement officials

Limited operational support for monitoring and follow-up is one of the key challenges of EIA in developing countries (Arnold & Hanna, 2017). Likewise, lack of manpower and funding to great extent, lack of comprehensive database, absence of opportunity for specialization and other research opportunities are some of the factors responsible for challenging the monitoring and follow-up of industrial units in Bangladesh by DoE.

The regional offices of DoE are understaffed and burdened with multiple responsibilities (interviewee #3). The World Bank (2017; p.24) suggested complete separation between staffs from environmental clearance and monitoring & enforcement can enhance efficiency and accountability. Also being burdened with excessive responsibilities impede the officials' scope to specialize in any sector (Interviewee #1 and #3). On the other hand, DoE is still does not have comprehensive database on EIA reports, inspection, fines and compensation charged-which impacts effective monitoring (The World Bank, 2018). Alongside, the textile units in Bangladesh often seem to apply for ECC after starting operation, mostly while signing contracts with international brands (interviewee #9, #10). Factories not having direct contract with international brands or serving only in domestic market also tend to skip ECC (interviewee #8). DoE cannot identify these units due to lack of database on industrial units of Bangladesh. A standard data management mechanism for DoE and competent staffs to review monitoring data and follow up with polluters is recommended by the World Bank (2018).

Alongside, there is no formal provision for auditing proponents' commitments in the EIA system of Bangladesh (Ahmed & Ferdausi, 2016). Experts suggested, ECC renewal requirement is considered as pseudo auditing mechanism by experts (Ahmed & Ferdausi, 2016). Report from annual monitoring visits and quarterly wastewater sample test results impact the decision on ECC renewal. On the other hand, ILO (2021; p.42) argues that for EIA in developing countries "Follow-up on whether mitigation actions agreed to as part of the development consent or certification process actually took place is rare". Due to insufficient time and manpower, monitoring officials in Bangladesh are not able to verify the adopted measures with EISs on site. Therefore, implementation monitoring hardly takes place in Bangladesh. While monitoring, mostly ECC conditions and wastewater parameters are substantiated. Besides, Effluent Treatment Plant (ETP) is visited. The checklist followed by the monitoring officials indicate that irrespective of sectors, EIA monitoring in the country basically revolves around wastewater quality (Appendix VIII). Sometimes the officials may also enter the production area within the factory, although it is often too large for them to cover (Interviewee #2). Therefore, neither the sector specific concerns are monitored during the visits, nor the officials can immediately spot technical discrepancies due to lack of specialized knowledge (interviewee #3). Limited resource also hinders prioritizing visit to pollution intensive industrial units (e.g., textile, pharmaceuticals, paper & pulp). Therefore, monitoring visits by DoE take place based on geographic zones (Interviewee #1). One of the experts (interviewee #9) commented,

> "There are around 4000 red category factories those need quarterly reporting. In current system, DoE would need to visit 1500-2000 units every month. It is not possible to meet such ambitious goal with their resources. They can use self-reporting by proponents and then verify a percentage of them randomly. Although it might appear challenging to maintain the confidentiality of the verification visit."

Therefore, the number of polluting industries is already high compared to the degree of enforcement activities (i.e., punishment and/or fine) by DoE (The World Bank, 2018). In year 2014-15, around 70% of the factories subjected to monitoring and enforcement by DoE were textile units (The World Bank, 2018). Since there is potentially a great number of non-compliant textile units, DoE can perform rather effective monitoring with a sector specific monitoring checklist. Although, the common monitoring checklist by DoE lists some textile sector-oriented queries (see Appendix VIII), there is no evidence of these information being utilized.

Although a range of fine (see table 8.1 in chapter eight) is listed in the amendment of ECA'95 (DoE, 2010), experts have expressed the concern that fine charged is often lesser than the impact created on environment (interviewee #2 and #9). This is specifically true when chemical or pharmaceutical units are involved (interviewee #2 and #9). However, there is no established system of incorporating environmental costs within the fine. Neither there is any evidence of such research by DoE. The significance of such penalty[75] is not realized by proponents since the repeated or volume of offence is either ignored while estimating the fine, or not the fine

[75] Author uses penalty is for both fine and punishment, while fine indicates monitory charges.

itself is not enough high (The World Bank, 2018). See section 8.1.2 in chapter eight for more discussion on this.

Lastly, there is no evidence of overall EIA system (legislation or procedure) being monitored or amended in last 24 years in Bangladesh (discussed in sections 8.1 and 8.3, chapter eight). Lack of comprehensive record keeping mechanism can also impede effective monitoring or amendment of the EIA system, since there is no provision to learn from previous errors. The attempts of upgradation of relevant regulation can reflect the intent of the authority to upgrade the standard of the EIA system itself. India's EIA notifications have been amended 50 times since 1994 (Jha-Thakur & Khosravi, 2021). Amendments of relevant regulation in Bangladesh rarely addresses the EIA process, rather are mostly concerned with the clearance process. On the other hand, Wood (2003) suggested, overall EIA system needs monitoring to understand whether existing regulations, guidelines, or enforcement adequate. If not, they can be amended from experience (Wood, 2003). Recently the generic EIA guideline for industries in Bangladesh has been updated after 24 years since inception.

DoE is the only institution with mandate for environmental protection in Bangladesh and has been given wide powers to fulfil that (The World Bank, 2018). Unfortunately, they are not equipped effectively to exercise this power (The World Bank, 2018). To ensure environmental sustainability in the country utmost priority should be given to strengthening DoE. Even after having various trainings on capacity building, DoE officials are not able to utilize those effectively due to lack of manpower (interviewee #11).

10.2 Evaluating the role of stakeholders: project proponents in post decision stage of EIA practice for textile industry in Bangladesh

Researcher interviewed representatives of proponents from three formal textile units taken as case studies (identified as CS1, CS2 and CS3 throughout this report). The interviews helped to understand their role in environmental protection and management for their units. The case study analysis further involved evaluating EIS quality (discussed in section 9.3, chapter nine) and performance in adopting mitigation and environmental management measures (discussed in section 10.3, within this chapter). Proponents' effort in taking these measures also reflects their intent and perception on environmental protection for their units.

Role of project proponents is evaluated in both pre and post decision stage of EIA for textile industry in Bangladesh. The first is already discussed in section 9.2 of chapter nine. The latter is described in the following-

10.2.1 Results of evaluation of role of project proponents

All the proponents currently have updated ECCs, since it is a prerequisite to continue business with the international brands (interviewee #6, #8, #10). However, two of them have somehow ran operation without ECC for at least 8 years (see section 9.2 in chapter nine). The international brands are now more concerned about social and environmental compliance of the manufacturing units running overseas (interviewee #10). Therefore, the textile units are also subjected to environmental audits by them. The proponents are rather attentive to these audits to uphold their corporate image and cost-benefit analysis within the audit reports (Interviewee #6, #7, #10).

DoE imposed an obligatory clause for developing a 3R strategy (alternatively called as Zero liquid discharge plan (ZLD)) to the industrial units of the country from year 2014. By 2020, only one of the proponents from the case study units have submitted ZLD plan to DoE. Alongside two of them also (CS1 and CS2) have record of being penalized by DoE for non-compliance to the environmental parameters (table 10.3). CS1 is still performing very poorly in environmental and chemical management. They did not have inhouse environmental expert or inhouse research facility and chemical experts at the time of interview (see section 10.3.2 for more discussion on this). The participant implied that mitigation measures adopted by them were mostly instructed by different brands. Therefore, CS1 seemed rather influenced by brands than DoE. On the other hand, the managers of CS3 appeared more responsive towards environmental management. They have dedicated environmental expert and have been involved with self-assessment indices, multiple ecolabels and complying to MRSL[76]. They have also submitted Zero Liquid Discharge plan for their unit to DoE. Management of CS2 reported adopting varieties of environmental protection measures specially in terms of upgrading machines and ensuring resource efficiency (see 10.3.1 for measures adopted by case studies). Large part of this is attributable to their involvement with PaCT[77]. However, continuous effort and research is still required for all of them to ensure existing environmental protection measures are functioning as expected.

[76] Manufacturing Restricted Substance List
[77] For clean production practice and resource efficiency in the export-oriented textile units of Bangladesh

Performance of their units are discussed in section 10.3. Method followed for interpreting the role of proponents (table 10.3) and performance of their units in adopting EMP (table 10.8) is shown in the following (table 10.2)

Table 10.2 Explanation for interpreting the response of the proponents and checklist on EMP

Responses	**Evaluation**	**Symbol used**
100% responses are positive	Satisfactory	
>50% responses are positive	Mostly Satisfactory	
<50% responses are positive	Mostly unsatisfactory	
100% responses are negative	Unsatisfactory	
No response received or not enough information	Unclear	

Source: Developed by author for this research

Table 10.3 Evaluation of the role of project proponents (from case study textile units)

Components	**Criteria**	**Sub-criteria**	**Findings**	**Remarks**
Post decision stage of EIA practice	Role of stakeholders (project proponents)	Have clean record in adhering to the existing rule (never penalized)		Two of the units were penalized by DoE at least once since inception. Though last wastewater test report is satisfactory for all of them
		In compliance with the 3R strategy (ZLD plan) introduced by DoE in 2014		Only one have submitted ZLD plan to DoE
		Adopted environmental protection measures for their unit		
		Motivated by environmental concern to adopt environmental protection measures		Compliance to buyer requirement, increasing production capacity or resource efficiency are the main motivation
		Intent to accept support and knowledge to enhance their effort in pollution minimization from their units		Most of them expressed grievances for being monitored by multiple organizations (have to attend audit team sent from each of the brands alongside DoE)

Explanation of the symbols:
● = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*
● = *Unsatisfactory,* ❓ = *Unclear*

Source: Field visit (2020) by Researcher

Table 10.3 identified that three out of five sub-criteria used for evaluating role of project proponents as mostly unsatisfactory, in post decision stage of EIA.

10.2.2 Discussion on evaluation of role of project proponents

In 2013, collapse of a readymade garment (RMG) factory in Bangladesh resulting in death of at least 1,132 people and injury of more than 2,500 (ILO, 2017) alarmed all the international brands upon imposing strict environmental and social compliance to their suppliers (interviewee #10). Due to increased enforcement, factory owners also started acknowledging authority of DoE in the similar timeframe (2010-2011) (interviewee #1). Probably this is when, many of the textile units of Bangladesh started taking steps towards social and environmental compliance.

Proponents of industrial projects have the potential to influence EIA process and enhance the environmental outcomes by great extent (ILO, 2021). Author in this study have sensed their relaxed attitude towards EIA, which is already discussed in section 9.2 of chapter nine. Apart from this, two of them were also penalized by DoE for non-compliance to environmental parameters. When asked, one of the units informed that they did not have any in-house environmental specialist at the time of interview, even while they were into business for 13 years (see interview questions in Appendix I). Therefore, the technical measure adopted by this unit are mostly imposed by the international brands. Such scenario can indicate this proponent's relaxed attitude towards overall environmental protection. In fact, DoE's initiative of conditioning ECC renewal with submission of 3R strategy (started around 2014) have compelled only one out of the three proponents in preparing the strategy for their unit and submit it by 2020. The aim of 3R strategy is to achieve Zero liquid discharge alongside environmental management system (EMS) in respective units. A study by DoE (2017) have found that only one out of ten units with approved ZLD plan is implementing it in practice. One of the experts (Interviewee #9) fear that currently implementation of ZLD plan is moving very slow. He commented,

> "India has been able to do it very easily. Both their expertise and policy making played important role in it. Their policy is very stringent, so is their judicial system".

On the other hand, DoE (2017) identified attitude of the industry as a major factor in achieving zero discharge. ILO (2021; p.04) identifies weakness in EIA system of developing countries involve “the lack of awareness and experience of industrial proponents on the importance of EIA and the need to mitigate environmental impacts, and how this links to sustainable development”. Such reluctance in post decision stage is identified as major constraint in advancement of EIA practice in Bangladesh (Kabir, 2012). As observed in UK, the culture of resistance and disownment of implementors can potentially impede the implementation of EIA (Jha-Thakur & Fischer, 2016).

On the other hand, interviewee #6 feels that the proponents respond more to the buyers rather than the current EIA process. She commented,

> “EIA process of Bangladesh still isn’t much helpful in safeguarding environment yet”.

The buyers have already led the proponents to incorporate self-assessment indices (e.g., Higgs, BEPI) within their units. The proponents are also willing to adopt other environmental policy instruments (e.g., EMS) if their buyer insists (interviewee #14, #16). Apart from these voluntary policy instruments, they have adopted several technical measures for their units, mostly being motivated by the brands (e.g., installing machines that consume less water or recycle water). While asked about strategies to keep proponents interested in doing so (see Appendix I for interview questions) one of the consultants (interviewee #7) suggested that proponents are not completely recluse, and they can be responsive to environmental protection measures if explained in financial terms. Financial analysts might not be well informed of the long-term benefits of environmental good practices (OECD, 2001). Therefore, the need of knowledgeable environmental experts who can effectively disseminate knowledge to the proponents regarding benefits of environmental good practice is essential.

Literacy rate in Bangladesh has reached from 30% in 1991 to 74.6% by 2019, however people’s awareness regarding environmental issues is still questionable. Currently there are seven government institutes offering undergraduate degree in textile engineering, six offering diploma in textile technology, 41 textiles vocational instates offering education on textile up to tenth class. As per researcher’s knowledge, rarely any renowned Universities in Bangladesh offering the course on Textile Engineering includes environmental management or EIA within the curriculum. Only recently (2018) Bangladesh University of Textile (BUTEX) have introduced “Department of Environmental Science and Engineering” for undergraduate class (Interviewee #9, see interview questions in Appendix I). Therefore, the prospective proponents or employees in textile industry of Bangladesh are most likely unaware of its environmental impacts and need of the mitigation measures. Proponents' awareness on environmental protection or good environmental practice enhances the possibility of better implementation of environmental protection measures (Jha-Thakur, 2011). Kabir (2012) implied that as long as the proponents perceive that the purpose of EIA is to only gain ECC, effective implementation and mitigation measures will likely be overlooked.

10.3 Evaluating the performance of textile units in adopting mitigation measures and environmental management plan

Performance of textile units in Bangladesh was evaluated as a part of case study analysis. Apart from this, EISs of these units were reviewed to evaluate their quality (see section 9.4 in chapter nine) and respective proponents were interviewed to understand their role in pre and post decision stage of EIA (see section 9.2 in chapter nine, section 10.2 in chapter 10 for discussion) within the case study analysis.

