

A Thesis
On
Challenges and Opportunities of Circular Economic Model for
Developing Countries: Evidence from Bangladesh

This paper is submitted to the Department of Management, Faculty of Business Studies, Hajee Mohammad Danesh Science and Technology University, Dinajpur for the partial fulfilment of the degree of Master of Business Administration (MBA) in Human Resource Management



Prepared by Sadia Afrin ID:1703220 MBA in Human Resource Management S-III, January-June, Examination-2022 Department of Management Faculty of Business Studies HSTU, Dinajpur	Supervisor Rafia Akhtar Professor Department of Management Faculty of Business Studies HSTU, Dinajpur
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Hajee Mohammad Danesh Science and Technology University
Dinajpur -5200, Bangladesh

June, 2024

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By

Sadia Afrin
ID:1703220
MBA in Human Resource Management
S-III, January-June, Examination-2022
Faculty of Business Studies
HSTU, Dinajpur.

Approved by

Supervisor

Rafia Akhtar

Professor

Department of Management

Faculty of Business Studies

HSTU, Dinajpur

Co-Supervisor

Lima Nasrin Eni

Lecturer

Department of Management

Faculty of Business Studies

HSTU, Dinajpur



Hajee Mohammad Danesh Science and Technology University

Dinajpur -5200, Bangladesh

June, 2024

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Sadia Afrin

ID : 1703220

MBA in Human Resource Management

S-III, January-June, Examination-2022

Department of Management

Faculty of Business Studies

HSTU, Dinajpur.

Certificate of Supervisor

I declare that this thesis paper entitled “Challenges and Opportunities of Circular Economic Model for Developing Countries: Evidence from Bangladesh” is a study of the economic sector in Bangladesh. This paper is an original work done by Sadia Afrin, ID: 1703220, MBA in Human Resource Management, S-III, January-June, Examination-2022, Faculty of Business Studies, Hajee Mohammad Danesh Science and Technology University, Dinajpur. She has completed the thesis under my supervision and submitted this paper for the partial fulfilment of the requirement of the degree of MBA in Human Resource Management.

I wish her every success in life

.....

Rafia Akhtar

Professor

Department of Management

Faculty of Business Studies

HSTU, Dinajpur.

Certificate of Co-Supervisor

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I wish her every success in life

.....

Lima Nasrin Eni

Lecturer

Department of Management

Faculty of Business Studies

HSTU, Dinajpur.

Student declaration

I hereby declare that the entitled thesis “Challenges and Opportunities of Circular Economic Model for Developing Countries: Evidence from Bangladesh: A Case of Economic Sector, embodies the result of my research works and efforts, prepared under the supervision of Rafia Akhtar, Professor, Department of Management and Co-Supervisor, Lima Nasrin Eni, Lecturer, Department of Management, Faculty of Business Studies, HSTU, Dinajpur.

.....

Sadia Afrin

ID : 1703220

MBA in Human Resource Management

S-III, January-June, Examination-2022,

Department of Management

Faculty of Business Studies

HSTU, Dinajpur.

Abstract

The circular economy model is used minimum in the developing nation as compared to the developed nation from the environmental as well as sustainable development focal point of view. The key objective of this paper is to identify the existing overall scenario of the CE model in Bangladesh and its possibility of sustainable development. The study is a kind of survey research and uses only secondary sources of data. In this paper, a general appraisal of the environmental conditions of Bangladesh, future conditions, opportunities and concerns for the application of circular economy model are all explained in detail. However, the conversion from linear economy has possibilities, but the research indicates that the CE model's adaptability is extremely limited in Bangladesh, and is currently implemented through recycling activities across some industries. Finally, we tried to identify, which factors might be restraining the practice of circular economy in Bangladesh, and reiterate some policy, technology, and public participation constraints present in Bangladesh. It is expected that this paper will be helpful to the policymakers in general and the ones of the developing countries including Bangladesh in particular so that they should look deep into the matter and the author wishes to propose some ideas for further researchers to work on the idea of CE in regard to certain sectors as well as the sub-sectors of Bangladesh.

Keywords: Circular economy, 3Rs (Recycle, Reduce, Reuse), Pollution control, Sustainable development.

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Chapter 1

Introduction

1.1 Introduction

There is no singular definition of circular economy as the concept can be understood in various contexts and varies with stakeholders' discourses. Under the EU Action Plan for the Circular Economy, The European Commission defines: "In a circular economy the value of products is preserved for as long as possible; diminished use of waste and resources are reused, and reused as much as possible within the economy once the product has come to its useful life and when it no longer serves the economy". Thankfully, the definition of circular economy (CE) has been stated for it to be a method to managing and optimizing the circularity of resources where wastes are used as resources to create value (Azizuddin et al. , 2021). The world society today adopts the system as a linear economy one. This model encompasses the manufacturing, usage and dumping of unnecessary amount (Figure 1a). However, one third of all assets are not recycled, burned, or end up in the garbage dump. There is more to that. These are basically stored in structures such as buildings and structures, bridges or in products for consumption. Currently, the growth of the world economy is taking a pattern of growth that could be described as "take-make-consume and dispose". A somewhat linear model, which originates from the offetive that resources are plenty available, is easy to obtain and cheap to discharge. Besides polluting the surroundings, the model is characterised with massive wastage and poor utilization of resources. The circular economy model, however, consists of the production, consumption, disposal of wastage to reuse it for production further (Figure 1b) and follows mainly the principles of recycling, reducing and reusing (3Rs) methods (Manickam and Duraisamy, 2019). Therefore, CE is one of the development models that concern the environment and sustainable development most (Andersen, 2007). Moreover, It is noteworthy that CE transition gives prospects to eradicate poverty which has been acknowledge by Constant et al. , (2013). There is symbiosis between SDGs and the circular economy because the model says use only what is necessary, use again what has been used before, fix what is damaged, and remake it when it can not be fixed.

A report from (UNEP) United Nations Environment Programme on the Natural Assembled Resources and their consumption revealed that extraction of natural resources has raised by three folds in the last 40 years (UNEP, 2016). Also, according to UNEP, the resources could tap an extra \$ 2 trillion for the global economy by 2050 if managed sparingly (Panel, 2017).

a) Linear Economy Model



b) Circular Economy Model

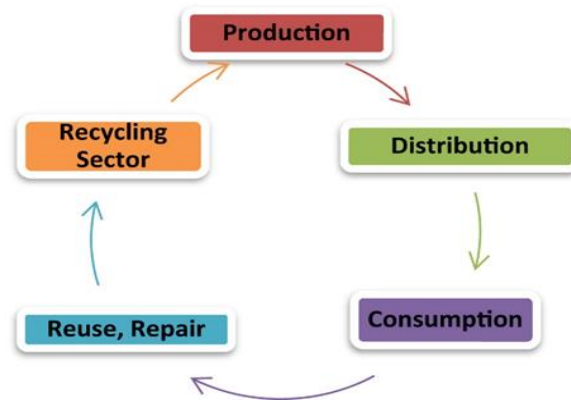


Figure 1. Linear Economy Model and Circular Economy Model

Besides, the behaviour of circular economy can be linked to some of the chartered goals like – SDG 6 (Clean water and sanitation), SDG 7 (Affordable & clean energy), SDG 12 (Responsible consumption & production), and, SDG 15 (Life on Land) (Schroeder et al. , 2019). This system is a service delivery system, devoid of any tangible products for sale as witnessed in the case of most businesses (Biswas et al. , 2019).

Furthermore, if we consider looking at the environment condition of Bangladesh, in the respect of PM 2. 5 Fine particle air pollution, Bangladesh stands as the most polluted country of the globe superseding India (Figure- 02) This pollution rate is six folds higher than the WHO Standard limit. According to WHO, about a few thousands of Bangladeshi population had

health-related negative effects of non-communicable diseases originating from where pollution was the dominant cause, Koop, 2021).

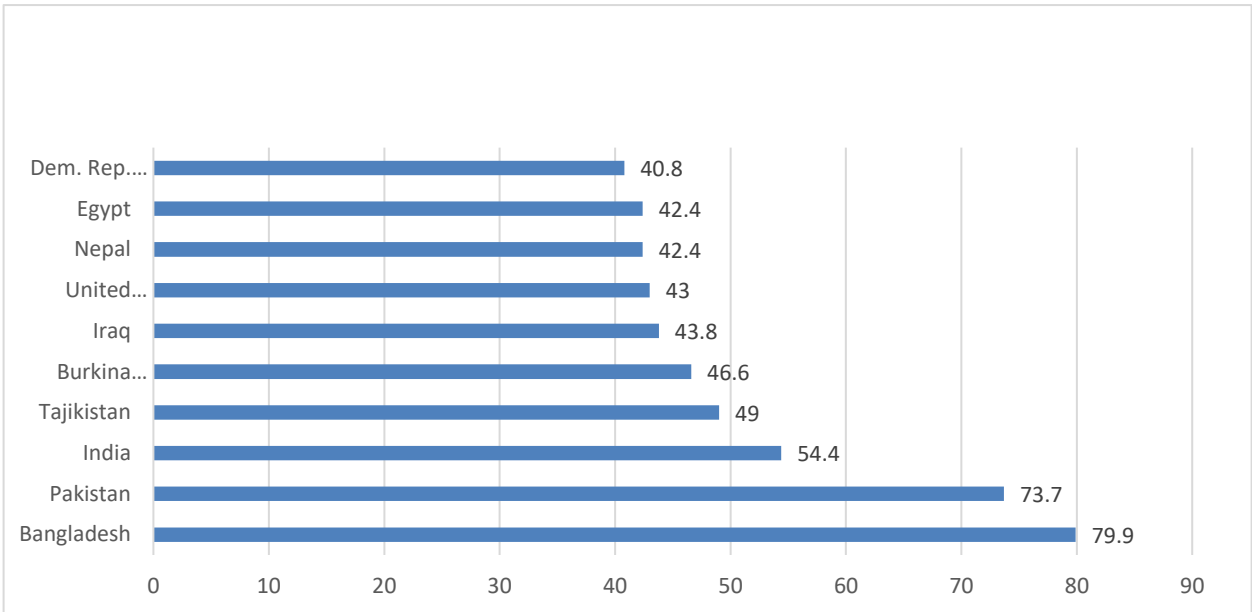


Figure 2.World's top ten polluted countries 2023. Source: IQAir 2023, World Air Quality Report.

Additionally, according to the report of world development indicator, by the World Bank, CO2 emission in Bangladesh (metric tons per-capital) was seen to increase steadily with a positive slope. In 1990, the value was 0.11, this figure increased dramatically to 0.59 in 2018 (336 times higher than it was in 1990). After that this rate is declining in the following two years rather than the previous years. In 2019 this rate was .56 and in 2020 was .51.

However the Southeast Asia is know for the transforming into city status throughout the years, it is important to state that this current urbanisation process is unsustainable (Arfanuzzaman and Dahiya, 2019). From the point of view of population in Bangladesh, rural to urban mobility that was originated due to the existing rural-urban disparity has ends up venting the population in Urban region (Biswas et al. , 2019). He et al. Sample papers Some previous works have highlighted a direct correlation between urbanization and environmental pollution, Ahmed & Islam (2014), Hossain & Hasanuzzaman (2012), Rahman et al. (2020).

Similarly, Ahmed and Islam, (2014) in their study also concluded that it is due to the formation of environmental problem, the urbanization factor emerged as the major cause. It disrupted water and supply services, collection, removal and disposal of solid wastes, movement of traffic, noise

pollution and water logging. Furthermore, accelerated economic development due to the growth of urbanization also leads to an increased use of energy, in this case pollution (Rahman et al. 2020).

However, Trading Economics shows that in Bangladesh, unemployment rate is also rising. Bangladesh being a developing country with demographical dividend requires employment opportunities to be initiated. Sanction also Bangladesh needs sustainable industrial development input resources for sustainable development Goal(SDG). In such situations, the concept of circular economy that is the vision for a totally new way of doing business and living contains a value for implementing the circular economy in practice in accordance with the 3Rs concept that are Recycle, Reduce, and Reuse (Yong, 2007).

That is, Scientific studies on the existing status of environment and application of circular economy model on the sustainable development goals (SDGs) is an urgent necessity in the context of Bangladesh. This indicates that we have very few pieces of literature with us specially focusing on the concept of CE in relation to developing nations including Bangladesh (Kirchherr and van Santen, 2019). While most of the articles within the developing country solely focused on the waste management (Abalansa et al. , 2021; Ali et al. , 2021; Khan and Ali, 2021), others in fashion (AtalayOnur, 2020), and renewable energy effect (Angulo-Mosquera et al. , 2021).

If focused on particular countries, literature review is dedicated to recommerce in Bangladesh and separately to leather, textile, and renewable energy sector for the country of interest (Islam et al. (2021); Moktadir et al. (2018); Saha et al. (2021)). But they also highlight the risks that may emerge as a result of CE practices in the supply chain and other aspects of SC SDGs (Azizuddin, Zaman, & Qasim, 2021; Dulia, Barua, & Sarkar, 2021). However, there is scarcity of research that attempt to present the full picture of implementation of CE and its existing environment coupled with the prospects, realization and issues of implementing CE by various sectors for a developing country Bangladesh.

Therefore, Hence, the purpose of this paper is to evaluate the circular economy model in Bangladesh and how changes can be made to sustain it in industries of Bangladesh. In terms of the research approach, the present study can be described as methodologically underpinned by quantitative descriptive analysis. The secondary data sources which have been employed in the study are Newspaper articles/ editorials, Magazine and journals and Grey Literature.

In the subsequent parts, in the section 02 and section 03 based on the literature review relevant findings suggested in the view of a developing country, Bangladesh has incorporated, moreover, the working methodology of this research has described too. In section 04, the practice of CE in overseas situation is depicted with the intention to inform the readers how CE is being implemented in other parts of the world so that the readers could have a comparison between the CE practice in Bangladesh with the modern global trend. Therefore, this sections comprises of the current practice and possibility or prospect of CE at a sectorial level in Bangladesh. The study then identifies the challenges in the application of CE model that is currently facing Bangladesh. In the following section 05, conclusions and recommendations are made according to the synthesis of the section 04. Last, related study are being discussed comparatively to conclude the study in the last part of the study which is Section 06.

1.2 Objective of the study

The main objective of my research paper is to review the challenges and opportunities of the circular economic model for developing countries like Bangladesh toward sustainable development.

Chapter 2

Literature review

2.1 Recent literature review

This study employed the systematic approach in conducting a literature review with focus on papers published in Scopus indexed journals from 2019 to 2022. So, by using two keywords: “Circular Economy”, and “Developing Country” we came out with a total 22 papers, and only these papers have been used to review the recent works in form of section 2. 1; afterward we further narrowed down our search of Circular Economy to only “Bangladesh”; and accumulated a total of 7 papers; which are presented below:1; afterward we further narrowed down our search of Circular Economy to only “Bangladesh”; and accumulated a total of 7 papers; which are presented below:

Table 1. Findings from recent literature in the context of Bangladesh.

Authors (Year)	Context	Methodology	Findings
Dulia et al. (2021)	Measuring risk toward the CE model in supply chain.	Fuzzy Synthetic Evaluation (FSE) based on primary data	Key findings of the research revealed that the overall risk involved in the framework and quality of the recycled product remained the primary area of concern in the case.
Repp et al. (2021)	EU’s transition to CE has had a shift in employment seen across the global employment shift.	Social life cycle assessment (SCLA)	It could be faced by Bangladesh since it results in loss of jobs for the employees of these companies.
Moktadir	Factors that	Graph theory and	However, the knowledge and

et al. (2018)	may have prompted the realization of CE practice in the leather industry of Bangladesh	matrix approach (GTMA)	awareness of CE in the case of the different stakeholders are one of the most vital factors for CE practices' implementation.
Saha et al. (2021)	CE practice in the Textile and Clothing Industry (TC).	Mixed method approach: quantitative analysis on the survey response data, qualitative analysis of the focus group discussion based on content analysis, and personal comments from the survey.	• The major difficulty observed in the process of setting implementation of CE practice is the attitude of the management, inadequate financial, personnel, IT support and the awareness of customers. • In summary, it would call for a combined effort of government, industry, and consciousness among the buyer. • It is also important to share sustainable knowledge in the value chain sustainable practice among the members.
Azizuddin et al. (2021)	The above discussion implies the following CE in Bangladesh for sustainable development.	Interview, review of theory and use of Delphi approach interview (Semi-structured)	• The integration of both government and private sectors can assist the nation achieve sustainable development by incorporating CE principles in various sectors of Bangladesh. • In addition to absence of information concerning CE among the public of Bangladesh, there are logistical and efficient technological support that

			hinder the implementation of CE
Arman and Mark-Herbert (2021)	Analyzing the influence of re-commerce for the practice of consumers' engagement	Review of literature, and focus group discussion	• Re-commerce practices in Facebook has some contribution to use the second-hand product to erase the taboo from society • Re-commerce avails awareness or concern about CE practices among the population.
Islam et al. (2021)	Sustainable energy production by conversion of animal waste	Scenario analysis, and GHG quantification model	• Implementing the commercial biogas generation system can aid in the production of a new form of renewable resources for Bangladesh. • To employ the use of biogas, it was recommended that a soft-loan for the lower income group be introduced by the author.