The practice of adopting technical measures and environmental management plan by the case study textile units (CS1, CS2, CS3) is evaluated using checklist. The checklists were filled up by visiting the production area and conversation with employees. Visit to the case study units extended for three hours each. The checklists were primarily prepared from national guidelines. The checklist for EMP was further amended from sector-specific international guidelines (see chapter seven for details).

Introduction to the case studies

Three red category, formal textile units are selected as case studies for this research. Rationale of selection and method of data collection from these units are already described in section 2.4.1 in chapter two, under the title "case study analysis".

These textile units are primarily producing for international brands. All of them currently have ECC. Two of the cases have performed EIA study, while the other only prepared environmental management plan (EMP) to obtain ECC. These case study units are denoted as CS1, CS2 and CS3 throughout the research. Brief information on them is provided in table 10.4.

Table 10.4 Brief profile of case study units

	CS 1	CS 2	CS 3
General information			
Type of factory based on process	Knit composite	Woven Dyeing and printing	Knit composite
Category of factory according to ECR'97	Red (heavy polluting)	Red (heavy polluting)	Red (heavy polluting)
Location	Tongi, Gazipur, Bangladesh	Tongi, Gazipur, Bangladesh	Gazipur Konabari, Bangladesh
Operating since	2006	1984	2007
Land Area	60,000 square feet (sqft) (approx.)	unknown	330,000 sqft (approx.)
Employee	1700 (approx.)	1,600 (approx.)	3,500 (approx.)
Target market	International market	Domestic and international market	International market
EIA and ECC related information			
EIA conducted	Yes	No[78]	Yes
Environmental Management Plan (EMP) prepared	Yes	Yes, according to them (but was not able to show it)	Yes
Presence of ECC[79]	Yes	Yes	Yes
First year of ECC application	2014	No information	2009

Source: Field visit by author (2020)

Location

The case studies are located in Gazipur district within Dhaka division (figure 10.1). CS1 and CS2 are located near Tongi area and CS3 is located near Konabari area of Gazipur. Gazipur is a major industrial region within Dhaka division of Bangladesh (ICE Business Times, 2014). Dhaka city is the capital of Bangladesh, situated within Dhaka district. Dhaka district along with other districts comprise Dhaka division. Gazipur has been recognized as a centre of Textiles and garments in this sub-continent ever since the Middle Ages, while Bangladesh was famous in the world for Muslin Fabric (ICE Business Times, 2014). It is still considered as a

[78] In Bangladesh, new red category units are required to submit full EIA report while existing factories at the time regulation came into force, are only required to submit an EMP to get Environmental Clearance Certificate (ECC) (discussed in 5.4.4).
[79] Environmental clearance certificate

"happening place for Knitwear". Connectivity, availability of skilled artisans are some of the factors making ideal ground for this district to be considered as a prominent industrial hub of the country (ICE Business Times, 2014).

All three case study units are red category units. Two of these units are located near water bodies. They are located near Turag river and Tongi canal. The third unit does not have any water body in close vicinity. Although they have a water treatment plant (figure 10.8) apart from ETP. The treated wastewater is discharged into local drainage system (figure 10.9).

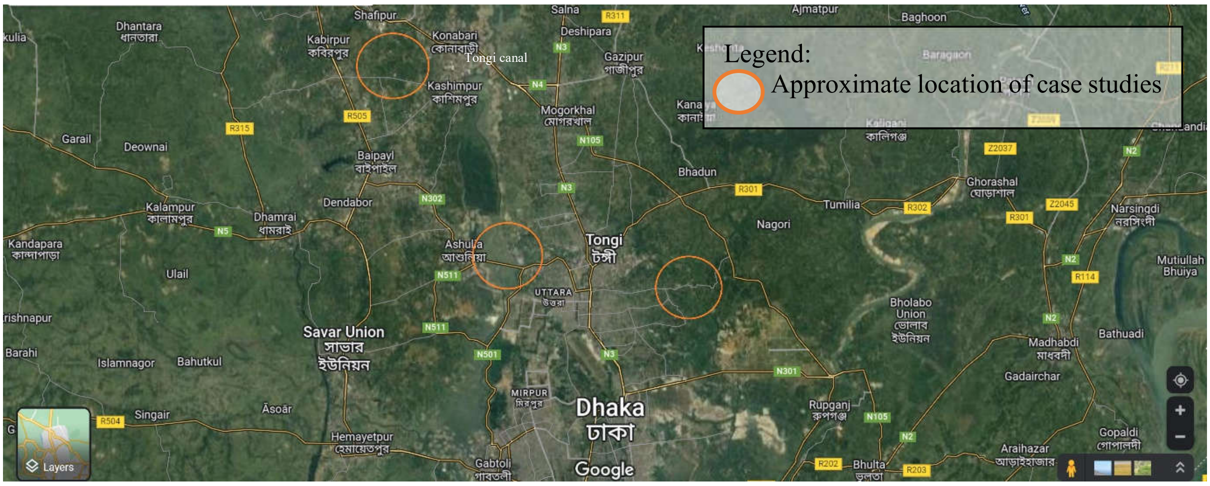


Figure 10.1 Location of case study units

Source: Prepared by author using Google Map

Visit to case studies

The distance travelled by author to visit the case studies CS1, CS2 and CS3 are approximately 27 kilometers (km), 24 km and 50km respectively. For the first two case studies, author travelled by car. For CS3, author travelled by bus.

After arriving at the textile units, the author first collected the EIA reports and browsed through them. Then she conversed with the representative of the proponents of the case studies. This took place in a form of semi structured interview to understand their perception of EIA and environmental management of their units. The author then took a tour of the production area of the units and their ETP (figure 10.6, 10.7). This tour helped in understanding the production practices and equipment used in textile units of Bangladesh (figure 10.2-10.9). During this tour, she gathered information from the employees regarding the technical measures, environmental management plan and practices within the units. Photos taken by author from the case study unit visit are shown in figure 10.2 to 10.9.

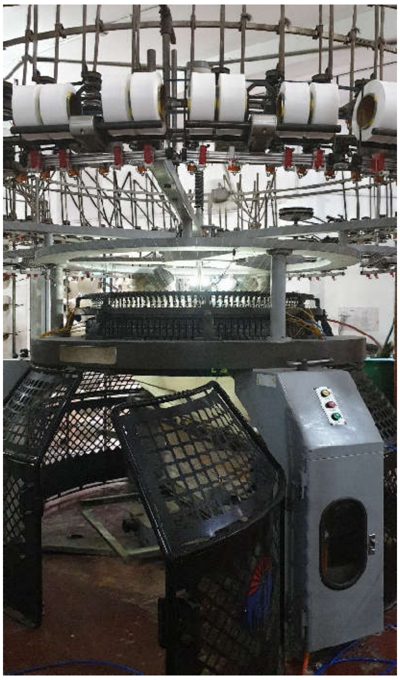


Figure 10.2 Circular knitting machine

Source: Author (2020) in field visit of case study units

Figure 10.3 Flat knitting machine

Source: Author (2020) in field visit of case study units

Figure 10.4 Drying wet fabric

Source: Author (2020) in field visit of case study units

Figure 10.5 Drying and folding fabric

Source: Author (2020) in field visit of case study units

Figure 10.6 Equalization tank in ETP

Source: Author (2020) in field visit of case study units

Figure 10.7 Water discharged into ETP for treatment

Source: Author (2020) in field visit of case study units

Figure 10.8 Water treatment plant in one of the case study units

Source: Author (2020) in field visit of case study units

Figure 10.9 Water discharged from ETP outlet into local drainage

Source: Author (2020) in field visit of case study units

Environmental assessment and management related information

All of the case studies have updated ECC. Two of them have submitted EIA reports to get ECC. The third case study submitted EMP in order to get ECC. Only one of them (CS3) started operation after getting ECC. CS1 started operation in 2006 and submitted EIA report 12 years after starting operation. CS2 started operation before the ECR'97 came into action and applied for ECC within past 10 years. More information relevant to their environmental management can be found in section 10.3.1 and 10.3.2. Proponents' role in environmental assessment and management of these units are described in section 10.2 of this chapter and section 9.2 of chapter nine.

10.3.1 Results of evaluation of performance of textile units in adopting technical measures and EMP

The tables used in gathering information from site visit regarding the technical measures adopted by case study units is shown in the Appendix III. The proponents' responses by cases are shown in the table 10.6, 10.7 and 10.8.

The technical measures adopted by the units were evaluated using two tables: one is for manufacturing processes; another is for wastewater treatment plant (table 10.6 & 10.7). The symbols used by author for interpreting the results from table 10.6 and 10.7 are shown in table 10.5. Many of the listed processes are not relevant for knit composite units as their machines often contain multiple processes. These are identified as 'NA' in table 10.6.

Table 10.5 Symbols used for depicting responses from case studies on technical measures

Symbols	Meaning
🟠 🔵 🟢	Response from CS1, CS2, CS3 respectively
✓	Exists
✗	Does not exist
?	Insufficient (or no) information available
NA	Not applicable

Source: Prepared and used by author for this study

Although the EISs reviewed in this study have incorporated EMPs, evaluation in this segment was performed solely based on findings from site visit (table 10.8). Information on EMP adopted by the units are shown in table 10.8. Interpretation of the symbols is already shown in table 10.2.

Table 10.6 Performance of case study units in adopting technical measures in production processes for impact mitigation

Measures → /Processes ↓	i.Housekeeping	ii. Process/equipment modify	iii. Chemical recovery	iv. Chemical substitute	v. Water conservation	vi. Innovation technology
a. Sizing			NA ✗ NA	NA ✗ NA		
b. Desizing		NA ✓ NA		NA ✓ NA	NA ✗ NA	
c. Soaping				NA NA ✓		
d. Scouring		✓ ? ✓		✓ ? ✓	✗ ✗ ✓	
e. Chemicking						
f. Washing		✗ ✓ ✓			✗ ✓ ✓	
g. Bleaching		? ✗ ✓			? ✗ ✓	
h. Mercerizing		NA ✗ NA	NA ✗ NA		NA ✗ NA	
i. Dyeing		Pad batch operation ✓ ✓ ✗	✗ ✗ ✗	Disperse dye chemical ✗ ✗ ✗	NA NA NA	Short liquor dye used ✗ ✗ ✓
		Use of Disperse and reactive dye ✓ ✓ ✓		Reduced stages in process ✓ ✗ ✓		Energy saving in pad batch dyeing ? ✓ NA

Measures → /Processes ↓	i.Housekeeping	ii. Process/equipment modify	iii. Chemical recovery	iv. Chemical substitute	v. Water conservation	vi. Innovation technology
						Urea reduction ✗ ✗ ✗ **Automatic dye dispenses** ✗ ✓ ✗
j. Printing		✓ ? ✓		✗ ✗ ✗	? ✓ ?	
k. Finishing		? ? ?		? ? ?	✗ ✗ ✗	✗ ✗ ✓
l. Effective Water management	**#Flow indicator** ✓ ✓ ✓ **#Flow meter** ✓ ✓ ✓					

Source: Field visit (2020) by researcher

Table 10.7 Performance of the case studies in adopting technical measures for wastewater treatment processes within ETP for impact mitigation

Segregated collection(piping) of waste from process	**ETP includes both primary and secondary treatment**	**Primary treatment process**	**Secondary treatment process**	**Stabilization pond** (minimum specifications met)	**Wastewater Parameters within acceptable limit according to last test**
✗ ✗ ✓	✓ ✓ ✓	Include Pre-aeration ? ? ✓ **Equalization tank** active for 24hrs ✓ ✓ ✓ **Neutralized before secondary treatment** ✓ ✓ ✓ Includes coagulant in chemical processing ✓ ✓ NA	Includes Trickling filter ✗ ✗ ✓ Includes activated sludge process ✓ ✓ ✓	**depth of pond (<1.2m)** ? ? ✗ **BOD load value 55-100kg/ha/day** ? ? ✓ **low ratio of BOD:MLSS** ? ? ✗	✓ ✓ ✓

Source: Field visit (2020) by researcher

Table 10.8 Performance of the case studies in adopting EMP based on site visit

Components	**Criteria**	**Sub-criteria**			**Findings**	**Remarks**
Adhering to mitigation measures and environmental management plan	Performance in environmental management plan	Management plans	Chemical management	Written management policy	⊖	Written policy exists in most cases but lacks significant issues like Responsibility matrix, inventory management, chemical disposal etc
				Comprehensive chemical inventory	⊕	Satisfactory for CS2 and CS3. But hazard classification is lacked in the inventory of CS1.
				Assigned trained person	⊖	Mostly a person is assigned but lacks training or unable to show the certifications
				Existence of in-house chemical research team	⛔	None of the cases included
				Risk assessment for hazardous chemicals	⛔	Not performed by anyone since no such research team exists in any of these factories
				Separate storage for hazardous or flammable chemical	⛔	No separate storage provided by any of the cases
			Waste management	Process exists for identification of source	⊕	Does not exist for CS1
				Waste inventory available and maintained	⊕	Does not exist for CS1
				Appropriate waste storage	⛔	No separate designation of storage based on the category or hazard level of the waste.
				Trained ETP manager and Documented ETP operating procedure	⊖	Only exists for CS3

Components	Criteria	Sub-criteria			Findings	Remarks
				Reuse-recycle practice for sludge	⊖	Only exists for CS3
				Waste reduction plan	⊝	Does not exist for anyone
			Safety measures	Availability and maintenance of protective gear for workers handling chemicals	⊝	Was not observed in visit and need assessment never performed by any of the cases
				Safety gears used by workers in other sections	⊖	Mostly not worn. Very few use gloves
				Emergency response plan for all sorts of situation (e.g., fire, chemical spillage, flood)	⊖	Not sufficient for CS1 and CS2. CS3 has emergency response plan for all these.
			Dedicated staff for environmental management		⊖	CS1 does not have any
		Monitoring plans	Regular housekeeping (**Checking, Repairing** faults regularly)		⊕	
			Effluent and emissions	Wastewater	⊖	CS2 and CS3 regularly monitors significant parameters, in house, but inhouse monitoring does not exist for CS1.
				Air emissions	⊖	The guideline mentions frequency should be 24hours for two days a week. Only CS3 conducts yearly monitoring for Green House Gases. Other units do not conduct monitoring by themselves but depend on DoE's monitoring.

Components	Criteria	Sub-criteria			Findings	Remarks
				Solid waste	⊖	Sold to third party, most of those do not have license. Audit was never conducted for them.
			Provision of internal audit		⊕	Does not exist for CS1
			Regular third-party audits		✚	
		Follow mitigation measures proposed in the EIS or EMP			━	Have no idea about the contents of the EIS/EMP submitted, however majority seem to follow some sort of self-assessment indices and ecolabelling

Explanation of the symbols:

✚ = *Satisfactory,* ⊕ = *Mostly satisfactory,* ⊖ = *Mostly unsatisfactory*

━ = *Unsatisfactory,* ❓ = *Unclear*

Source: Field visit (2020) by researcher

Table 10.6 listed 15 positive responses from CS3, 11 from CS2 and eight from CS1 regarding technical measures adopted for environmental protection. Visibly CS3 adopted wide variety of technical measures among the case studies. On the other hand, majority of sub-criteria used for evaluating EMP of the case appeared mostly unsatisfactory to unsatisfactory (50% and 29% respectively, see table 10.8).

Although the proponents were unaware of the contents of EIS submitted by their own units, all of them adopted some sort of environmental protection measures. Process or equipment upgradation was the most common measure taken by the cases in favour of environment (table 10.6). Since this information is rarely visible in respective EISs, therefore the units were probably influenced by buyers. Especially, CS1 reported explicitly about being influenced by buyers to adopt environmental protection measures; although most likely in a limited manner (table 10.6, 10.9). They improved dye ratio for only one machine. CS2 included automated dye dispensing in yarn dyeing and printing. Apart from these, no significant effort could be identified behind substitution or recovery of the chemicals by CS1 or CS2. On the contrary, CS3 reported complying with MRSL, which could help them reducing the environmental impacts caused by toxic chemicals to some extent. They also reported using short liquor dye in their machines. Being modern knit composite units, CS1 and CS3 had advanced machinery intending for production efficiency, thus can be assumed to support in resource minimization to some extent. CS2 also started the process of reusing wastewater from some machines after basic treatment. The other two cases (CS1, CS3) have not taken any such initiative yet. Since the polluted wastewater is largely attributable to negative environmental impacts, reducing its volume could possibly make a difference. CS2 was also involved in PaCT which led them into upgrading some of their machines aiming at energy saving. Along with that, they have been upgrading their dye machines gradually to ensure lesser amount of dye is used, to ensure resource efficiency (see table 10.9).

In case of wastewater treatment, all the cases seemed to be doing well, since their latest wastewater reports were certified satisfactory by DoE. All the cases reported following standard procedure for ETP in respective units (table 10.7). However, this is still difficult to state that if their ETPs are running all the time and none of the wastewater was being bypassed. Alongside, the specifics (i.e., dimensions) of the treatment plant, composition of chemical or biological compounds with respect to wastewater parameter impacts the result of the treatment largely. Due to a lack of sufficient information, this part could not be discussed in detail in this study.

Table 10.9 Technical measures incorporated by the case study units for minimizing environmental impacts

	CS 1	CS 2	CS 3
Measures adopted	- Substitution of chemicals (gradually working on it, but still not adapted MRSL). -Waste reduction (through upgraded machineries) - Reducing use of dye through improving dye ratio for a machine - Compliance to effluent parameters (according to latest report)	-Waste reduction (through upgraded machineries i.e., automated dye dispensing in yarn dyeing, digital printing). -Recovery of energy/heat (through jacket water heat recovery system, heat recovery for gas engine) - Reducing dependency on separate boilers through using exhaust gas boilers (EGB), which can be used to create steam without needing a separate boiler. - wastewater reuse in few machines after basic treatment - substitution of chemicals (through asking for MRSL certifications of chemicals and planning to enter ZDHC) - chemical hazard risk assessment conducted, and separate storage provided for flammable chemicals - Compliance to effluent parameters according to latest report,	- Waste reduction/productio n efficiency through upgrading dyeing and washing machines. - chemical hazard risk identified and maintain chemical compatibility chart. - Complying with MRSL through ZDHC. - Compliance to effluent parameters (according to latest report)

Source: Field visit (2020) by Researcher

Likewise, CS1 was also lagging in the practice of EMP, as it can be seen from table 10.8. Risk of hazards from chemical had been assessed by CS2 and CS3. However, adoption of relevant action was mostly unsatisfactory for the cases. Only CS2 provided separate storage for flammable chemicals. The hazard of mixed waste storage was not acknowledged by any of the cases. These could be attributable to lack of in-house chemical research team. Alongside, importance of protective gears for workers seemed to lack attention. Except CS3, emergency response plan was also unsatisfactory for others. Wastewater parameters are regularly monitored by CS2 and CS3. While, CS3 also monitors air, although the frequency seems insufficient (DoE, 1997a). None of the other cases monitor air quality at all. In case of solid waste management, all the units reported selling solid waste to third party.

10.3.2 Discussion on evaluation of performance of textile units in adopting technical measures and EMP

Experts opine "ultimate effectiveness" of EIA system is largely based on successful implementation of mitigation measures (Sadler, 1998; Wood, 1995; Morrison-Saunders & Bailey, 2000).

Among the case study units, the knit composite units are established within last 15 years. While the woven-dyeing unit seemed to be in the course of upgrading the equipment, the Knit factories are already advantaged with modern equipment (figure 10.10) serving multiple functions and helping in resource efficiency (e.g., water preservation, water reuse, less energy consumption) (interviewee #10). However, any discussion on requirement for equipment upgradation or efficiency of existing equipment could not be found in their EISs. This indicates insufficient attempt in evaluating and incorporating manufacturing processes within the EIA studies of respective textile units. One of the factory representatives (interviewee #14) also indicated that they have updated their process or equipment according to their buyer's suggestions. Interviewee #7 assumed this to be true for the textile units of Bangladesh. The woven factory within the cases was established in 1980s. Now, it has rather older machines (figure 10.11), which are being upgrading gradually. Having complex process, woven factories usually involve large number and variety of machineries (interviewee #10). Therefore, their measures were visibly applied to multiple machines. Apart from being recently established, the knit composite units usually have lesser number of machines. This could be one of the reasons for few initiatives visible to upgrade machines or processes since operation in CS1 and CS3. However, it is difficult to ascertain the adequacy of their adopted measures in reducing environmental impacts without thorough technical assessment, which was not within the scope of this study.

Figure 10.10 Modern machines used in dyeing section of knit composite textile unit
Source: Author (2020) in field visit of case study units

Figure 10.11 machines used for dyeing in Woven-dyeing textile unit
Source: Author (2020) in field visit of case study units

On another note, site visits to the cases found significant lack of attention to chemical (or dye) recovery and reuse. Although the negative environmental impacts of the chemicals involved in textile industry is recognized around the world. While most of them had some sort of policy on chemical management in paper, they did not have any visible attempt to address those. For example: most of the cases did not have clear responsibility matrix, chemical inventory management and chemical disposal plans (table 10.8). None of them took any initiative of recovering chemicals or had automated dye dispensing system[80]. Nor they had performed risk assessment for hazardous chemicals or had dedicated storage for those (figure 10.12 and table 10.8). Most of their dyeing operation was continuous, while pad-batch method is widely recognized as the most economic method of dyeing cotton fabrics in general (DoE, 1997b; Textile Today, 2012). There was no provision of reusing dyeing chemicals or substituting to environment friendly fixing agent or mordants (e.g., using ammonium sulphate instead of acetic acid[81]) in dyeing process. Also, two of them used acetic acid instead of formic acid[82] (UNEP suggested to substitute acetic acid with formic acid in 1992), while the other one used green acid in dye bath. Only one of them used short liquor ratio[83] (7:1 as stated in interview). Since large liquor ratio has negative impacts on environment caused from more carbon emission, this practice indicate energy efficiency intended for the unit's dyeing machine (Shang, 2013; Snowden-Swan, 1995). While two among the three cases had dedicated person for chemical management, they were not adequately trained nor any of them had in-house chemical research team. USEPA (1996) suggests training and knowledge of staff regarding chemical and waste management can help in pollution prevention from processes within textile industry.

[80] "The advantage of such equipment for solid dyes include sealed, dry and safe storage of dyes preventing moisture fluctuations and the elimination of health hazards together with the provision of a high level of accuracy" (Textile Today, 2016)

[81] Used as mordant to attach dye with fabric. Ammonium sulphate is effective alternative to acetic acid. Acetic acid is easily removed in washing, and released in environment, which is harmful to plants, animals and aquatic life. (Kemtex, 2014; National pollution inventory, 2021)

[82] Formic acid is stable and stronger compared to acetic acid, however, can be dangerous if comes to direct contact with skin or ingested. Acetic acid has a BOD of 0.64 Kg BOD/Kg and Formic acid 0.12 Kg BOD/Kg, thus can be more environment friendly if used with caution. On the other hand, green acid can reduce upto 50% of BOD load compared to acetic acid. (UNEP, 1993; Chemsec, 2021; Michigan State University, 2013)

[83] Liquor ratio is defined by volume of liquor per weight of textile to be taken in dyebath, no doubt short liquor ratio reduces COD loads, but performance of dyeing might be compromised (e.g., levelling of shade, wash fastness). (Chakraborty, 2010)

Figure 10.12 Incompatible chemicals kept together in one of the cast study units

Figure 10.13 Workers without protective gears performing printing process in case study unit

Source: Author (2020) in field visit of case study units

In addition to this, two of the units did not have adequate emergency response plan (in case of fire, chemical spillage or flood), lack of which was also observed in their EISs. While for the third, both EIS and written plan within the factory addressed all the emergency situations. On the other hand, author observed that protective gears were still not adequately maintained by the employees. For example: very few were observed wearing gloves within the production area (figure 10.13). The employees did not appear well trained regarding the need of such gears while handling chemicals.

Alongside, neither unit had any written waste reduction policy or appropriate waste storage for diverse wastes produced within the units (figure 10.14). Although, two of them developed waste inventory[84] that can help tracing the waste back to source. Besides, the cases reported selling solid wastes to third parties, but with no knowledge of its final destination. None of the cases were aware whether these third parties had license. Among the three, only one of the cases had provision of separate wastewater collection (pipes) from processes. In case of effluent treatment plant (ETP), all the cases included both primary and secondary treatment

[84] list of items

process[85] and those were working as expected (e.g., equalization tank is active for 24 hours, wastewater is neutralized before secondary treatment). The minimum required specifications for the plant (e.g., depth of pond, BOD load value per day) could not be verified for two of the cases since the responsible persons were not adequately informed. However, the third provided the specifics when asked, but it appeared inadequate according to existing sectoral guideline (DoE, 1997c). On the other hand, only one of the cases had trained ETP manager and well documented ETP procedure. Although two of the cases reported being penalized by DoE for incompliance to wastewater parameters, all their latest test results were satisfactory. Only one among the three cases had re-use, recycle plan for sludge generated from wastewater. Other units were not able to report on the sludge management.

Figure 10.14 Sign saying ""hazardous chemicals: empty drums", while they are disposed together, in an open place

Source: Author (2020) in field visit of case study units

Apart from these, in house monitoring of environmental parameters appeared insufficient for the cases. For example: two among three units kept record of the wastewater parameters in house. On the other hand, only one of the cases monitored air quality parameters once a year

[85] Primary treatment is removal of organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming. The residual organics and solids are removed in secondary treatment (FAO, 1992)

by third party. However, all of them go through third party audits performed by or for the brands.

Finally, it was found that the mitigation measures or EMP listed in the EISs of respective units, had no relation with their practice. It was also identified by Kabir (2012) in his study. Researcher in this study found that none of the factory representatives or dedicated environmental personnel have any idea of the contents of their unit's EIA report. However, they adopted some measures according to their buyers' suggestions and had involved themselves into self-assessment indices like BEPI or Higgs to be easily monitored by buyers. It was difficult for the researcher to assess the adequacy of those measures relating to environmental sustainability of the units.

Quoting from Glasson, et al. (2005, p.04), "monitoring systems should relate to parameters established in the initial project and baseline descriptions". Since, DoE's monitoring primarily focusses on wastewater parameters, they are also likely to be unaware of the units lacking appropriate chemical, waste management, emergency response plans or trained personnel dedicated for these purposes. Initiative to implementation monitoring is still missing from DoE. They only perform impact monitoring, and that too partially (for example: air quality monitoring stations are placed only in few locations and there is no evidence of identifying sound or soil pollution). Therefore, with the current practice, DoE can influence the proponents only until preparation of EIS, while it has limited control over the proponents during the implementation of project and mitigation measures (Kabir, 2012). However, for textile units, brands can play a very significant role in post decision stage of EIA if utilized.

On the other hand, experts found public pressure and local knowledge can play important part achieving better environmental outcomes (Slinger, et al., 2012) as they can have better comprehension on mitigating socio-economic impacts of the project (Momtaz, 2006; Morrison-Saunders & Arts, 2005). Inadequate community participation and monitoring in post ECC stage was observed by experts in Bangladesh (Kabir, 2012; Ahammed & Harvey, 2004). It appears that the country struggles to implement basic mitigation measures within the textile units. Therefore, if the community participation in EIA follow up is not legally mandated it is unlikely to be practiced. Researcher in this study realize, not being legally mandated community participation in EIA follow up would be most likely ignored, while the developing countries struggle to implement even basic mitigation measures. Interviews reveal that once the ECC is obtained, EIA reports are never revisited while monitoring. Thus, compliance to mitigation measures promised within the report is largely absent within the existing industrial units.

Chapter summary

For Bangladesh, post decision stage can still be considered as most neglected part of EIA system, since the practice largely revolves around preparation of EIA reports, followed by inadequate monitoring and lack of knowledge and interest from proponents' side. Even the regulators active at this stage are not able to exercise their power fully due to severe drawbacks within the system. Project proponents lack awareness that negatively impacts the implementation of the environmental protection measures. Although the textile units participating in this research have adopted some such measures. However, these were not contributed by EIA system, but the business prospect with international brands. Textile units producing for international brands in Bangladesh can be easily brought under successful monitoring since they are careful about their corporate image. For this purpose, the strategies should be formulated to utilize this concern and incorporate the EMSs (and other measures) intended for the buyers within the EIA follow-up process.