2.2 Literature review: developing country perspective

According to JW Kirchherr and van Santen (2019), more focus on the study of CE is required, especially for emerging and developing nations as only 5% of the papers are published that address the concept of CE in the development context (Kirchherr and van Santen, 2019).

In the context of the developing countries aiming at becoming sustainably developed, the elaborated transition to CE practice needs to occur in nearly all sectors with the focus on: The type or category of waste collection and management that has received the most attention is. Hence, the need to rise to the occasion and implement affordable enhanced technologies that would help facilitate this change (Ullah and Ali, 2021; Serrano et al. , 2020; Winterstetter et al. , 2020). Additionally, the governments of the developing countries are encountering high challenges in managing, making policies, implementing the policies and in fact the use of technologies (Ding et al. , 2019). But the industries in the developing countries are rapidly getting mould into cleaner production and CE practices to come up with goods that are

environmentally friendly, cheaper in costs and demand by the communities of the developed countries. Within this regard, Shayganmehr et al. (2021) has pointed out necessity of utilizing the industry 4.0 technologies which hopefully may act as a stimulus for enhancing alternative CE practices.

The fact is that the developing countries more often suffer from the lack of proper and systematic reactions in relation to climate objectives to their policy actions and developmental strategies (Serrano et al. , 2021). This research paper suggests that the countries should start moving towards policies that would facilitate decoupling; thus it is continuing the economic growth with the inclusive development perspective to eradicate poverty and preserve the environment (Scheel et al. , 2020). Altruism, the improving economic performance of a country, and raising people's awareness for the importance of CE can all act as a driving force for stimulating CE practice in developing nations (Ngan et al. , 2019). Further, Khan (2021) and Ali et al. (2021) argued that in Pakistan, the problem of waste management stems mostly from its mismanagement because of inadequate legislation. The author said that in addition to proper treatment of waste this country should begin directing its efforts towards investment in technologies (IoT & ICT) to transform its waste management practice into a CE model one.

Especially for waste-water treatment Chrispim et al. (2020), revealed that the rate of resource recovery is relatively low, at least one resource recovery plant is only 26% in the study country Sao Paulo, large plants do better than the small plants among the waste its extract from the sludge can serves compost fertilizer material, building material the some few effort to recover energy through biogas. On this note, Amoah et al. (2021) suggested that nutrients wastewater should be used as fish feed for better efficiency. Similarly, in the iron and steel industry for waste management, the growth and development of countries are restricted, here an engineered zero-waste circular economy system is required for the efficient management of waste apart from enhanced investment on solution and technology (Schoenan, Ryer, Croudace, & Franz, 2021). Similar to previous studies, Yadav, Soni, and Kumar (2021) again highlighted that there are several main issues that hinder waste management as follows: They are the failure to have efficient benchmarking processes, the absence of good and efficient financial policies, and management plans by the government to support they effort. Although the CE model can be helpful in eradicating food wastage, which is amongst one of the most prominent causes of

hunger globally (Addressed by SDG 02), there exist several political, cultural, and technical barriers (Ali et al. , 2021).

Angulo-Mosquera et al. (2021) noted that since the recovery practice of traditional energy is not friendly, biomass or solid biofuel recycling should be used as an energy source. Electronic scrap disposal, especially, is known to be mainly carried out in the less developed nations where E-waste is believed to be mainly imported from the developed nations. With regards to the developing countries, they stated that there are positive impacts that may be derived from e-waste processing such as generation of employment opportunities and the use of the raw materials for other productions while on the negative side there are impacts likes environmental degradations and deterioration of worker standard health. But the author reiterated that if the countries do CE practices in managing the E-waste, then these unfavorable impacts could be prevented (Abalansa et al. , 2021).

Another aspect that Wu et al. (2021) and Bening et al. (2022) highlighted on about CE was the positive impacts; the authors stated that circular practice with the plastic industry could generate new employment opportunities , new value addition propositions hence economic growth. However, in Ghana, research result shows that the ‘waste pickers’ involved in the collection of plastic waste are most time living in the poor standard, lacking the basic necessities of life to meet their daily need.

Furthermore, there is a great improvement in the education curriculum in the fashion industry that has incorporated the CE practices, thereby adding that in the future, other fashion stakeholders will practice environmentally friendly habits in their projects (AtalayOnur, 2020). Comparing the poor people generating less amount of waste and less life expectancy with the rich population, we find that the priority fixing low life expectancy with thirst for generation of wastes and emission of CO₂'s. Furthermore, they were more involved in waste management regarding conversation through the practice of recycling contrary to other groups (Caruso and Gattone, 2019).

To address the issues associated with the adoption of CE practices, it is mandatory to take a broad base multistakeholder cooperative approach (Gunarathne et al. , 2019; Mishra et al. , 2019; Radelyuk et al. , 2021). To deal with solid waste in a CE manner, a top-down approach, the

concept of worth, an integrative and adaptive Co-decision procedure, and Shapley value is needed (Oliveira Silva and Morais, 2021).

There is the evidence of some changes in the specific focus areas linked to the handling of solid waste owing to COVID-19 in a number of approaches. COVID-19 throughout the world increased and by June 2021 the total number of confirmed cases has reached 172 million with total deaths 3.7 million deaths globally. Regarding COVID-19, one of the issues hospitals, healthcare facilities and even individuals generate more wastes than normal due to used masks, gloves, gowns and other contaminated protective wears with the virus (Cai et al. 2021).

Many more single-use plastics have been manufactured as a direct end-result of the increased use of such products. Back and forth easing and reinstitution of some contained restrictions that have profoundly altered people's mobility, consumers' conduct, and waste solutions have all influenced municipal solid waste production and disposal elicited by the COVID-19 pandemic. Comparing the amount and composition of municipal solid waste in selected countries USA, Brazil, Canada, the UK, France, and Italy before pandemic in 2019 and during the pandemic in 2020 and 2021, the result concludes that unlike the household wastes, lockdown for longer period led to a greater proportional marginal reduction in commercial and construction wastes due to constrained economic and tourist activities (Cai et al. 2021).

However, as reported by Teymourian et al., (2021), change in the nature of waste from the qualitative and quantitative perspectives was promptly initiated consequent to its Person to Person Transmission. A variety of suppression or mitigation actions have been employed in many countries due to coronavirus disease. Consequently, there was a significant increase in manufacturing and utilization of healthcare products, plastic products, and plastics, which are used for medical applications and also for general packaging and other non-medical applications such as PPE waste and medical waste generation. That being said, it is also true these shifts can aggravate pollution situations with regards to solid wastes for sure has been a problem even prior to the COVID-19 pandemic.

Healthcare waste (HCW) as a big environmental threat has direct implications to people and even future generations, referring to the three sustainability pillars of people, planet, and prosperity. A global generation of HCW according to the studies is 37, which follows a growth rate of 2-3%. The HCW growth rate is even faster in China, which is expected to reach a volume

of 2.496 million tons in 2023. Hence HCW requires adequate handling and appropriate disposal methods prior to disposal in order to eradicate such effects and counter any infection or hazardous risks emanating from it.

Ranjbari et al. (2022) identified four dominant HCW research themes: Specifically, the following HCW areas were evidenced: (1) HCW minimisation and its safe management and policies; (2) HCW incineration and its environmental effects; (3) hazardous HCW management practices; and (4) HCW handling and staff and training. Additionally, results of the research also revealed that although the healthcare industry could play significant potential in the achievement of CE transition, it has been left out from the discourses of CE due to single usage phenomena in the healthcare industry because of the emergence of infectious, toxic, and hazardous HCW streams. Hence, it greatly requires additional creative solutions towards achieving circularity and implementing the loop-closing concept for providing quality healthcare services with employing limited resources and producing fewer HCW.

On the other hand, the problem of SWM is the crosscutting problem that has the significant implication to the current situation with the relation to the pandemic. SWM can on a special note be associated with 12 of the 17 United Nations – Sustainable Development Goals (UN-SDG) as the utilitised that over 2 billion people around the world do not have today. Nowadays, global waste is around 2.01 billion tons and is expected to grow to 3.4 billion tons by 2050. Solid waste–related emissions are also anticipated to increase to 2.38 billion tons of CO₂ equivalent per year by 2050 if no improvements is made in this sector (Sharma et al. 2021).

Chapter 3

Methodology of the study

3.1 Data

The analysis is conducted with the help of secondary research data. Some of the sources of secondary data include the World Bank reports, Trading economics, World Air Quality Reports, and any other published data from industries. Specifically, for a certain type of paper that appeared in the 2018-2022 period, empirical studies were obtained from the SCOPUS and WoS database.

3.2 Analytical tools

In the study, the analysis that has been done is content analysis. The facts and figures relating to the environmental status of Bangladesh have been described graphically in the following sub-sections. Furthermore, and more importantly, supported by appropriate facts and figures, literature review (findings) provide a description of the practices of the circular economy model in different sectors in Bangladesh.

Chapter 4

Analysis and interpretation

4.1 Circular economy practices around the world

A large number of application of circular economy model can be observed through many such new generation innovations including action like turning plastic into carpet (Possioble, 2010), transferring bioplastic product into biogas(Vasmara and Marchetti, 2016), using elephants waste to produce paper(Nishat, 2019). Some companies are even creating plastic highways; some homes using old shipping container are built (Bendix 2019, Megan, 2020), Biodegradable cutlery are manufactured, lather bag using fish skin are produced (Timmins, 2019), mushroom from the coffee waste is grown (Sayner, 2012), jeans from a waste plastic bottle are made (Webb, 2013), and carpets are turned

The circular economy model has gradually been introduced in various developing regions like South Asia and Southeast Asia. Where Atterio is collecting e-waste, HaatiChaap creating Papers form Elephant manure (Goyal et al. , 2018). One of the companies owned by several youths of India is WVI (Waste Ventures India Organization) that gathers organic waste and produces compost. There is also the use bio gas run bus service in Kolkata which has brought cost efficiencys and relativity sustainable means of transport as comparing to the Maassen and Altamirano observation in 2017.

According to a report on the European Commission, moving the EU to the circular economy could add € 0 to GDP. of new jobs representing .5% in the total jobs provided in a country and generate 700 000 jobs by 2030 (Commission, 2020). EU discovered that this-shift pattern would enable it to boost its workforce by 4% through the implementation of circular economy. On the same year it would therefore provide a net benefit of one by the year 2030. The medium term goals include investing 8 trillion Euros, cutting down CO2 emission by 48%, and raising average income per household by 3000 Euros (Company, 2015). But these practices could facilitate the shedding of employment for countries in the development process such as Bangladesh (Kirchherr, 2021; Repp et al. , 2021).

Within the same context of South Africa, the scrap tires collection rate increased from three percent to seventy percent. It will begin and launch a midsize recycling firm by 2020 which will primarily transform waste into material recovery processes of high worth.

Table 2. Major practices of CE Model around the world.

Continent	Country	Major Practices of CE Model
North America	United States	Manufactured of a carpet from a plastic material; construction of houses fabricating jeans from; apparel made from; utilizing the old shipping containers; waste plastic bottle; reuse or recycle the waste products; recycling and reusing used clothes; welding investment to make green practice to its suppliers.
	Canada	Reusable, recycling, and compostability lables creation plastic packing and use and reuse of cartons.
Europe	UK	Making of plastic highways.
	Poland	Making of biodegradable cutlery.
	France	Applying circular economy ideas throughout its agricultural processing and all the subsequent phases.
	Belgium	C&M collecting only organic cotton.
	Portugal	The cultivation of mushrooms using residual coffee waste products as a substrate
	Sweden	Packaging and creating of recycleable containers and pallets; recycling as well as utilising of used garments.
South America	Brazil	Recycling of concrete and the preparation of mortar and for construction the construction material Available construction aggregates for construction Concrete and construction material Recycled paper and plastic.
	Uruguay	Collection of solid wastes in a manner that allows for recycling of some of these wastes.
	Argentina	Collection of materials for recycling, pollution, creation of pieces of furniture made of trash on streets like benches.
	Chile	Recycling, and reuse of wastewater; recycling of solid wastes.

Australia	Australia	Crafting of lather bag from fish skin; fashion of reusable palate, crates and other containers.
	New Zealand	Making of carpets to bikes
Africa	South Africa	Recycling by collection of scrap tires.
Asia	Japan	Recycling by collection of scrap tires.
	China	Collection and recycling of used clothes.
	India	The process of creating paper out of elephant dung; disposal of electronic wastes; collection of organic wastes, using them to produce compost fertilizer; and operation of buses using renewable biogas.
	Singapore	Feeding the wasted foods to other foods such as producing manure; gathering of wastes, and recycling, disposing wastes to ENERGY plants.
	South Korea	Recycling of the wastes which are plastics, using eco friendly low quality paper to manufacture cups that can be recycled.

Source: Authors' collection.

Many manufacturers in Sweden depend on the re usable crates and pallets of Svenska Retursyste which is an organization that compels, establishes and implement an effective re usable system to its customers and helps in extending logistics and distribution of goods of its customer. Brambles, a service company based in Australia, undertakes production, sales as well as distribution of particulars such as reusable palates, crates, and containers to about sixty countries all over the world. On the other hand, the same case applies to the French Food and Water company Danon, and the concepts of circular economy are implemented in all the stages of agricultural production.

Another practice implemented in Xiangyang, China was to start Sludge to Energy Programme in which bichar and compressed natural gas was produced by sludge of the city's wastewater and local organic wastes; food wastes included.

In Capetown, South Africa attempt was made to establish an on line marketplace for exchanging waste material known as Integrated Waste Exchange (Maassen and Altamirano, 2017). However,

Germany collects three quarters of all used clothing in their country, they reuse half portion of the clothes and recycle one quarter as well. Other such countries include US at 15%, Japan 12% and china at approximately 10% of all used cloths.

Major brands like- H & M & Levis in association with I: CO's primary environmental responsibility involves the collection of garments and footwear for recycling within the firm. Patagonia initiated to recycle or reuse all the used cloths and the company offer the facilities of repairing the apparels for using them for a longer time. C & A, a clothing chain store, has recently undertaken an initiative to sell items made only from organic cotton. Fortunately, in 2016, Walmart foundation informed those five universities as the chosen university for the R & D of a sustainable scheme for the apparel industry. They are also concerned with their suppliers; by the year 2017 it became company policy to only purchase materials from factories that have energy management plans, the company and assist suppliers with software programs for the most effective utilization of resources & energy. A study that evaluates the circular economy in the apparel industry indicated that likened to competing globally, there is an opportunity side to the tune of USD 560 billion to be made besides protecting the apparel industry from pollution . In the developed countries like Europe and USA it has been observed that the clothing is not only being bought for fashion and comfort, the consumers are now expecting more environment friendly products (Doboczky, 2019). Around 32 leading fashion firms formed a charter to move the fashion sectors to total carbon neutrality in the next three decades (Hacker, 2019). Even some giants in the fashion industry including H&M, Burberry, and Chanel are focusing and are ready to invest in research and development of the sustainable clothes. Currently, they are in the process of supplying quality expensive cloths on rent to minimize pollution since it cuts on the demand for clothes which end up polluting the environment.

The textile dying is a chemical intensive industry and around over 8000 chemicals are employed in some or the other stage of the process and it was estimated that dying requires from 30- 50 liters of water per kilogram of cloth (Kant, 2011). Twine, the globe's initial digital thread dyer startup produced the TS-1800, that is a mere 2m x 1. 5m in size which start the job in minutes hence freeing from the dangers associated with handling the cables manually. In addition, it needs a small amount of water, and by moving dyeing services to manufacturers, designers, or apparel producers, it cuts their costs on logistics.