Section D: Recommendation and Conclusion

Chapter Eleven: Recommendations and Conclusions

This chapter draws overall conclusions of the research and develops recommendations. In doing so, the chapter is presented in four parts. In the first section, the findings of EIA requirements of the textile industry in Bangladesh are compared against the empirical evidence that is collected of EIA practice within the sector. Then, a brief summary of findings relevant to the respective objectives of this study is given in second section. Third section provides recommendations based on those findings. Finally, the fourth section draws concluding remarks to this research. This chapter accomplishes the fifth objective of the research. Findings from previous objectives, which were accomplished with the help of methods like face-to-face interview, document analysis, literature review and case study analysis have cumulatively contributed to achieving this objective.

11.1 Comparative overview of EIA system requirement and practice for textile industry in Bangladesh

This research evaluated the requirement and practice of EIA system for textile industry in Bangladesh against 75 major sub-criteria within framework of analysis (see chapter seven). It not only investigated the presence of model EIA system requirements but also explored their potential and limitations in practice using a framework of analysis. A comparative overview of the requirement and practice of EIA system for textile industry in Bangladesh is shown using Table 11.1. The remarks column is derived from the discussion provided in chapter eight, nine and ten.

The author evaluated 20 major sub-criteria of EIA system concurrently for their requirement and practice in textile industry of Bangladesh in the following table (table 11.1). Six of these sub-criteria does not exist in Bangladesh e.g., provision of independent reviewer, display of approved EIA report. While the requirement for rest of the 14 sub-criteria exists either legally or procedurally (marked as “L” and “G” in the table), half of them is inadequately prescribed (marked as “Ip” in the table). On the contrary, the practice appears unsatisfactory (marked as “U” in the table) for at least 11 sub-criteria. For example: Department of Environment (DoE) is established by law and regulating the EIA process. However, they are overburdened with multiple responsibilities and understaffed to a great extent, thus the practice appeared unsatisfactory.

Table 11.1 Comparison between EIA system requirement and practice for textile industry in Bangladesh

Sub-criteria for evaluation	**Requirement**	**Practice**	**Remarks**
EIA required for environmentally sensitive projects	L	?	No provision of data/record keeping. Thus, difficult to make correct statement on whether all units are conducting EIA. Numbers of ECC renewals are below expectation (Ahmed & Ferdausi, 2016)
Separate environmental agency	L	U	DoE has inadequate manpower, fund, independence & authority over other government agencies (Ahammed & Harvey, 2004; Kabir & Momtaz, 2018). Also lack technical skill to overview sector specific EIA
Linkage of EIA to decision making	L	U	Project needs ECC to start operation and ECC is dependent on result of EIA report review. However, review body does not have veto power over project approval. Projects are not frequently modified because of EIA findings, nor the decision on projects are significantly affected by the EIA results (Ahammed & Harvey, 2004)
Requirement of public consultation in EIA	Ip (L, G)	U	EIA stages requiring public consultation is not prescribed in regulation (DoE, 1997b). The law also does not require public disclosure of approved EIA report (DoE, 2010).
Provision of penalty for proceeding without ECC or failure to take remedial measures	L	U	Enforcement mechanism lacks data management system. Provision of estimating compensation is ad-hoc, thus insufficient (Source: field survey). Also, only a part of fine is collected (The World Bank, 2018).

Sub-criteria for evaluation		Requirement	Practice	Remarks
Judicial provision relevant to EIA system		Ip (L)	U	Environmental court offer limited opportunity for EIA system as they only address offence and claim compensation under ECA 1995, ECR 1997 and Brick Manufacturing and Brick Kilns Establishment (Control) Act of 2013 (DoE, 1995;1997b) . Also, EIA stages not being established by law keeps a loophole Kabir & Momtaz, 2018.
Key stages of EIA process	Screening	L	?	The existing list serving the screening is mostly developed based on environmental impacts of the projects. Several other factors like production capacity, project size, amount of raw material used, emission level, and ecological and cultural sensitivity were not taken into consideration (Ahammed & Harvey, 2004)
	Scoping	L	?	EIA is prepared based on approved scoping report, but public participation is not established at this stage (Source: filed survey).
	Alternatives	Ip (G)	U	Case studies indicate inadequate consideration of alternatives and previous studies indicate the same.
	EMP	Ip (L)	U	Case studies indicate inadequate EMP.
	Public participation	Ip (G)	U	Prescribed in guideline, but case studies indicate inadequate practice.
	Contents of EIS	Ip (G)	U	Not specific to sectors, rather generic (DoE, 1997a)
	EIS review	Ip (G)	U	Previous guideline was inadequate, latest one is more

Sub-criteria for evaluation		Requirement	Practice	Remarks
				detailed (DoE, 1997a; 2021). However, in practice the reviewers don't follow any methodical process while reviewing yet (Source: field survey).
	EIA monitoring	Ip	U	Guideline includes monitoring instructions for proponents, but instruction for DoE is inadequate (DoE, 2021a). In practice monitoring mostly focusses on wastewater quality ignoring implementation monitoring and sectoral overviews (Source: field visit).
Absent in the system:				
Legal requirement of displaying approved EIA		X	X	-
Provision of independent reviewer		X	X	-
Legal requirement of compliance to ECC conditions and EIS		X	X	-
Legal requirement of EIA procedural steps		X	X	-
Requirement of technical and sectoral expertise in DoE to overview EIA process		X	X	-
Sector-specific EIA guideline for key sectors		X	X	-
Explanations: *"L" = Legal, "G" = Prescribed in guideline, "Ip" = Inadequately prescribed, "X" = Does not exist* *"S" = Satisfactory, "U" = Unsatisfactory, "?"= Insufficient information*				

Source: Prepared by author from the findings of this research discussed in chapter eight, nine and ten.

11.2 Summary of the findings from study objectives

This research has five objectives and 14 key research questions (see section 1.3 of chapter one). The study began with extensive literature review to establish the context and formulate framework of analysis (for objectives one and two). Following on, face-to-face interviews, document analysis, case study analysis supported in evaluating EIA system requirement and practice for textile industry in Bangladesh (for objectives three and four). Finally, the recommendation was formulated with the help of all these information attained (for objective five). The findings based on the objectives are summarized below-

11.2.1 Findings from objective one: to review environmental policy instruments for addressing the impacts of the textile industry and understanding the role of EIA amidst them

Units of yarn manufacturing, fabric manufacturing, wet processing (dyeing, printing, finishing) and textile fabrication (i.e., clothing preparation) compose the textile industry (Choudhury, 2014; Radhakrishnan, 2015; Madhav, et al., 2018). Immense resource consumption, extensive use of chemicals and generation of pollution intensive wastes are the key environmental impacts of this industry (Sherburne, 2009; Resta, et al., 2016; Choudhury, 2014). These are responsible for environmental damage, serious health issues in people and aquatic lives, resource scarcity among many others (see section 3.3 in chapter three for details).

Globally, three categories of environmental policy instruments are utilized to address environmental issues of textile industry. Legislations and performance standards as regulatory instruments; tax, tradable permits, green finance as market instruments; agreements, ecolabelling, environmental management systems, guidelines as voluntary and information-based instruments (VIBs) are some of the major environmental policy instruments relevant to textile industry (see section 4.2.3 in chapter four for more). More than 100 countries use EIA for environmental control and management of textile industry (Resta & Dotti, 2015). EIA has potential to draw from the other instruments (Lawrance, 1997). EIA can assist in development permit and environmental licensing regulations, appraisal of economic instruments and can also serve as information processing model (Lee & Goerge, 2000; Bartlett & Kurian, 1999).

Textile industry of Bangladesh is primarily composed of i) yarn manufacturing, ii) fabric manufacturing, iii) textile dyeing-printing-finishing, iv) clothing manufacturing & processing and v) textile composite units (see section 5.1 in chapter five). This industry is causing heavy chemical usage combined with water, results in “large volumes of untreated effluent being discharged, affecting potable drinking water supplies, fisheries, and agricultural productivity, and citizen's health and wellbeing"- World Bank (2014, p. xvi). Every year, textile sector of Bangladesh consumes about 1,500 million cubic meters of groundwater using around 980 million Kilowatt-hour electricity for extraction at the expense of four billion USD (Haque; et al., 2021).

EIA in Bangladesh influences variety of environmental policy instruments for textile industry. Environmental conservation rules (ECR) '97 require industrial units to receive Environmental clearance certificate (ECC) before starting operation. For pollution intensive textile units detail EIA report is required with ECC application (see section 6.1.2 in chapter six for details). Completion of EIA and acquiring ECC also influence market-based instruments. For e.g., while applying for loans to financial institutes and starting business with international brands in Bangladesh. EIA is embedded in EMS and can assist ecolabelling (Bartlett & Kurian, 1999; Glasson, et al., 2005). Adopted VIBs within textile units of Bangladesh are EIA guidelines by DoE, agreement on Zero discharge plan with DoE conditioned with ECC renewal, "Made in Green" ecolabelling, EMS of ISO 14001, Higgs (Self-assessment) index (see section 5.3 in chapter five for details).

EIA system of Bangladesh is comprised of legislative framework, administrative arrangement, EIA procedure (starting from screening to preparation of EIS), EIS review, post EIA environmental monitoring (See section 6.1 in chapter six). Relevant stakeholders are DoE, EIA consultants, project proponents, affected public, academicians & experts, international brands, donor agencies and international organizations among others (See section 6.3 in chapter six).

11.2.2 Findings from objective two: To develop a framework of analysis based on good practice examples of EIA system with specific focus on textile industry

For evaluating the EIA system around the world, experts have assessed theoretical and empirical dimensions within the EIA system. Theoretical dimension of EIA is represented by institutional framework, which can be evaluated through-

a) Legal framework;
b) Administrative arrangement;
c) Procedural framework.

Empirical dimension can be observed through pre, and post decision stage of EIA practice. Hence, the practice can be evaluated using the following major criteria-

a) Role of stakeholders;
b) Quality of EIS;
c) Performance of textile units.

Sub-criteria under these main criteria are tailored for this study focusing on textile industry. There are 75 main sub-criteria within the framework of analysis for this research (See section 7. in chapter seven). The findings from objective three and four (section 11.2.3, 11.2.4) are reflected from the framework of analysis developed for this research.

11.2.3 Findings from objective three: To evaluate the requirements of the EIA system for textile industry in Bangladesh

Policy documents, previous literature and in some cases face to face interview were used in this evaluation. Around 40% of the sub-criteria used in this research for evaluating legal framework for EIA system in Bangladesh for textile industry, appeared unsatisfactory. The **legal framework** here lacks the following-

a) Dedicated EIA legislation or legal requirement on procedural stages of EIA;
b) Provision of independent reviewer;
c) Provision of penalty for non-compliance to ECC conditions or EIS;
d) Provision of public consultation or public display of approved EIA;
e) Application of EIA system beyond project.

Around 80% of the responses for the sub-criteria used for evaluation of **administrative arrangement** for EIA system in Bangladesh for textile industry appeared somewhat[86] unsatisfactory. The deficiencies exist in-

a) Judicial control over EIA system;
b) Interagency coordination;
c) Adequate resources of environmental agency;
d) Technical expertise to overview EIA process for specialized sectors.

Around 72% of the responses for the sub-criteria used for evaluation of **procedural framework** to conduct EIA for textile industry in Bangladesh appeared satisfactory. However, it lacks the following-

a) Sector specific EIA guideline;
b) Guideline for EIA monitoring by agency;
c) Regular updating of existing guidelines and
d) Reference to international guidelines.

[86] mostly unsatisfactory to completely unsatisfactory

11.2.4 Findings from objective four: To evaluate the EIA practice for textile industry in Bangladesh

Document analysis, face to face interview and case study analysis was used in this evaluation. This research **reviewed EISs** from five red category textile units of the country to understand their quality. The findings are-

a) 60% to 85% of the 31 minimum requirement sub-categories in amended Lee-Colley's package appeared unsatisfactory;
b) Description on "identification & evaluation of key impacts" and "alternatives & mitigation" received poorest ratings among the four key areas of evaluation;
c) Overall quality of all the reports was unsatisfactory (see section 8.2 in chapter eight for details).

While evaluating the **role of key stakeholders** (i.e., EIA consultants, regulators, project proponents), the researcher found that the regulators are lagging the most. 79% of the responses to the sub-criteria for evaluating role of regulators appeared unsatisfactory. Deficiencies exist for-

a) Manpower and funding to great extent;
b) Data storage & management;
c) Research opportunities;
d) Sectoral specialization;
e) Technical and strategic methods & directions for review and monitoring.

Meanwhile, 57% of the responses for the sub-criteria for evaluating role of EIA consultants appeared somewhat unsatisfactory. Drawbacks exist in-

a) Provision for registration;
b) Provision for accreditation and code of conduct;
c) Budget and time allocated by project proponents.

On the other hand, 38% of the sub-criteria for evaluating role of project proponents appeared satisfactory. Deficiencies show-

a) Absence of knowledge on own EISs, compliance record;
b) Lack of motivation from environmental concern to adopt environmental measures.

While evaluating the **performance of three case study textile units**, 24%-44% of the sub-criteria in the checklist of technical measures appeared positive for case study units.

a) Positive responses were mostly relevant to process modifications.

b) Chemical recovery & substitute, water conservation appeared to have received less attention by proponents.

On the other hand, 79% of the sub-criteria in the checklist of EMP appeared somewhat unsatisfactory for case study units. Deficiencies exist in-

a) Clear chemical and waste management policy;
b) Specialized and designated personnel & research team;
c) Risk assessment & separate storage for hazardous chemicals among others (see 10.3.2 in chapter 10 for details).

11.2.5 Findings from objective five: To develop recommendations for improvement of EIA system for textile industry in Bangladesh

Based on the findings from previous objectives, recommendations are formulated in this research and discussed in the following section.