4.2 Current practice and prospects of circular economy in Bangladesh

According to the components of a circular economy model as illustrated in the Figure 1, b, recycling is most prominently practiced in Bangladesh. However, the idea of reuse has emerged recently among the population of Bangladesh, as people selling items on Facebook use Re-commerce practices and thus, eradicating the use of pre-owned products among the population (Arman and Mark-Herbert, 2021).

Similarly, several industries and producers are also interested in minimizing the consumption of resources, which in turn lowering the wastage rate. The recycled waste however is likely to be small compared to the produced waste and this would also mean that more energy was expended in the process. The most apparent and maybe one of the frequently occurred recycling processes includes following aspect that garbage generated in cities is mostly collected by the urban poor who are employers of the informal sector in Bangladesh. According to national and international surveys, 0.12 million of these poor people are engaged with the processing and handling of waste directly or indirectly. This garbage produced and discharged in 522 cities and towns of Bangladesh is 13,332 tons per day and those in a year are 4. 86 million, tons of severe environmental pollution (Chowdhury et al. , 2014).

But in practical condition, the result showed that the average efficiency of waste collection in the different areas of Bangladesh is only 55% which is not suitable for making Smart Green City. Therefore, for the system generation of waste, the Government of Bangladesh started the 3R plan of waste management in the year 2010. This is set to minimize the generation of waste and enhance the recycling of waste as practiced by the tenets of waste hierarchy. The recycling training center was set up in 2005 with an observation of UNDP, SEMP and MoEF to train yet another type of professional population about the managing of waste & energy (Bangladesh, 2010).

The finding is summarized in figure 3, table 3, and table 4 in relation to the 3Rs practices and prospects in Bangladesh For further details, it shall discuss the suitability of circular economy model in the different sectors of Bangladesh elaborately.

a. Garments Sector

Textiles and garments industry alone contributes the largest part of foreign exchange of Bangladeshi economy. From other private reports for clothing bearings it has been identified that around 5 thousand garments factories supply up to 4. 2 million jobs. Random research held in Narayanganj proves that this area produces 120- 125 tones waste / garments wastes daily (Alom, 2016). Another research indicates that Bangladesh's textile industries gave nearly 1. Wastewater generation by fabrics: Clothes & textiles industry produces about 80 million metric tones fabrics produced and produced about 200 to 217-million m3 wastewater. They calculate that by 2021, the textile industries of Bangladesh will supply nearly 2. Mainly, 91 million metric tons of fabrics of which results in about 349 Million m3 of wastage (Brett, 2018).

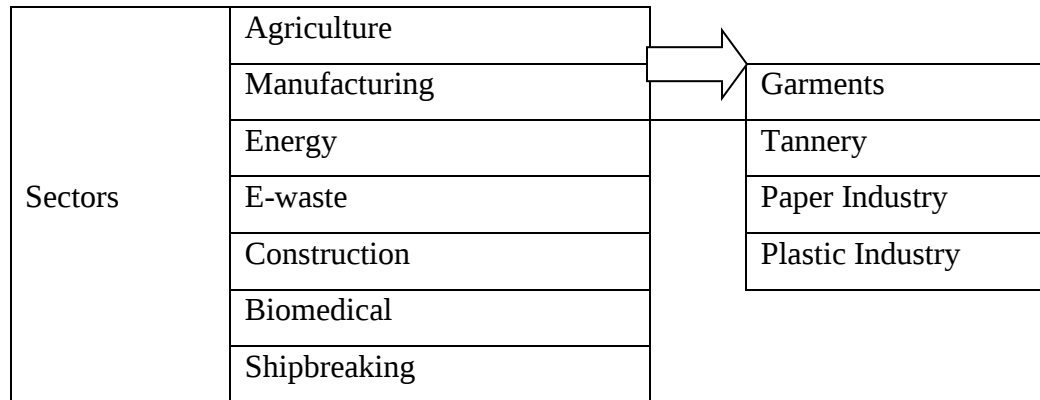


Figure 3. Practices of 3Rs in Bangladesh.

Since we are not directly interface to the consumers, Bangladesh has a great chance. Thus, it is possible to develop and implement the circular economy model with the large apparel and fashion chain stores interested in seeking the circular business model (M. Uddin, 2018). Besides, every sector in this business has a massive influence on the recycling of wastes which is our main source of income for many of us. Regular shops which can easily process garments waste are many out there.

Table 3. Practices, and opportunities of CE in Manufacturing Sectors.

Industry	Current Practices	Opportunities
Garments	✓ Collection of garments wastes ✓ Reverse resources are trying some more to establish market place for	✓ The government and the companies of Bangladesh can co-develop the Circular

	garments waste. ✓ Simco spinning, and textile swirling and swirling yarns from cotton bills clips. ✓ Filotex Ltd., is the first organization in Bangladesh to have their business model operational under the concept of Circular fashion.	economy model with the big apparel and fashion chains. ✓ If bi-products such as garments waste are recycled in Bangladesh, it will enhance more income in this sector, and add approximately \$4 billion to the trade while opening up new job possibilities.
Tannery	✓ Initiation of green supply chain ✓ It includes the construction of CETP (Central Effluent Treatment Plant), and SPGS (Sludge Power Generation System) for treating hazardous wastes, and generation of power from those wastes in Savar of Bangladesh.	✓ No mentionable prospects
Paper	✓ Recycling rates are low, with less than half the total used papers recycled in the country. ✓ Besides recycling the used papers, the paperpackets are made from the remnant papers. ✓ The Karnaphuli paper mill of Bangladesh utilizes less than 10% or less recycled fibers in total furnish whereas the private factories for the same use a large amount of recycled fibers with virgin fibers	✓ No mentionable prospects

Plastic	✓ Only 9.2% plastic wastes of Bangladesh are recycled every year ✓ In Dhaka city of Bangladesh; 137.57 tons of plastic is recycled per-day but the health and environmental challenges are not given adequate consideration.	✓ The process of collecting plastic wastes can go along way in helping reduction of pollution and also save the country a lot of its foreign currency exchange.
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Source: Secondary data sources.

From Table 5, it can be observed that the waste amount, prices, and salaries vary depending on the size of the shop and the workers get a salary of 2500-6000 Taka. Small shop usually have few workers which is between 3-5 while in large shops it takes double or even thrice the time to get the workers. Further on, through the buying and selling price of waste one is able to see that large shops get much more per kg as compared to the small shops. Their sold jhut which include fabric or fiber related waste coming from garments are used for dusting, making pockets; converting it to cotton for production of bobin, pillow and mattress. However, the large rejected cloths are purchased by small factories to stitch comparatively inferior quality dresses (Tabassum et al. , 2017).

A software based company from Estonia (Reverse Resources) is attempting at creating a marketplace for garments waste in our country. Furthermore, Simco Spinning and Textiles Limited of Mymensingh can prepare 15 tones yarns per day from the cotton clips which are being cut off during the garments stitching portion.

As per the information published in the Textile Today, Filotex Ltd. is the pioneer garment factory in Bangladesh, which has adopted the 'Circular Fashion' and 3R (Reduce, Reuse, Recycle) concept (Team, 2018). Currently, 'jhut' that are sold to garments mainly exported to countries such as India and China where it can be transformed to fines yarn (Devnath, 2017). As per the apparel sector officials in the top management in a statement to the media, the income doubles if the garments bi-products are recycled and it can be an industry of \$4 billion (Ovi,

2014). It means that if the industry grows, there will be many opportunities for obtaining a new job (Rahman et al. , 2020).

In this sector, some of the major problems that are faced while adopting CE practice are as follows: The management is not much willing to implement CE practice, The required financial, human resource, and technology support is not properly available. Also, the absence of relative consumer interest towards the environment-friendly products is another disadvantage (Saha et al. , 2021). Thus, to combat these challenges a tripartite action plan involving government, industry, and consciousness among the buyer is the need of the hour. Moreover, it is also important to enhance the sharing of knowledge for the sustainable practice of the value chain (Saha et al. , 2021).

b. Tannery Sector

The Tannery Industry is the second largest source of foreign currency earners next to garments in Bangladesh. EPB data reveal that leather and its products share a significant position in the country's export earning; it earned US 1. Consequently, it contributed about AUD 08\$ billion to the country's economy in the 2018–19 period. At present, the tanneries have been found to emit pollutants in to the environment with great intensity. However, none of those tanneries have a practice of recycling and reuse of water. However in tanneries that practice ETP (Effluent Treatment Plant) there is at least a reduction in the level of harm to the environment. In order to minimize negative impact on environment, Bangladesh government has shifted tannery's from Hazaribag to Savar, where population density is low and area is wide compared to Hazaribag (Paul et al. , 2013).