11.3 Recommendation to improve EIA system to deliver environmental sustainability for textile industry in Bangladesh

From the previous section, it can be observed that majority (more than 50 percent) of the findings from the sub-criteria used in this study for evaluating the EIA system for textile industry in Bangladesh appears somewhat unsatisfactory to unsatisfactory. Especially, the evaluation shows significant drawback in cases of administrative arrangement of EIA system in Bangladesh, role and poor capacity of EIA regulators specially in review and monitoring, poor quality EIA reports and post decision performance of case study units regarding EMP. Legal provision for EIA in Bangladesh also appears to be deficient, lacking wider coverage of the EIA system (e.g. EIA stages, review, implementation monitoring and public participation). While procedural framework appears to have some satisfactory remarks, lack of sectoral consideration within it is a substantial downside considering this study. Development decision seem to be rarely influenced by EIA ((Ahammed & Harvey, 2004). This indicates EIA's role in Bangladesh as a short-term tool for development approval rather than having a long-term commitment (Kabir & Momtaz, 2018; ILO, 2021). Quoting from Ahmed and Ferdausi (2016, p. 01),

> "Evidence suggests that EIA has not yet evolved satisfactorily in Bangladesh"

On this note, experts in developing countries have mostly identified the poor implementation of EIA related to the procedural inadequacy, low level of capacity and resource of the relevant agencies and stakeholders (Ahammed and Harvey, 2004; Ahmad and Wood, 2002; Glasson and Salvador, 2000). Although, where there is significant advancement made in legislative and administrative framework in developing countries (e.g., Kenya, Tanzania, Vietnam, Bhutan, India, Nepal), contextual factors lead to poor implementation of the EIA system (Marara et al., 2011; Khadka and Shrestha, 2011; Clausen et al., 2011). This study identifies inadequacy in institutional framework and role of stakeholders along with contextual factors affecting the implementation of EIA system in Bangladesh negatively. Bina (2007) suggests that context includes institution and organisational locations, which are further influenced by society's broader social, cultural, and political values. This contextual set up performs as backdrop for effectiveness of EIA system of a country (Bina, 2007). On the other hand, for Bangladesh, contextual factors leading to the poor implementation of EIA system are identified as "political will, bureaucratic culture, and environmental awareness among the proponents and local community" (Kabir, 2012, p.14).

Wood (2003) suggests, developing countries lack widespread demand for environmental protection. This can be attributable to unawareness of the general population regarding environmental issues (Nadeem & Hameed, 2008) and political will (Kabir, 2012) while prioritizing economic development over environmental constraints of the project (Brito & Verocai, 1999). Especially, when political time horizons are short (on average four to five years), political leaders are less encouraged to invest in the long-term task of building bureaucratic capability (McCullough, 2017). This study identifies the limitations faced by DoE are relevant to resource, funding, expertise, power and independence. Such limitation can reflect the fact of limited political will. While dealing with this extent of constraints, it can often be difficult for such agency to form a sound legal mechanism and procedural framework.

Lee & George (2000) suggest that, where there is only one environmental agency responsible for all environmental matters within a developing country, their capacity can be challenging considering the short number of staffs. Experts evaluating EIA system in Pakistan and India (the neighbouring countries of Bangladesh) also noted the limited capacity of environmental agencies in their countries (Jha-Thakur & Khosravi, 2021; Nadeem & Hamid, 2008; Jha-Thakur, 2021). However, even within such constraints, these countries appoint experts in their EIA report review panel and have provision of public hearing of the report (Nadeem, et al., 2014), while both of these are absent in Bangladesh. Apart from this, DoE not having veto power over project approval (Ahammed & Harvey, 2004) shows the limitation of power and independence bestowed upon them (see table 11.1). Developed countries can here show a different scenario due to awareness and power to general public and statutory independence of the environmental agencies (e.g. Western Australia) (Morrison-Saunders & Bailey, 2000). Experts suggest, for quality control and transparency in EIS review and follow-up, independent body is instrumental. It can be seen from the experiences of Canada, Netherlands, Hong Kong (Arts et al., 2001; Wood, 2003). When condition for development approval does not coincide with the environmental agency's recommendation, public appeal or opinion of other regulatory agencies can influence (Morrison-Saunders & Bailey, 2000). However, this is only possible when the public are aware and knowledgeable; this is rarely a common scenario in developing countries (Nadeem & Hameed, 2008; Kabir & Momtaz, 2018). Infact, unawareness of general population regarding environmental issues and EIA is one of the key reasons of limited public participation in EIA process in developing countries (Nadeem & Hameed, 2008; Kabir & Momtaz, 2018). Apart from this, reluctance of DoE and project proponents were also held responsible by experts for causing limited public participation in EIA process in Bangladesh (Kabir & Momtaz, 2018) (see (iv) from section 8.1.2 in chapter eight for more).

On the other hand, deficient procedural and legal framework is a display of lack of capacity within administrative arrangement. Although there are several international organizations and projects aiming at capacity development and environmental improvement of the industrial units (see section 6.3 in chapter six), role of the responsible agency weighs the most while upholding the quality of EIA system within the country. Inadequate procedural and legal framework (e.g. lack of legal status of implementation conditions and EMP, lack of provision for implementation monitoring, lack of sector specific guideline) are attributable to deficiencies in EMP and compliance monitoring (see section 10.1 and 10.3 in chapter 10 for more). Such deficiency is a reason behind poor linkage between EIA and later stages of project (Goodland & Mercier, 1999). Poor implementation of EIA in developing counties is mostly related to the procedural inadequacy along with low level of capacity and resource of the relevant agencies and stakeholders (Ahammed and Harvey, 2004; Ahmad and Wood, 2002; Glasson and Salvador, 2000). Therefore, while deficiencies in EIA system requirements and role of stakeholders can cause poor implementation of EIA, these issues altogether are influenced by contextual factors prevailing within the country.

Therefore, there are two key approaches to make suitable recommendations for improving the EIA system of a country (Khosravi, et al., 2019b). Firstly, a country's context for EIA system and secondly, recommendations used internationally for similar setting (Khosravi, et al., 2019). This research used both. The comparison of the results with global scenario specially the good practices within developing countries (see chapter eight, nine and ten) provided insights to formulate several recommendations. Additionally, the findings from previous relevant studies for Bangladesh (Kabir & Momtaz, 2018; Ahmed & Ferdausi, 2016; Ahmmed & Harvey, 2004; ILO, 2021, The World Bank, 2018) have influenced the formulation of recommendations to some extent. The sources for the recommendations used directly from this literature is shown within the table (table 11.2).

Table 11.2 is designed by the researcher to deliver the recommendations for this study. These recommendations are cross-referred to the findings from criteria within framework of analysis. The timeline and responsible authority are also designated for these recommendations. Recommendations for legal and institutional reforms are usually designated longer period as timeline (The World Bank, 2018). Considering the urgency of the need, timeline for these recommendations is mostly assigned medium term by author (e.g., dedicated EIA legislation that addresses key stages of EIA process). On the other hand, the recommendations regarding the components present within the system are designated “short-term” in the timeline. For example: recommendation on speeding up the judicial practice, filling up the vacant posts of DoE can be utilized or modified easily. The table also includes several recommendations those can address multiple deficiencies within the system. For example: provision of registration of EIA consultants can improve the quality of EIA reports, can enhance their role in the system by ensuring accountability and can also help developing pool of experts to support the EIA system within the country.

Table 11.2 Recommendations to improve EIA system for textile industry in Bangladesh, with respective timeline and responsible authority

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
i) Legal framework	a) Inadequate legal framework	Dedicated EIA legislation that addresses key stages of EIA process comprehensively Revising the list of projects within ECR'97 applied on screening considering production capacity, raw material usage, size of project, ecological and cultural sensitivity (Ahammed & Harvey, 2004). Mandating health impact assessment within EIA for projects sensitive to natural resource, environmental quality, heath & wellbeing of community Formulating hazardous material and chemical management regulation Strengthening solid and hazardous waste management regulation	Medium	MoEFCC, DoE
	b) Lacking independent reviewer	Forming national expert pool and promoting rigorous peer review of EISs of key industrial sectors	Medium	MoEFCC, DoE
	c) Existing rules on penalty requiring reform	Establishing legal status of conditions accompanying ECC approval and incorporating promised mitigation measures in EIS within the approval conditions Establishing other means of penalty (e.g., ceasing/halting business license) by law Developing methodology to incorporate environmental externalities while calculating fine	Medium	MoEFCC, DoE

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
		Rule based system for penalty, especially for levels of violation (The World Bank, 2018)		
	d) Inadequate rule for public display of information	Clearly designating the stages of EIA process requiring public participation by law. Public display of approved EIA report. Requiring public disclosure of all environmental information on existing structures and development projects subject to ECC (The World Bank, 2018)	Medium	MoEFCC, DoE
	e) Lacking environmental assessment beyond project	Introducing and performing SEA for new industrial zones (The World Bank, 2018) Introducing Rapid Environmental Assessment (REA) for approval of Small industrial units	Medium	MoEFCC, DoE, BSCIC
	f) Strengthening position in project cycle	Reforming existing legislation regarding land development prior to review of full EIA report	Medium	MoEFCC, DoE
ii) administrative framework	a) Low resource, manpower	Filling up existing vacant posts of DoE to work at full capacity Distributing staff to regional offices considering the volume of activity (e.g., number of polluting industrial units in the region) (Jha-Thakur, 2011; The World Bank, 2018) Increasing DoE's budget allocation and revenue fields (The World Bank, 2018) Prioritizing core functional areas (e.g., monitoring, enforcement) (The World Bank, 2018)	Short/Medium	DoE

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
	b) Lacking sectoral expertise	See (g) under (iv)		
	c) Poor judicial support	Utilizing judicial support by speeding up the current practice and wide publication of the results on environmental justice. Introducing sectoral consultants in mobile court led by magistrates from DoE and environmental court led by joint district judge. Amending the Environment Court Act 2010 to allow direct public access to the courts (The World Bank, 2018) Paving way of people's access to environmental lawyers (see (g) under (iv) for more)	Short	DoE, district judge's court, Bangladesh environmental lawyers' association
	d) Lacking comprehensive database	Preparing database on industries and updating their records on environmental performance, monitoring, ECC renewal (The World Bank, 2018)	Short	DoE, sectoral ministries
	e) Political influence	Ensuring transparency through involvement of public. see (h) under (iv) Statutory guarantee of independence of DoE	Short	DoE, MoFCC
	f) Lacking interagency coordination	Establishing environmental cells and training officials in relevant ministries (e.g., ministries of industries, commerce, textile & jute) thus mainstreaming environmental management in government agencies (The World Bank, 2018)	Short	DoE, relevant government agencies

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
iii) Procedural framework	a) Lacking clear sectoral guidelines	Developing guideline on sectoral methodology for EIA	Medium	DoE supported by international organizations (WB, IFC, GIZ), academicians
	b) Lacking comprehensive guideline	Formulating comprehensive guideline on the EIA process, contents of EIS and detail review process of EIS (Kabir, 2012), clear directions of follow-up monitoring and EMS, designating responsibility of stakeholders in each stage of EIA	Short	DoE supported by international organizations (WB, IFC, GIZ), academicians
	c) Dated guidelines	Frequent updating of guidelines, syncing with latest international sector specific guidelines Forming interdisciplinary research team within agency to keep pace with updated international guidelines	Short	DoE
	d) EIA not recognized as continuous process	Establishing the practice of EMS within EIA system and ensuring adequate follow up Strengthening knowledge base of stakeholders. See (h) in (iv)	Short	DoE, NGOs
iv) Role of stakeholders	a) Qualification of EIA consultants	Provision of accreditation and registration of EIA consultants Formulating code of conduct for EIA consultants and legal implications in case of avoidance Including qualification of consultants within EIA reports to encourage liability and ensure interdisciplinary team for performing EIA	Short	DoE, Bangladesh Accreditation board

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
	b) Lacking transparency in decision making	Ensuring transparency in review process through publication of detail review reports (specific to the project) and approved EIA reports	Short	DoE
	c) Lacking sector specific strategy in monitoring	Integrating EMS and auditor's reports within the routine monitoring of textile units. Formulating sectoral checklist for monitoring visits and involving sectoral experts	Short	DoE
	d) Lacking sector specific strategy in EIS review	Formulating and following sector specific review package and involving sectoral experts	Short	DoE
	e) Lacking implementation monitoring and partially lacking effects monitoring	Verifying implementation of mitigation measures promised within approved EISs while visit Incorporating all environmental parameters besides wastewater while monitoring	Short	DoE
	f) Lacking efforts/opportunity for compliance and enforcement	Increased political will through enhancing knowledge base and prioritizing environmental concerns Different strategies for small and big businesses	Short	DoE, BSCIC, NGOs
	g) DoE lacking sectoral expertise for EIA (policy making, review and monitoring)	Interagency co-ordination with specific attention to key industrial sectors (e.g., textile, pharmaceuticals) Forming national expert pools for consultation on review, monitoring specially for key industrial sectors Outsourcing where technical expertise lacked in-house	Medium	DoE, Academicians, relevant government agencies

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
		Project specific ECC conditions and follow-up monitoring		
	h) Encouraging public participation and capacity building of other stakeholders (including project proponents)	Arranging workshops to disseminate knowledge on: EIA, general wellbeing and environment affected by industrial developments, information about their rights to report to DoE in case of any suffering caused. Also, enhanced disclosure and accessibility of empirical data on environmental degradation, Open access to approved and translated (where required) EIA reports Mandating public hearing on EIA for projects where DoE representatives will attend to ensure transparency Emphasizing knowledge base development of project proponents, their key management personnel and following up their commitments	Short	NGOs, DoE
		Including explicit cost-benefit analysis within EISs to inform project proponents on long term benefits of mitigation measures and EMP	Short	EIA consultants
v) Quality of EIS	a) Lacking diffusion of EIA experience	Publication of detail review reports and approved EIA reports so consultants can learn from the previous experiences	Short	DoE
	b) Inadequacy of baseline information	Use of advanced technology (e.g., Geographic information system, Remote sensing) to acquire and store information with ease in an effective and economic way (Wood, 2003)	Short	DoE, Information and Communication Technology

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
				Division of government
	c) Lacking sector specific instructions for contents of EIS	Formulation of sectoral guideline and legally mandating the sectoral concerns to be addressed in EIS	Short	DoE, sectoral agencies
	d) Qualification of EIA consultants	See (a) from (iv)	-	-
	e) Lacking structural EIS review	Formulation of sector specific review package and involving experts in reviewing EISs	Short	DoE, sectoral agencies (when required)
vi) Performance of textile units in adopting mitigation measures	a) Lacking monitoring and enforcement of sectoral conditions and proposed mitigation measures	See (c), (d), (g) from (iv)	-	-
	b) Project proponents (or representatives) lacking knowledge on EIA	See (h) from (iv)	-	-
	c) Lacking in house chemical	Rule should be established in long term, however in short term can be enforced by ECC conditions	Medium	DoE, proponents