In addition, some CETP (Central Effluent Treatment Plant) has been developed by the government in Savar to treat hazardous wastes from tanneries (Schroeder et al. , 2019). CETP will be integrated with SPGS (Sludge Power Generation System), which has the capacity to produce energy of 5 MW/h (Alamgir et al. , 2017). Additionally, for the purpose of following the government rules and regulations and to fulfill the buyers' requirements, the concept of green supply chain is being implemented in some instances (Moktadir et al. , 2018).

c. Paper Industry

The number of paper mills in Bangladesh are nearly one hundred and these industries are manufacturing 6-8 lac tons of paper annually. After satisfying the national demand for the paper, the country exports the paper to more than 30 countries. The recycling rate of used papers in Bangladesh is below than fifty percent of the total used papers. According to a survey of Dhaka city, there are 6,500 waste collectors called tokais and 3,600 hawkers known as feriwallas to collect used paper. They purchase cartoons for taka fifteen per kilogram and sell them in taka eighteen per kilogram. There are old books which are bought at taka 30 per kilogram and are sold at taka 40 per kilogram. Paper packets are produced using recycled paper and can be purchased at 40-60 Taka per kilogramme (Chakraborty and Aaqib Javed, 2018).

Karnaphuli Papermill is the largest integrated pulp paper industry of Bangladesh and it is state owned. It utilizes 10% or less recycled fiber in the total furnish. Used fiber contributes to 45 percent of all the materials used in the paper industry in the global market. In private factories, the majority of the used fibers are recycled fiber with a little portion of virgin fiber (Quader, 2011). The Karnaphuli papermill is reportedly was discharging huge amounts of wastes into the Karnaphuli River because it does not have an effluent treatment plant (Tribune, 2016).

Since one ton of paper requires approximately 90 tons of water, each paper producing factory must therefore establish its own Effluent Treatment Plant to minimize water usage and prevent the destruction of biomes (Debnath, 2018).

d. Plastic Industry

Bangladesh emerged at 89 in the global scale of plastic export as per the data of Emerging Credit Rating Limited, which identified the growth rate of this sector at 20% per year in the last two decades. Bangladesh consumed 3. According to the Waste Concern, the per capita yearly consumption of plastic was in 2014 was 5 kg. Only 9. This means that only 2 percent of the total plastic used in Bangladesh was recycled; the rest is discarded and it affects the environment negatively (Moazzem, 2016).

Ovi and Mahmud (2019) also identified that if the waste is collected from Dhaka with modern technology, 75% waste materials can be converted into new products where saving 7 billion in foreign exchange can be ensured. The savings in foreign exchange will assist in developing the economy; thereby promoting employment (Rahman et al. , 2020). Furthermore, 137. Currently, 57 tons of plastics are recycled each day in Dhaka Bangladesh, but the sad reality is that health and other environmental concerns are not well handled (Bangladesh, 2010).

Table 4. CE practices and opportunities such as energy sector, agricultural sector, construction sector, E-waste sector, and biomedical sector.

Industry	Current Practices	Opportunities
Energy	✓ Employment of electricity generated from solar; mainly among the rural folks ✓ The largest Solar Power Plant is now operational in Hnila Teknaf, and it is producing up to 28MW of power. ✓ Biomass or Biogas, Wind-power contribute by 1%, and 0.5% of total renewable energy production in Bangladesh. ✓ Renewable Power Plant uses water to produce electricity called Karnaphuli Hydroelectric Power Station, which has the capacity of generating 230 MW of power ✓ A private company which was established with the help of World Bank had installed its power plant in Kapasia, Gazipur	✓ No mentionable prospects

	of Bangladesh and was generating the electricity through biomass. ✓ A furniture manufacturing company in Gazipur of Bangladesh involves biomass run boiler where the said company was enabled to save Tk. 52. 5 lacs per year	
Construction	✓ No mentionable practices	✓ A study on recycling brick in Bangladesh reveals that it can meet the requirements of international standards such as ASTM C33 and it has a compressive strength ranging between 2500 & 5000 psi.
E-waste sector	✓ E-waste recycling is benefiting the economy of Bangladesh by offering a form of employment. ✓ Dhaka city is one of the world's largest takers of electronic waste but only 15% of the total generated E-Waste is being recycled daily and it comes to 475 tones. ✓ According to the available statistics, the year of 2006 is	✓ No mentionable prospects

	very crucial for Bangladesh which has saved about US \$ 4.73 million by extracting lead from the used lead-acid battery. ✓ A major lead-acid battery manufacturing industry of Bangladesh has set up a smelting plant on recycled battery in an environmental friendly way with the projection of reclaiming 660000 batteries and 33000 ton of hard lead annually.	
Ship-breaking	✓ Around 20 thousand metric tones of ships which are beyond economy usage are recycled annually in various yards of Bangladesh. Almost all of the parts of vessels are re-usable; the material is predominantly; steel, and stations for processing such are hence available. ✓ This industry also emitted tremendous revenues and created tremendous revenues	✓ No mentionable prospects
Biomedical	✓ In the Dhaka division, it has been found that biomedical waste & disposal service is provided to the private medical college& hospital by an NGO.	✓ No mentionable prospects

e. Energy Sector

The government of Bangladesh also has an intention to produce 10% of the country's total power from renewable resources which has planned to establish large scale projects liked solar power stations (Nabi, 2019). Further, the use of solar power is more usual commonly to the rural people. From the previous findings, it shows that through the income-generating activity the Solar Home System (SHS) play roles of eradication of poverty; the level of installations was realized to be 5. 8 billion by 2022. They love to install SHS due to its cheaper price than the normal solar power system. Another interviewee, Zohurul Islam of Rahimafrooz, an executive of Bangladesh based solar panel manufacturer, was reported in The Daily Star that people can install 120 W SHS with only 20,000 taka to 25,000 taka. With the stated capacity, a customer is able to power between 3-4 LED Bulbs, 1 Solar running Fan and a Television, suffice for an average family in Bangladesh.

Of the biggest Solar Power Plant in the Hnila Teknaf is now operating where the electricity generation is 28 MW. This Solar Power Plant is the basic show of the governmental towards its 2021 goal of generating 2000MW of power from solar industrial facilities (Correspondent, 2018).

Besides SHC, Biomass & Biogas, wind power plays only less than one per cent of the total non-conventional energy generation. 5 per cent of their total generated electricity from renewable resources and the second ten years at up to 20 per cent untied targets which amount to five per cent of the total renewable energy or power output. Karnaphuli Hydroelectric Power station Yes Renewable location power Source type Total installed capacity Karnaphuli Hydroelectric Power Station is a Hydroelectric power station producing at the rate of 230 MW from water Mozumder 2003. Therefore, the commercial use biogas generation is seen as a potential solution to develop a new renewable energy from Bangladesh (Islam et al. ,2021). There is a private company which has been funded by World Bank and has established its electricity generation plant in Kapasia, Gazipur of Bangladesh which has adopted biomass as fuel. The feedstock for this generation of biogas is husk three bags of rice husk per a day would yield 30-40 KW of energy. Similarly, a furniture manufacturer in Gazipur, Bangladesh have installed a biomass fired boiler which is helping Tk. 52. yet, the annual income of a villager is only 5 lacs per year (Bangladesh, 2010).

Islam et al. (2021) suggest an approach for offering soft-loans particularly to the low-income communities to enhance their utilization of biogas.

f. Agricultural Sector

Some of the districts in Bangladesh utilize waste water for especially agricultural purposes like irrigation. In Rajshahi the process is currently being done since 1976. Attached is a snapshot of farmers who prefer using waste water because it reduces the amount of fertilizer needed in addition to water scarcity of fresh water. Situation of Rajshahi: In the case of Rajshahi, a survey investigated the views of the farmers and 70% of them said that they require lesser amount of expense on fertilizer because of waste water (Kumar et al. , 2008). Hence in the rural areas the major wastes that are recycled are those from the agricultural operations, and these are decomposed to form compost fertilizers used on agricultural lands beside inorganic fertilizers as noted by Ara et al. , (2020). Also, the national 3R strategy required the usage of organic fertilizer, which was promoted in the production of palm oil.

These cities produce waste of 13332 tonnes every day being 72% organic wastes. From-45 million ton of straw to 35 million ton dung, 5 million ton poultry litter are produced in our country annually which is the basic input for making organic fertilizer (Islam, 2015). At the stakeholder preliminary stage, the Department of Environment paved the way in providing the initiative in Bangladeshi municipalities to launch composting operation (T. B. Yousuf, 2014). From the domestic waste materials collected from Khulna city, 30 tons of compost fertilizer is prepared monthly by an NGO – RUSTIC. The following are the existing composting firms in Dhaka city, one of which is a small private firm specialized in collection of organic wastes through transporting and converting it into compost fertilizer that is sold to farmers (Chowdhury et al. , 2014). Here, it is crucial to mention that the livestock sector in Bangladesh contributes only 26 percent of the total emission. Greenhouse gases in the form of carbon dioxide equivalent quantity amounted to 55 million tons. In their review on the prospects of applying the CE-based approaches, K. N. Islam et al. (2021) have reported that, thereby achieving a reduction by 37. Whereas, ODA from China has contributed an average of 5 percent below the BAU emission levels. In addition, in the context of poultry farming in Bangladesh the above said 3R strategy is

not being practiced but forming reverse supply chain and 3R strategy can earn more income with protecting environment from pollution according to the findings of Shamsuddoha et al. (2011).

g. Construction Sector

As Bangladesh is one of the developing countries of the world, the construction practice is found across different regions. However, proper waste management practice has not been observed widely in construction project. Construction waste is usually dumped in landfill which has a negative impacts to the environment because it does not involve reusing and recycling .

In construction, the primary material is bricks essential for building houses and other structures. Bricks are manufactured from clay which is burnt at nearly 1,100C, thus resulting in a substantial amount of pollution of the environment. Research has revealed that about 40 percent fine particles in the air of Dhaka City strictly originates from the brick industry. Indeed, a research survey conducted in Bangladesh revealed that the above cycled bricks meet standards set by ASTM C33 and has a mortar of approximately 2500-5000 psi as stated by (D. M. T. Uddin, 2019). So, recycling bricks can go a long way in sparing Bangladesh the ignominy of being a Environment polluter and an exploiter of resources.

h. E-waste Sector

E-waste has dangerous hazardous materials which are capable of posing threatening consequences to our ecosystem and more so the persons living close to the place of dumping (D. Yousuf and Reza, 2011). Since the progressive modernization of Bangladesh through digitization, the rate of E-waste has grown to a very high rate (Aowsaf, 2019). Whereas, according to the record of 2019, the generation of E-waste in the total quantum in Bangladesh was 199 kilo tonnes. The E-waste generation in Bangladesh was 346.36 KT and it was analyzed that the percentage of growth is 20 percent per year and the generation will be 4620 kilo tonnes in 2045 BUET (Aowsaf, 2019).

In regards to the Effectiveness and efficiency of the E-waste recycling industry, one could say that it is highly factor for the economy. There are so many employment opportunities which have been made available by the new business entity. In turn employment opportunity will rise as the level of those utilizing E-waste will also rise such as in the following. This is due to the fact that E-waste is being produced at very high rate and the government has had to put out new laws that can deal with their disposal.

In the Dhaka city, for instance, it is estimated that only about 15% of total waste that is generated daily, is recycled and this amounted to 475 tones as estimated by S. Hossain et al. (2010). The paper also cites that Bangladesh was able to save nearly US \$ 4, in 2006. 73 million by only regenerating lead from the used lead-acid battery.

Currently, the battery buyback business is dominated by only one firm, which is in the private sector. In an effort to promote ‘green’ production, one of Bangladesh’s biggest producers of lead-acid battery recently set up a plant for the environmentally sound recycling of batteries with the target of recycling 660,000 batteries and recovering 33,000MT of hard lead every year and this was made possible when the government encouraged the producer to launch the environmentally friendly plant(Bangladesh, 2010).

i. Ship-breaking Industry

The ship recycling yards are located at Chittagong part of southern region of Bangladesh. According to the NGO Shipbreaking Platform report Bangladesh tops the list of ship breaking destinations globally and the volume of business executed in 2018 was highest (Patwary, 2019). In fact, nearly 2,00,000 metric tonnes of such ships are got recycled yearly in total yards of Bangladesh. The vessels are constructed mainly of steel; most parts of vessels can be, in principle, recycled. This industry is also opening the doors to massive revenues and employment. However, adequate implementation of environmental and safety measures in these yards is not sustainable in an appropriate manner (K. Hossain, 2017).

The European Commission also claims that 40% of Chittagong’s coast is used for ship recycling and that weather from the sea impacts the quality of the air. For environmental conservation, the Environment regulation should be adhered to, while the teardown of the ship, which is most

hazardous to the environment, should not be imported and there is the need to have proper implementation of environmental laws (Sejan, 2019).

j. Biomedical Waste Collection and Disposal

The government has failed to maintain an adequate amount of health care facilities and also cut throat carelessness for disposing of garbage which can lead to severe environmental problems, as well, health care is at the stake due to these diseases like hepatitis and HIV etc. Later, in the same year, biomedical waste and disposal service to the private hospitals in Dhaka city is provided by an NGO. This NGO wants to encourage the health care facilities to work for the improvement of their internal climate, make the urban environment clean and less hazardous for the people, make every effort to minimize the occupational health risks at the workplace of health sector employees in Bangladesh (Bangladesh, 2010).

4.3. Challenges to implement CE in Bangladesh

The current Government of Bangladesh has given focus to issues of the environment. Due to the prevalence of Article 18A in the constitution of Bangladesh, the state is obliged to try to conserve the environment and enhance it, to maintain and preserve natural resources, biodiversity wetlands, forests, and wildlife for the existing and forthcoming generations. Unlike the Article 12 of the Environment Conservation Act 1995 it is implied that every industry should have the Environment Clearance Certificate from the director-general. Nevertheless, the Environment Conservation Rule 1997 divided various lists of projects where the Environment Clearance Certificate to be given. The POPsystem has distinguished four groups: Green, Orange A, Orange B, and Red.

However, the Environmental Clearance Certificate companies in Bangladesh are violating lot of laws and polluting the environment at a very fast pace in exchange of farmlands as wastage. (M. Yousuf, 2019). Even in the cases of the concentrations of most polluting parameters in the effluents the values were higher compared to the respective allowable discharge limits (Azizul Haq, 1989). Some of the evidences of industrial pollution include smoke emission, poor disposal

system for solid wastes, and discharge of untreated effluent into lakes, rivers, and ground water as postulated by Alam (2009).Moktadir et al. (2020) identified that the scarcity of operational financial facilities as one of the factors hindering the formulation of circular economy Model in the BMCs in Bangladesh. According to Dulia et al. (2021), the most significant concern regarding CE practices is the decrease in quality of the final end products that are produced with recycled materials.

We also talked with Dr. Muhammad Saiful Islam, a faculty of Department of Civil & Environmental Engineering, Shahjalal University of Science & Technology, Bangladesh about some hardship in setting circular economy model new in Bangladesh during the interview. Verbal communication: Siri predes & Dr. Muhammad Saiful Islam, Personal conversation, 1st December 2020 at 235 PM.

In his opinion, there are three big technological challenges or obstacles that help to avoid implementation of this model: weak knowledge utilization skill new technology, undefined or unrecognized reasons to apply this ‘green’ technology, and low level of public awareness. These are policy barriers such as the absence of research based policy and policy generated from research; the non friendly nature of the technology; the improper policy and guidelines as to how the model can be effectively applied; lack of experienced personnel to assess whether the model is correctly applied in real situations; lack of bureaucracy and institutional policies as to how the model can be implemented in the field; lack of funding. Lastly, the lack of goals and outputs in a general manner.

He further added ‘Our ignorance and culture to pollute the environment by generating waste, Information and motivation regarding the importance of recycling, reducing and reuse waste /products are the worst facets of public participation among the most significant barriers to this.

There are different challenges as listed by Dr. Islam and other environmental researcher Professor Dr. Mohammed Yusuf from Bangladesh has been with me all along. He also said that Bangladesh has the over all edge to implement the model of circular economy on solid wastage than the liquid wastage treatment. That, however, major steps should come from the policymakers, he insisted with a note of assertion couched in his voice. [Based on verbal communication with Dr. Mohammed Yusuf on the 28th of November in the year 2020].