Evaluation criteria	Issues	Recommended actions	Timeline	Responsible authority
	and environmental specialists			
	d) Proponents are more motivated by business prospects than existing EIS system	Utilize actions and measures intended for international brands and incorporate within EIA process (as EMS)	Short	DoE, proponents
	e) Inadequate risk management plan	See (c), (d), (g), (h) in (iv)	-	-
	f) Factory workers lacking training on environmental risks	See (c), (d), (g), (h) in (iv)	-	-

Source: Prepared by author based on the discussion provided in chapter eight, nine and ten

11.4 Conclusion

EIA is a widely practiced regulatory and management policy instrument used in 187 countries of the world (UNEP, 2019). On the other hand, textile industry is regulated by mandatory EIA rules in more than 100 countries including Bangladesh (Resta & Dotti, 2015; DoE, 1997b). EIA exists in Bangladesh since 1997 and influences diverse environmental policy instruments (i.e., regulatory, market and voluntary & information based) for textile industry. Several studies have been executed regarding overall performance of EIA in Bangladesh. However, sector specific evaluation of EIA for textile industry is rare, even in global context. Therefore, this study aims to explore the role of existing EIA system in delivering environmental sustainability within the textile industry of Bangladesh. Five objectives are selected in this study for this purpose: i) to review environmental policy instruments for addressing the impacts of the textile industry and understanding the role of EIA amidst them, ii) to develop a framework of analysis based on international good practice examples of EIA system with specific focus on textile industry, iii) to evaluate the requirements of the EIA system for textile industry in Bangladesh, iv) to evaluate the EIA practice for textile industry in Bangladesh, v) to develop recommendation for improvement of EIA system for textile industry in Bangladesh. This research finds existing legal and administrative requirement of EIA system as inadequate for textile industry in Bangladesh. On the other hand, the procedural framework within the EIA system appears predominantly satisfactory, but it lacks sector specific considerations which is a significant drawback. While evaluating the EIA practice, this study finds quality of EISs prepared for textile industry in Bangladesh largely unsatisfactory. It also identifies inadequate role played by the key stakeholders for establishing the EIA practice, where regulators are lagging the most. On the other hand, the case study textile units seemed to have adopted certain technical measures, although mostly being influenced by the international brands. Major environmental concerns for textile industry (e.g., Chemical, waste and water management) were found least prioritized/addressed in adoption of both technical measures and EMP of the units. However, Interviewee (#11) suggested,

> "The textile industry of the country is gradually focusing on environmental improvement"

Although, there are several projects by international organizations regarding environmental improvement of textile industry in Bangladesh, the country lacks overall capacity and effort in enhancing the institutional framework and practice of the existing environmental tool like EIA focusing on this key industry. Considering the growth and diversity of textile industry in

Bangladesh, it can be said that international projects alone cannot assist in enhancing the environmental practice for the entire industry. The country needs to utilize its knowledge, resource, and capacity methodically to bring environmental sustainability to this industry. The key recommendations based on the findings of this study include formulation of dedicated EIA legislation; formation of national expert pool and utilizing them for EIA process of main sectors (including textile); strengthening DoE with manpower and finance while ensuring its statutory independence; introducing provision of accreditation and registration of EIA practitioners; developing guideline on sectoral methodology (including textile) for EIA integrating responsibility of stakeholders designated in each stage of EIA, contents of EIS and detail review process of EIS; regular updating of guidelines referring to best available international guidelines and formation of research team on this regard; ensuring transparency in EIS review and project decision by enforcing public display of information and community participation in stages of EIA; establishing implementation monitoring (for measures promised in EIS) as a requirement; utilizing EMS and self-assessment indices practiced in the textile units by incorporating them in EIA follow-up; enhancing knowledge of general public and project proponents regarding environmental impacts from industrial establishments, rights of affected people in acquiring judicial services, requirement and potential of EIA among others.

While conducing this research, the author also encountered number of challenges. Those were attributable to insufficient and difficult to access information including EIS, nation-wide lockdown during the interview and site visits.

To the author's best knowledge this research is the first comprehensive study on EIA system relevant to textile industry. The framework of analysis developed for this research can be adopted with necessary amendments for other sectoral EIA studies. EIS review package prepared for the purpose of this research can be readily used by environmental agencies to review EISs of textile units. The findings of this research can be utilized as background study while preparing sector specific guideline for EIA in Bangladesh. Policy makers of the country can adopt and amend the recommendations formulated within this research to enhance both the overall EIA system and sectoral concerns within it.

Further research is needed especially for the informal textile units, given the contribution they have within the textile industry of the country. These were beyond the scope of this study. Being unlisted and disregarded from the requirement of detail EIA, research on such units appeared tricky. An initiative of database development for informal textile units and introducing the process of Rapid Environmental Assessment (REA) can be a beginning to incorporate their environmental concerns within textile industry of Bangladesh.

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Appendix I: Interview schedule

Interview schedule

Exploring the role of existing EIA system to safeguard environment within textile industry of Bangladesh

(PhD Research)

Study Area: Bangladesh

Greetings! I am Dipita Hossain, a commonwealth scholar and a third year PhD student studying at University of Liverpool, UK. Accept my sincere gratitude for agreeing to talk to me and provide your valuable response for my research.

My research intends to explore how the sector wise EIA guideline for textile is performing to serve its purpose and to investigate the extent to which it is being followed. This helps my research in establishing the role EIA is playing to safeguard the environment within textile industry of Bangladesh. For this purpose, interviews are conducted involving EIA Practitioners/consultants, experts and academicians, project proponents of textile firms and EIS reviewers and monitoring personnel from DoE.

Your participation is humbly requested in this interview as an important stakeholder of EIA practice in Bangladesh. With your consent, this interview will be recorded in an audiotape and will take around 45 minutes. You reserve the right to hear the record and see the transcript relevant to you. You can withdraw yourself from the study at any point if you want to.

The information provided will be used to analyse and form a part of this PhD thesis, which will eventually be submitted in the Department of Geography and Planning at University of Liverpool. Your identity will be protected through coding and will be kept confidential within the thesis and any subsequent publication.

<u>PhD Researcher:</u>

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This questionnaire has six sections. A general section asking for general information from interviewee is provided before these six sections. After completing it, please proceed towards the next relevant section. Each of those sections are designed uniquely according to the stakeholder group to which the participant belongs

General Section

General information about interviewee and knowledge regarding technical guideline formulated by DoE:

Code	(i)Profession	(ii) Organization	(iii)Experience (yr.)
	□ (a)Project proponent/ representative of PP □ (b)EIA Practitioner □ (c)EIS Reviewer □ (d)Monitoring-enforcement personnel □ (e)Expert/Academician □(f) International organizations (Donor/non-profit)		

If your answer to A.1(i) is (a), please answer section A

If your answer to A.1(i) is (b), please answer section B

If your answer to A.1(i) is (c), please answer section C

If your answer to A.1(i) is (d), please answer section D

If your answer to A.1(i) is (e), please answer section E

If your answer to A.1(i) is (f), please answer section F

Section A: Interview questions for EIA practitioner

A1. Information on capacity of the consulting firms and practice of EIA study

1. How many textile units have taken your service till date? Can you share your experience with them in general?
2. Can you please share information about your resources and expertise?
3. How much do you charge for complete EIA?
4. Is there any provision of accreditation of EIA experts in the country? Have you applied to DoE for enlistment?
5. Are you aware of the sector specific industrial guideline formulated by DoE in 1997? If not name, the guidelines you follow.
6. Which factors do you recommend while preparing EIS for textile wet processing units?
7. Do the proponents implement the measures and EMP you proposed in the reports? Is there any way to keep them interested in doing so?
8. If you have monitored any of your projects till date, what is the rate of their compliance (i.e., what % of firms comply to the EMP and to what extent?
8. Do you get the chance to work with them after they get ECC? Who is responsible for post ECC monitoring/audit in textile units?
9. Can you comment on the conditions provided with the ECC?
10. Can you please share if there is any difficulty you face in this business?

Section B: Interview questions for Project proponent (/representative)

B1. Information on the perception and activity of project proponents regarding environmental protection measures for their (textile) units

1. Are you aware of the negative environmental impacts from the manufacturing processes by textile units?
2. When did your factory started operation? When did you apply for the first ECC? Can I see your last renewal of ECC?
3. How much did the consultants charge for the EIA?
4. Have you ever been penalized by DoE?
5. What are the government/non-government projects you have been involved with? • Have you submitted the ZLD plan to DoE yet?
6. Do you apply to DoE for the wastewater sample collection and ECC renewal every year?
7. Did you implement the measures suggested by consultants? What are the measures you have adopted for environmental improvement within your unit? Please describe. What was the motivation?
8. What difficulties do you face while introducing such measures?
9. Do you have inhouse experts for environmental and chemical management?
10. What is the frequency of in-house monitoring?
11. Do you have any comments regarding the existing environmental policy tools relevant to the textile units?

Section C: Interview questions for EIS reviewers from DoE

C2: Information on the EIS review process practiced by DoE

1. Can you describe the review process followed by DoE?
2. Who are the members of review committee? What is their expertise? Do they review the full report? Can you involve sector specific experts any prioritized industrial sector?
3. How many reports get approved at first chance? What happens if that is not the case?
4. What kind of environmental protection measures do you emphasize while reviewing reports? (e.g., process modification, resource consumption)
5. Do you have adequate manpower and fund available for review in all the offices?
6. Do you have any provision to verify falsified data provided within the report?
7. Do you have any formal procedure to penalize the consulting firms producing falsified reports?
8. Do you visit the factory before issuing ECC?
9. Do you follow any specific guideline/checklist in review process? Do you have any sector specific guideline?
10. Do you publish the decision on EIA report? Would you say that your comments on the reports appear quite generalized (according to the meeting minutes available on website)?
11. How do you find the quality of EISs belonging to textile units?

Section D: Interview questions for monitoring and enforcement personnel from DoE

D1. Information on the monitoring-enforcement practice of DoE

1.Please describe the procedure followed in monitoring of industrial units.
2. What are the areas of interest within a factory while monitoring? (i.e., ETP process, floor of production, ETP outlet pipe, chemical storage etc.)
3. Can you perform implementation monitoring? Do you check the EIA reports on site?
4. Do you have a sector specific checklist?
5. Can you prioritize your visit to the polluting industrial units? Do you have adequate resources available specially in zonal offices? Can you bring any sectoral expert with you, or do you think one is required?
6. What are the factors impeding regular monitoring?
7. How long does one visit take? How many units can you visit in a day?
8. How do you convey results of monitoring to proponent and authority?
9. How many of your daily visited factories are found compliant to ECR? Are there any specific category (e.g., pharmaceuticals, textile dyeing etc.) of factories, those are found incompliant most of the times?
10. How many times do you visit the units annually?
11. Do you have any provision to find out factories skipping ECC or wastewater sample collection or regular reporting or renewal for ECC?
12. What is the procedure to determine the compensation and charge the polluting units?
13. Can you elaborate your plan for the industrial units to adopt Zero Liquid Discharge?

14. Can you comment on exemption of cottage units from ECC in ECR'97? Do you have any plan to cover monitoring for informal textile units?

D2. General Information

15. Is there any provision to enlist the EIA consulting firms?
16. Do you involve with international agencies when they initiative a project with textile industry in Bangladesh?
17. Do you have any provision to involve sector specific experts in the EIA process?

Section E: Interview questions for expert/academician

E1: Information on the environmental management for textile units in Bangladesh

1. What is your opinion regarding the ongoing projects involving textile units in Bangladesh? Aren't these projects corrective, rather than preventive?
2.. Did you have the opportunity to go through the sector specific guideline for textile industry in Bangladesh formulated by DoE? Can you make any comments on it?
3. Are there any projects including the informal textile units of Bangladesh? What is the current situation of environmental management for them? Do you have any suggestions how they can be included in the system?
4. There are policies from DoT (textile policy 2017), MoI (Industrial policy 2016) regarding CETP for informal units, environment friendly production. Can you share your experience/knowledge regarding is their progress with these policies?
5. Does the educational institutes offering degree on textile engineering incorporate EIA or environmental issues within curriculum?
6. What do you think of the approach of industrial pollution control in Bangladesh? Is it corrective or preventive?

Section G: Interview questions for experts from international organizations

G1: Information on IFC, The World Bank and GIZ's involvement in environmental management of textile industry in Bangladesh

1. How did the international organizations started involving in environmental improvement policy, projects and/or financing for textile sector in Bangladesh? what are the factors influencing such concern?
2. What are the motivations behind the research works undertaken by you relevant to this industry?
3. Please describe the process of involving into policy, project or financing the textile sector of Bangladesh? How do you involve the stakeholders in the process?
4. Can you discuss some of your recent projects involving textile units in Bangladesh and their results? Do you work with informal textile units of the country?
5. Describe your level of involvement within the EIA system of Bangladesh. How do you think your projects are contributing to the environmental management for textile units?
6. What do you feel about the perceptions of the country regarding environmental improvement within textile industry?
viii. Do you have any information regarding share of informal textile (wet processing) units in this country compared to formal ones? Have you been involved in environmental management of informal textile units in Bangladesh?

Appendix II: Participant information sheet, consent form and list of participants

Participant information Sheet

1. Title of Study

Exploring the role of Environmental Impact Assessment (EIA) in safeguarding environment within textile industry of Bangladesh

2. Version Number and Date

v.2; 20 January, 2020

3. Invitation Paragraph

You are being invited to participate in Ms. Dipita Hossain's PhD research titled Exploring the role of Environmental Impact Assessment(EIA) in safeguarding the environment within textile industry of Bangladesh.
Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you have any queries. Please also feel free to discuss this with relevant persons if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

Thank you for reading this.

4. What is the purpose of the study?

This research intends to understand the role environmental impact assessment(EIA) is playing in protecting the environment from the impacts caused by textile industry in Bangladesh.
As you know, textile and apparel industry is the most important manufacturing industry of Bangladesh since they constitute about 40% of the total manufacturing establishments and employ around 71% of manufacturing industrial workforce. However, it cannot be ignored that the textile sector has been also designated as one of the most polluting industries throughout the world. Impact assessment can play significant role in minimizing such impacts and make the industry sustainable for long term. EIA is the only relevant and institutionalized policy tool as it already provides guidelines for textile industry through the project named "To develop and apply sectorwise industrial guidelines and standards and to monitor compliance" by Department of Environment, Bangladesh. My research intends is to explore how this sectorwise guideline for textile is performing to serve its purpose and how much of it is being followed.

5. Why have I been chosen to take part?

You have been chosen to take part in this research as an important stakeholder of EIA practice in Bangladesh.

6. Do I have to take part?

Participation in this research is voluntary. Even you can withdraw yourself at any point without any explanation. Your disagreement to participate or wish to withdrawal will not cause any kind of inconvenience to you or your organization.

7. What will happen if I take part?

If you decide to participate, you will be asked to take part in an interview and sign a consent form. In the interview, you will be requested to provide your response on number of questions related to EIA guidelines for textile industry, review of EIS, monitoring and compliance to the guidelines etc. depending the stakeholder group you belong to. The schedule is divided into separate sections for this purpose. It will take approximately 45 minutes to complete the interview. Your response will be recorded in an audiotape with your consent, and along with that researcher may take notes on the interview schedule. You reserve the right to access the recording or transcription and erase or modify your response.
The questions will be asked by Ms. Dipita Hossain, who is taking this interview for her PhD research.

8. How will my data be used?

“The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of ‘public task’, and in accordance with the University’s purpose of “advancing education, learning and research for the public benefit.

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University’s research. The [Principal Investigator / Supervisor] acts as the Data Processor for this study, and any queries relating to the handling of your personal data can be sent to Dr. Urmila Jha-Thakur (email: urmila1@liverpool.ac.uk).

Further information on how your data will be used can be found in the table below”.

How will my data be collected?	Will be collected through recording device
How will my data be stored?	Will be transcribed and stored in password protected cloud drive (university M drive). Audio Record will be deleted from device after transcription.

	Data will be stored in anonymized transcripts and thus cannot be linked back to the participants.
How long will my data be stored for?	For 10 years according to research data management policy of University of Liverpool.
What measures are in place to protect the security and confidentiality of my data?	Participant's names will be anonymised through coding, responses will be stored in password protected cloud drive of university of Liverpool and paper documents will be shredded.
Will my data be anonymised?	Yes.
How will my data be used?	Will be solely use for research purpose, e.g analysis and writing up of the PhD thesis. It will also be used for academic publication from this thesis.
Who will have access to my data?	The researcher and her supervisor
Will my data be archived for use in other research projects in the future?	No
How will my data be destroyed?	Paper documents will be shredded. Digital documents will be erased following university protocol.

9. Expenses and / or payments

The researcher is not able to provide any kind of payment for participating in the interview.

10. Are there any risks in taking part?

There are no risks involved in participating in this interview. No personal information is being collected in this interview. The Information used for writing the thesis will be coded thus cannot be traced back to the interviewee. Also the questions are non-sensitive and should not cause any discomfort to participants.

11. Are there any benefits in taking part?

There might not be any direct benefit for the participant, however as a well-wisher of EIA system of Bangladesh, you will be able to provide your valuable opinion and will be able to help me formulating my recommendations for EIA process in textile industry of Bangladesh

12. What will happen to the results of the study?

The results of the interviews will be used in writing the thesis and publish journal papers in the future. Copies of these works might be available upon request.

13. What will happen if I want to stop taking part?

You can withdraw yourself at any point of interview without any explanation. Also you can withdraw your response until the researcher completes data processing (by September 2020).

14. What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting [**Dr. Urmila Jha-Thakur, email: urmila1@liverool.ac.uk, tel: +44-151-7943120**] and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Ethics and Integrity Office at ethics@liv.ac.uk. When contacting the Research Ethics and Integrity Office, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

The University strives to maintain the highest standards of rigour in the processing of your data. However, if you have any concerns about the way in which the University processes your personal data, it is important that you are aware of your right to lodge a complaint with the Information Commissioner's Office by calling +44-303 123 1113.

15. Who can I contact if I have further questions?

You can contact Dr. Urmila Jha-Thakur (PhD Supervisor of Ms. Dipita Hossain)

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Participant consent form

Version number & date: 2, 20 January, 2020

Research ethics approval number:

Title of the research project: Exploring the role of EIA in safeguarding environment within textile industry of Bangladesh

Name of researcher(s): Dipita Hossain(PhD researcher), Dr. Urmila Jha-Thakur(supervisor)

Please check box

1. I confirm that I have read and have understood the information sheet dated 20 January, 2020 for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that taking part in the study involves an audio recording. ☐
3. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. In addition, I understand that I am free to decline to answer any particular question or questions. ☐
4. I understand that I can ask for access to the information I provide and I can request the destruction of that information if I wish at any time prior to completion of data processing (by September 2020). I understand that following September 2020, I will no longer be able to request access to or withdrawal of the information I provide. ☐
5. I understand that the information I provide will be held securely and fully anonymized in line with data protection requirements at the University of Liverpool and it will be stored for ten years in accordance with the University data management policy. ☐
6. I understand that signed consent forms and the audio records will be retained in the password protected university cloud drive and researcher and her supervisor will have access to it until the research is published ☐
7. I agree to take part in the above study. ☐

___________________________	__________	_______________________
Participant name	Date	Signature
___________________________	__________	_______________________
Name of person taking consent	Date	Signature

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Table: Information on participants for interview and interview dates

Code	Organization /Stakeholder Group	Date of Interview
Interviewee #1	DoE	18-02-2020 (morning)
Interviewee #2	DoE	12-03-2020
Interviewee #3	DoE	28-06-2020
Interviewee #4	DoE	11-03-2020
Interviewee #5	DoE	18-04-2020
Interviewee #6	EIA consultancy firm (Annon.)	18-02-2020(afternoon)
Interviewee #7	EIA consultancy firm (Annon.)	19-02-2020
Interviewee #8	EIA consultancy firm (Annon.)	10-03-2020
Interviewee #9	BUTEX	25-02-2020
Interviewee #10	Auditor for international brand	17-02-2020
Interviewee #11	GIZ	01-03-2020
Interviewee #12	The World Bank	30-04-2020
Interviewee #13	IFC	02-03-2020
Interviewee #14	Project proponent from Case Study 1	20-02-2020
Interviewee #15	Project proponent from Case Study 2	24-02-2020
Interviewee #16	Project proponent for Case Study 3	26-02-2020
Interviewee #17	Ministry of Industries	20-02-2020
Interviewee #18	Department of Textile	19-02-2020
Interviewee #19	Independent local entrepreneur	28-02-2020
Interviewee #20	Bangladesh Bank	24-02-2020

Appendix III: Checklists for case study units

Table: Checklist for technical measures adopted by case study units

Measures /processes	i.Housekeeping	ii.Process/equipment modify	iii.Chemical recovery	iv.Chemical substitute	v.Water conservation	vi.Innovation technology
a.Sizing			***Use in sizing:*** #starch #Carboxy methyle cellulose(CMC) #polyvinyle acetate(PVA)	#starch #PVA #acrylic		
b.Desizing		#enzyme process #oxidation process by peroxide		#Enzyme #Acid	***In operation*** #counter current manner? #other	
c. Soaping				#conventional #synthetic detergent		
d.Scouring		***Solvent added*** #yes, #no		#soda ash #sodium acetate	***Continuous J box System?*** # Yes , # No ***Precautions in Kier boiling*** # Yes , # No ***Process In tank?*** # Yes , # No ***Near Washing machine?*** # Yes , # No	
e.Chemicking						
f.Washing		***Washing configuration*** #horizontal #vertical ***Washing temperature*** #Hot water #Cold Water			***Counter current method?*** # Yes , # No	

Measures /processes	i.Housekeeping	ii.Process/equipment modify	iii.Chemical recovery	iv.Chemical substitute	v.Water conservation	vi.Innovation technology
g.Bleaching		***Solvent added*** #yes, #no ***Chemical used*** #Peroxide #Hypochlorite ***Activated peroxide bleaching*** #yes , #no			***Peroxide used?*** # Yes , # No ***Combined with Chemicking?*** # Yes , # No	
h.Mercerizing		#Hot #cold ***Agent*** #liquid Ammonia #caustic	***Caustic recovery?*** #Yes , #No ***Through-*** #Evaporation or membrane separation? #other		***High Temperature?*** # Yes , # No ***Counter current washing with Caustic soda?*** # Yes , # No ***Increase time & force of washing to use less water?*** # Yes , # No	
i.Dyeing		***Operation*** #Pad batch #Continuous ***Method*** #padding #iExhaust ***Vat color dye process*** #electrolytic #other ***Blended fabric dye*** #combined disperse & reactive color dye #other ***Type of dye used***	***Reuse dye solution from dye bath?*** #yes, #no	***Disperse dye*** #acetic acid #ammonium sulphate ***Vat dye oxidation*** #acetic acid #sodium bi-carbonate ***Stages*** #single #2 stage ***Dye bath*** #acetic acid #formic acid	***In batch dye*** #jigger dye #hank dye #package dye #other ***In vat dye rinsing oxidation*** #Mix of sodium bicarbonate and hygdrogen peroxide #other ***Stock tank for keeping treating solution?*** # Yes , # No	***Short liquor dye?*** # Yes , # No ***Pad batch method*** #cold #hot #bifucntional reactive dye ***For urea reduction*** #Pad-Dye-bake #other #not reduced ***Direct dye*** #benzidine #Non-benzidine

						Reactive dye #Hetero bifunctional #Other
Measures /processes	**i.Housekeeping**	**ii.Process/equipment modify**	**iii.Chemical recovery**	**iv.Chemical substitute**	**v.Water conservation**	**vi.Innovation technology**
j.Printing		***Rapidogen print*** #dry heat fixation #Acid steaming		***Printing*** #gum #emulsion ***Pigment printing*** #acetic acid #ammonium sulphate ***Screen printing*** #Gums #Permanent adhesive		
k.Finishing				**Starch finish** #temporary #durable	***Counter current in resin finishing?*** #yes , #no	
l.Monitoring	**Frequency of maintenance:** #Checking #Repairing					
m.Water management:	#Liquid level control #Flow indicator #Flow meter					

Table: Checklist for the measures adopted by case study units for effluent treatment plant (ETP)

Waste treatment #Separate process waste(+piping) #Combined waste(+piping)	**Treatment options** #Primary(pre treatment) #Secondary (biological) #Both	**Primary treatment process**	**Secondary treatment process**	**Stabilization pond**
		Equalization tank for 24hrs #yes , #no ***Pre-aeration?*** #yes , # no	***Includes*** #Trickling filter #Activated sludge process #both	***Oxidation pond*** **#depth of pond** **#BOD load value** **#BOD:MLSS** **#extended aeration process included?** Yes No
		Used in neutralization #hydrochloric acid # sulphuric acid # compressed Co2 #flue gas		***Aerated Lagoon included?*** #yes #no
		Chemical precipitation #4 stage coagulation? #other ***Coagulant used*** #Alum #Ferrus sulphate		
Plant performance data for Ph, BOD, COD, TS (raw and treated)				

Appendix IV: Environmental pollution by textile units

Table: Contribution of textile wet processing units into water pollution

Process	**Polluting components and Contribution to wastewater parameters**	**Key WW parameter values (mg/L), except pH**			
		pH value	Total Suspended solids	BOD	COD
Desizing	Organic waste. High BOD and total solids	8.8-9.2	18-800	1700-5200	950-20,000
Scouring	Hydrogen peroxide, sodium silicate/organic stabilizers, alkaline solutions/soaps/detergents, fat, oil, sizes. High pH, high BOD, COD and solid	7.2-13	184-17400	100-2900	8000
Bleaching	Hydrogen peroxide, hypochlorite, sodium silicate/organic stabilizers and alkaline conditions. High pH, high solids	6.5-13.5	130-25000	100-1700	288-13,500
Mercerizing	Sodium hydroxide. High pH	-	-	50-100	1600
Dyeing	Cationic materials; color; BOD; sulfide; acid, metal, Metals, salt, surfactants, alkaline/acidic conditions. Metal, salt, color	6.3-10.7	72-956	100-1080	1100-4600
Printing	Suspended solids; urea; solvents; color; metals; heat; foam; formaldehyde. High COD, nitrogen and dye loads, Metal, salt, color	6.7-8.2	250-390	135-1380	410-4270

Source: Adapted from (Babu, et al., 2007; Yaseen & Scolz, 2019; Samanta, et al., 2019; Shukla, 2007; Bisschops & Spanjers, 2003)

Table: The World Bank (2000)'s standard for air emission from textile industry

Pollutants	Units	Guideline Value
VOCs	mg/Nm^3	2 / 20 / 50 / 75 / 100 / 150 [a b]
Chlorine	mg/Nm^3	5
Formaldehyde	mg/Nm^3	20
Ammonia	mg/Nm^3	30
Particulates	mg/Nm^3	50[c]
H_2S	mg/Nm^3	5
CS_2	mg/Nm^3	150

NOTES:
[a] Calculated as total carbon.
[b] As the 30-minute mean for stack emission. Applicability of guideline values:
- 2 mg/Nm^3 for VOCs classified as carcinogenic or mutagenic with mass flow greater than or equal to 10 g/hour;
- 20 mg/Nm^3 for discharges of halogenated VOCs with a mass flow equal or greater than 100 g/hour;
- 50 mg/Nm3 for waste gases from drying for large installations (solvent consumption >15 t/a);
- 75 mg/Nm^3 for coating application processes for large installations (solvent consumption >15 t/a);
- 100mg/Nm^3 for small installations (solvent consumption <15 t/a).
- If solvent is recovered from emissions and reused, the limit value is 150 mg/Nm^3

[c] As the 30-minute mean for stack emissions.

Source: (IFC & The World Bank, 2007, p. 12)

Appendix V : Checklist for Environmental and Social Due Diligence (ESDD) by Bangladesh Bank

Table: ESDD checklist by Bangladesh Bank

Sl. No.	Question /Issues to check	Response
Project Summary Information		
1	Reporting period covered by this supervision report	
2	Specification of project stage (design, construction, operation or closure stage)	
3	Key developments and any major changes in project location and design, if any from the time of loan disbursement or from the last supervision period.	
General Information		
4	Status of implementation of covenants/corrective action plan. Is it in line with the agreed timeframe? (i.e.,if all covenants are implemented or partially implemented or not implemented or delayed implementation). If partially implemented or not implemented or delayed implementation, RO to please mention the reason in the response column along with a timeline for completion of implementation as committed by the client during supervision.	
EHS Management		
5	If there was any incidence of accidents, spills, leakages, explosionetc. during the reporting period. If yes, what was the scale of damage (e.g. if there was any fatality, monetary loss etc.)? What was the action taken in response to the incident?	
6	If there were any recent fines or penalties issued by the regulatory body. If yes, RO to please mention the nature of violation, amount of fine/penalty paid, action taken by the client to address the issue to avoid any such fine/penalty in future.	
7	If there was any health & safety incident. If yes, what was the extent of injury – minor, major or fatal? What was the action taken in response to the incident?	
8	If there are any new E&S risks or adverse impacts observed due to client's operation. RO to please mention the types of new E&S risks, the reason for such new E&S risks, mitigation measures undertaken by the client to address the E&S risks.	
Permits and Compliance Certificates		
9	All the required permits, licenses and clearances in place. RO to please mention the issuance dates and duration of validity of	

Sl. No.	Question /Issues to check	Response
	all such permits, licenses and clearances.	
10	Other international management systems (for e.g. ISO 14000, OHSAS 18001, SA8000) followed by the client and if they have valid certifications for those management systems?	
Grievance Redressal		
11	If there have been any recent complaints, grievance or protest received from local communities. If yes, RO to please specify the nature of grievances; actions taken by the client to resolve grievances and if there any outstanding issues and measures proposed by the client to resolve them.	
12	If there were concerns raised during the stakeholder consultations carried out by the client during the reporting period. If yes, what was the approach undertaken by the client to address those concerns?	
Other Information		
13	Any other information pertaining to environmental matters, management approach, community, media or NGO coverage that need to be mentioned. If there are any environment friendly initiatives, energy saving equipment etc. that might be relevant for the Bank/FI.	

Source: Bangladesh Bank (2017, p.02)

Appendix VI: Environmental policies, projects for environmental improvement relevant to textile industry in Bangladesh

Table: Historic timeline of environmental policies and related institutions in Bangladesh

Year	Environmental concern and policies	Source
1970	Formulated Water pollution control ordinance.	Clemett, 2004
1973	• Water pollution control ordinance promulgated (after Stockholm conference in 1972). • Wildlife preservation order formulated.	(Paul, 2015), (Government of Poeple's Republic of Bangladesh, 2017)
1977	Environment Pollution Control ordinance formulated along with- • Environmental pollution control board (16 members). • Environmental pollution control cell (27 members). • Environmental pollution control project.	
1985	Established Department of pollution control.	(Government of Poeple's Republic of Bangladesh, 2017)
1989	• Established Ministry of Environment, Forest and Climate change ry (MoEF) (environmental issues institutionalized at this stage). • Department of pollution control renamed into Department of Environment.	
Late 1980s to early 1990s	EIA in Bangladesh was undertaken or demanded by donor agencies for their own funded projects.	(Ahammed & Harvey, 2004); (Momtaz, 2002)
1991-92	MoEF prepared Bangladesh country Report for *United Nations Conference on Environment and Development (UNCED)*, where EIA has been identified as a management tool for sustainable development of the country.	(GoB, 1991); (United Nations, 1996)
1992	National Environmental Policy 1992 (inspired by “earth Summit’ in Rio de Janeiro in 1992) formed. Objectives: 1. Maintain ecological balance and overall development through protection and improvement of environment. 2. Protect country against natural disaster. 3. Identify and regulate activities that pollute and degrade environment. 4. Ensure environmentally sound development in all sectors. 5. Ensure sustainable, long term and environmentally sound use of natural resources. 6. Activity remain associated with all international environmental initiative to maximum possible extent. **Institutional arrangements:** • MoEF for policy implementation. • National environmental committee chaired by head of Govt.	(Netherlands Commission for Environmental Assessment, 2013), (Paul, 2015)
	Guidelines on Environmental Issues Related to Physical planning.	
1993	National environmental committee formed.	
1995	Guidelines for Physical Planning of Rural Areas in Bangladesh	

Year	Environmental concern and policies	Source
	Bangladesh Environmental Conservation Act (ECA) formulated on the basis of Environment policy 92 and national environment management action plan 1995. Key points were- • Declaration of ecologically critical areas • Restriction against vehicles, manufacturing process emitting injurious smoke. • Environment clearance certificate and formulation of environmental guidelines. **Institutional arrangements** • Department of Environment got legal basis under the rule to carry out purpose of this act on behalf of Government. • Director General of DoE should prevent accidents causing environmental degradation and pollution by any material; give advice or directions for environmentally sound use-storage-transport-import-export of hazardous material; conduct enquiries or research regarding environmental conservation, improvement and pollution; advice government to avoid manufacturing processes causing environmental damage. ECA Further amended in 2002 and 2010.	(Department of Environment (DoE), 1995)
1997	Formulated Environmental Conservation Rules (ECR) Key points were- • Determined standards of air, water, odour, sound • Determined standards for emission and discharge of waste. • Categorized industries according to their impact on environment and mandated IEE and EIA necessities for them Institutional arrangement. • DoE would review and process EIA reports and provide ECC for projects. ECR'97 Further amended in 2012.	(DoE, 1997b)

Table: Current projects by international organizations relevant to environmental improvement within textile industry of Bangladesh

Name of project	Approach of impact on textile industry	Implementing agency
Projects by World Bank		
Boosting Business with Economic zones	Promoting compliance with international quality standards, good social and environmental practices etc.	Economic Relations Division, Bangladesh Export Zones Authority (BEZA), Bangladesh Export Processing Zones Authority (BEPZA), Bangladesh High-Tech Park Authority (BHTPA)
Reforms to create more, Better, and Inclusive jobs	Expected result is 'Full compliance to environmental standards under the National Environment Policy 2018 of key export-oriented industries'	Ministry of Finance
Making Microenterprises Clean and green	Will help about 20,000 microenterprises adopt environmentally friendly practices through loans for 'innovative, environmentally sustainable technologies and practices and for shared amenities to reduce pollution and reduce pollution environmental degradation'	Palli Karma-Sahayak Foundation (PKSF)
Bangladesh Environmental Sustainability and Transformation Project (Still on proposal stage)	Strengthening Environmental Governance (includes improve environmental monitoring and enforcement as one of the targets) Addressing air and water quality, focussing on pollution hotspots	Ministry of Environment, Forest and Climate Change
Projects by GIZ		
Support of Safety Retrofits and Environmental Upgrades in the Bangladeshi Ready-Made Garment (RMG) Sector	Financial system development, promoting availability of information in textile sector, expanding the range of services offered by private service providers	Ministry of Finance, Financial Institutions Division, Government of Bangladesh

Name of project	Approach of impact on textile industry	Implementing agency
German-Bangladesh Higher Education Network for Sustainable Textiles (HEST)	Including social and environmental aspects into the curriculum and integrating practice-oriented teaching methods; research in response to the needs of the textile and apparel sector and developing training modules from the research outcomes	Ministry of Education, Government of the People's Republic of Bangladesh
Promoting Sustainability in the Textile and Garment Industry in Asia (FABRIC)	Regional dialogue and knowledge sharing about socially responsible, environmentally sound and economically viable business models; Cooperation with the private sector; developing capacity for improved social and labour standards, promoting gender equality, supporting implementation of efficient environmental management	GIZ
Project by IFC		
Established technical knowledge hub, the Textile Technology Business Center (TTBC) with BGMEA	"To improve access to information on best practices, resource-efficient technologies, financing options, and technology suppliers, making matches between service providers and industries."	BGMEA
Partnership to Cleaner Textile (PaCT)), phase three in collaboration with internationally leading brands	For clean production practice and resource efficiency in the export-oriented textile units of Bangladesh	IFC, BGMEA

Source: (GIZ, 2020; The World Bank, 2020; IFC, 2022)

Appendix VII: Components for evaluating efficacy of EIA system

Table: Components adopted by global experts for evaluating the efficacy of EIA system

Authors / Country	Sadler (1996) **(International)**	Doyle and Sadler (1996)	Leu et al. (1996) **(Taiwan)**	Sadler (1998)	Kennedy (1988)	Wood et. al (1996) **(EU countries)**	Glasson and Salvador (2000) **(Brazil, UK)**	Arts et al. (2012) **(UK, Netherlands)**	Ortolano (1993)	Hijri & Ortolano (1991) **(Kenya)**
Components adopted for evaluating EIA system	i) appropriateness of institutional control	i) institutional arrangement for EIA incorporating legislative and administrative means	Environmental policies, regulations, guidelines	i) institutional control	i) a specific legal requirement	ii) influence of EIA procedural changes (i.e., new guideline) on the reports	i) environmental policies and regulations	i) regulatory and institutional framework	procedural control (central agency promulgating procedure)	i) compliance with procedural requirement
	ii) adequacy of operational performance for main stages and components of EA	ii) preparations of EIA and procedural performance	Administrative framework	ii)3R of good practice (use of best available techniques, appropriate method for public consultation, timely - adaptive implementation	ii) preparation of Environmental Impact Statement (EIS) is mandatory	i) quality of EIA reports	ii) institutional and administrative framework	ii) characteristics of EIA procedure	judicial control (court have power but not direct control over agency)	ii) adequacy of EIA documents
	iii) relevance of decision-making	iii) implication of performance	EIA procedure		iii) authorities consider the results of it	iii) implication of EIA on	iii) EIA procedure	iii) quality of EIS	evaluative control (appraisal of env agency	iii) utilizing appropriate

Authors Country	Sadler (1996) **(International)**	Doyle and Sadler (1996)	Leu et al. (1996) **(Taiwan)**	Sadler (1998)	Kennedy (1988)	Wood et. al (1996) **(EU countries)**	Glasson and Salvador (2000) **(Brazil, UK)**	Arts et al. (2012) **(UK, Netherlands)**	Ortolano (1993)	Hijri & Ortolano (1991) **(Kenya)**
					while making decisions	project modification			leads sanction issued by central admin)	methods to assess impact
			Role of actors involved				iv) role of key actors	iv) role of stakeholders	professional control (professional standard and codes of ethics	iv) influence on decisions at different levels of project
			EIA implementation (contextual factors, awareness and link to SEA				v) EIA Compliance monitoring and enforcement	v) decision making and follow up	Direct public and outside agency control (citizen group's pressure influencing env agency	v) weight given to environmental factors in final decision
			EIA compliance monitoring						Instrumental control (market instrument conditioned with EIA completion)	
			Availability of resources							

Table: Components adopted by experts from developing countries for evaluating the efficacy of EIA system

Authors Country	Nadeem & Hameed, (2008) **(Pakistan)**	Valappil, et al. (1994) **(India)**	Rathi (2017) **(India)**	Jha-Thakur & Khosravi (2019) **(India)**	Annadale (2001); Ahmed & Ferdausi (2016) **(Maldives; Bangladesh)**	Ahmed & Harvey (2004) from Leu, et. al (1996) **(Bangladesh)**	Shakil & Ananya (2015) from Chanchitpricha & Bond (2013) **(Bangladesh)**	Kabir & Momtaz (2018) **(Bangladesh)**
Components adopted for evaluating EIA system	i) legislative system	(i) screening	i) scoping	i) stages in EIA process	i) legal/administrative backing	i) environmental policy, regulation and guidelines	i) procedural	i) Institutional arrangement
	ii) administrative set-up	ii) scoping	ii) evaluation of significance	ii) adequacy of guidelines	ii) preliminary and detailed assessment	ii) administrative framework	ii) Substantive	ii) Quality of EIS
	iii) EIA process and practice.	iii) preparation of EIA	iii) review of EIA reports	iii) transparency and influence in decision making	iii) EIA review	iii) EIA procedure	iii) Transactive	iii) post EIS stage of EIA
		iv) acceptability of project and independence in control	iv) monitoring and follow-up	iv) qualification of consultants	iv) decision making	iv) role of actors involved	iv) Normative	
		v) public participation		v) quality of EIS	v) follow up	v) compliance monitoring and enforcement		
		vi) decision making		vi) public participation	vi) administrative support	vi) EIA Implementation in practice		
		vii) post project analysis		vii) compliance monitoring		vii) availability of resources		
				ix) effective implementation of mitigation measures etc.				

Appendix VIII: DoE's monitoring checklist for industrial units

Checklist format for DOE monitoring

Name of organization:

Address:

Address and phone no. of chairman/owner/managing director:

Date of visit:………………………….. , time of visit: …………………am/pm

Name of monitoring officer:

Name, designation and phone number of factory representative:

Information found from monitoring:

1. Has site clearance/ environmental clearance : yes/ no / applied. If yes,

Serial no:

Validity:

2. Has site clearance/ environmental clearance been renewed: yes/ no. if yes,

Serial no:

Validity:

3. Size of factory:

4. Ownership of factory: owned / rented

5. Date factory started operating:

6. Activity: Dyeing/ washing/printing/finishing/spinning/knitting

7. Category of factory: Green/Amber A/Amber B/Red

8. Status of operation while monitoring: Active/ Inactive

9. Dyeing type: fabric/yarn

10. Daily dyeing volume: Average ………. gauge/ton

Figure: DoE's checklist for monitoring visits p.01

11. Washing type: denim and twill

12. Daily washing: Average: denim: …….. Pc/day, twill: ……….. pc/day, average weight:……gm/pc.

13. Machineries in factory: a. no. of dyeing machine ……..

b. no of washing machine ………

c. no of printing machine ………

14. other factories: a. ceramic: daily production: ……….. ton ceramic tiles/tableware

b. pharmaceuticals:

c. oil refinery: daily oil production: …………. Litre

d. paper and board mills: daily production: ………….

Type: pulp paper/recycle paper mills

e. chemical factory:

f. miscellaneous

15. Daily liquid waste generated by factory: ……….. lit/day or ……… cubic meter/day.

16. Status of ETP: Active/ Inactive/Does not exist/under construction.

17. Type of ETP: Chemical/Biological/Bio-chemical/electro-coagulation

18. ETP capacity: …………cubic m/day

19. Presence of water flow meter in ETP inlet: Yes/ No. Mention reading:……………

20. Presence of water flow meter in ETP outlet: Yes/ No. Mention reading:……………

21. Sludge collection: Filter press/sludge blade/sludge centrifuge

22. Chemical dosing in ETP: Found Active/ Inactive

23. Presence of chemical in ETP dosing tank: Found/ Not found

24. Treated wastewater was discharged in surrounding waterbody while monitoring: ………..

25. Untreated wastewater was discharged in surrounding waterbody while monitoring:……….

Name of factory representative :
Signature:
Date:

Figure: DoE's checklist for monitoring visits p.02
Source: Author's visit to DoE (2020)