Engr. Mujahidul Islam another young Bangladeshi who is now working in Turkey as an environment and water resource engineer recalled the various exposures he had made in Bangladesh. He opine the issues that factory owners and lawenforcementagencies confront with is that the latter are very involved in this role. Unfortunately, some environmental officers are receptive to lenient rules at the expense of their revenue by failing to enforce the these laws. They chop a few dollars from factory owners and go ahead and pollute our environment. The author has discussed this with Mujahidul Islam formally during a formal interview on December 13, 2020.

In another interview, we have another face of Bangladesh Environmental consultant Engineer, Sahadat Hossain who is working at the world bank funded project. As for him, his opinion is that though policymakers have to contribute much, stakeholders' action is more significant in relation with the model of circular economy. In this regard, it was found that most of the producers ignore the law and possible environmental impacts to recycle wastages. This is a disturbing mentality for many producers because their mindset is not very friendly to the protection of the environment. These findings were stated by Sahadat Hossain in a conversation with the author on December 18, 2020.

Table 5 shows the brief analysis of the different issues that hinder the adoption of CE practices in Bangladesh.

Barriers	Key Points
Technological barriers	- The lack of clarity on their effectiveness - Some of the employees may lack knowledge about new technologies. - Insufficient knowledge of new operating technologies
Policy barriers	- Lack of targets and achievements - Absence of funding, and the supporting resources - Absence of adequate policy framework/ guide - Lack of research-based knowledge, and user-friendly technology

	• Lack of organizational skills, and knowledge • Failure to adhere to environmental policies
• Public participation barriers	• Lack of environmental knowledge and, negative attitude towards the environment. • Ignorance about environmental problems such as CE • Lack of motivation • Lack of financial facilities

Table 5. Challenges in implementing CE model in Bangladesh.

According to Moktadir et al. (2018), Saha et al. (2021), Azizuddin et al. (2021), Ali et al. (2021), and Yadav et al. (2021), many of the existing barriers mentioned in Table 5 are also substantiated. The mentioned barriers (Table 5) were also reaffirmed by other authors in relation to Bangladesh, while according to Saha et al. (2021) the problems stemmed from the improper management, lack of technology, financing and human resources. In addition to these, the author attributed the absence of demand consciousness with regard to environmental friendly products as a major factor. Similar to Saha, et al. (2021), Azizuddin, et al. (2021) recalled that a considerable amount of awareness is still a problem among the public as well as technology support; the authors also pointed at the lack of logistic for implementation of CE practices. Besides, the inadequate knowledge amongst the stakeholders was also mentioned by Moktadir et al. (2018) for instance they attributed poor policy formulation and execution. In addition to the aforementioned, the specific barriers obtained from the interview include lack of information engaging research, and official's corruption.

Apart from the issues discussed above, getting to know another concept of circular justice, which was attributed to Julian Kirchherr (2021) as a fact of making employees redundant for the purpose of shifting to CE practices. The author enticed that CE transition's advantage be made globally sustainable and equitable; hence suggested that there be sharing of technologies, and greater research emphasis, or indeed bias, put on the developing world. Nevertheless, as we pointed earlier in the findings section, there is a positive economic effect of shifting towards CE, which suggests more employment opportunities (Ovi (2014); Ovi and Mahmud (2019); Rahman et al. (2020); M. Uddin (2018)). But if it lags behind because of the technological developments

that are in comparison to the developed countries, it might lead to job loss (Julian Kirchherr, 2021; Repp et al. , 2021).

As for the approach to address the barriers while incorporating CE practices, according to Hartley et al. (2020), there were some main policies suggested. The authors suggested engaging stakeholders in the following ways including; the fabrication of standard circular practice norms, boosting circular procurement, providing factories with a tax exemption if they adopt CE models, and reversing legal policies that hinder waste trading, promoting circular trading platform, establishing an eco-industrial park, and enhancing the visibility of existing waste databases. In addition, a country must achieve the following to realize sustainable development. There is a need for the combination of both government and non-government efforts to bring CE into practice in the context of Bangladesh (Azizuddin et al. , 2021).

Chapter 5

Findings and Suggestions

5.1 Findings

The collected data showed that the phenomenon of reuse & recycling was discussed actively in the last few years within the framework of Bangladesh's general public, and e-commerce practices on Facebook allowed importing second-hand goods' restrictions. What we found to cut out the garment waste bi-products, the income of this sector can get double to the industry. Here the problem of consumers don't have a preference for fresh green product consumption remains a problem in this sector. Only 9. It has also found that 2% recyclable wastes of Bangladesh are recycled annually. In Dhaka city of Bangladesh; Altogether: 137. 57 tons of plastic is recycled per-day, but the health and environment implications which are equally disagreeable are not given their deserved attention. The three include Biomass and Biogas and Solar home system (SHS) it is renewable source of energy as they assist in income generating activities hence eradication of poverty. Water for washing in Rajshahi regions, the organic fertilizer which is produced from organic wastes, such as straw, dung and poultry litter are promoted through the national 3R strategy. Poultry farming is in operation in Bangladesh but 3R strategy is not in practice, but if it practices by rearing birds on the basis of reverse supply chain then it is possible

to earn more income without polluting the environment. The burned bricks incorporated in construction sector pollutes the environment and pollutes the surroundings as landfilling the construction waste is rampant while recycling and reusing are almost unheard of. In Ship-breaking Industry an immense identifying aspect is that most of the parts of vessels, which are made of steel, are recyclable and this generates a lot of revenue and employment. However, legal requirements and environmental and safety concerns are not implemented effectively. Disposal of biomedical waste and providing this service to hospitals have become a big issues for Dhaka city. Contribution to the ... health care facilities improvement, decrease of pollution of the urban environment, decrease of the public health risk by elimination of the occupational diseases which may be connected with the health care sector.

5.2 Suggestions

If the bi-products of garments waste are recycled properly then new jobs will be generated and unemployment will also not remain. Government support along with sharing of sustainable knowledge to all the stakeholders involved in the value chain of the industry and awareness of buyer is needed in order to overcome the problem of no preference among the consumer. So just in this plastic waste, I proposed that the plastic waste collection could assist in the reduction of pollution and also save the large amount of money in foreign exchange. In the case of construction building, if the use of recycled bricks are incurred, it can be beneficial to Bangladesh as these actions do not pollute the environment and does not exploit resources. The keeper ship breaking industry is to enhance its consciousness among the people and environmental laws should be properly formulated in eliminate the waste and for creating new employment opportunities. Lastly, I suggested that standards circular practice norms must be developed, the Western & Central procurement circle should be extended, factory that has implemented the CE models should be given tax, legal hindrances to waste trading should be eliminated, circular trading platforms should be promoted, an industrial park based on cyclic economy should be set & waste databases must be made more available. Realization of CE practices for achieving sustainable development in Bangladesh needs to be complemented with government and private hybrid partnership.

Chapter 6

Conclusion

The circular economy model is eventually one of the most prospective models, which the world looking forward to for sustainable development. Innovation and modern technology required institutions of the society to deem waste as a valuable product in many places across the globe. In many countries, people are converting wastes to making house, pants, cutlery, carpets and so on and so forth. The practice of circular economy is partly in existence in Bangladesh in various sectors. Recycling of waste is most often utilized by large business establishments in Bangladesh. However, the major challenges affecting the overall implementation of the model involve inadequate technological skills and human talent alongside inadequate public awareness of the technology, and adequate funding, ineffective policies, insufficient research-based information, and lack of implementation of the law mostly by vrch, due to bribery by officials. Bangladesh will derive a lot of benefits because the circular economy model would help the nation avoid the exhaustion of resources and emergencies of pollution, hence development. The government must promote the sentiment of circular economy in Bangladesh, and to enforce the already existing legislation of Environmental Law in the country more seriously.

As the number of CE studies remain scarce in case of Bangladesh, this study shall go a long way aiding the stakeholders to come up with effective sustainable long-term decisions pertaining to production, consumption as well as the policymaking. In addition, in the future days, more work will be needed on this topic and it is possible to identify all these sectors of Bangladesh accurately, by using more empirical methods focusing on primary data collection or secondary data collection.

Despite not able to provide strong evidence to support the CE in Bangladesh, some research limitations can be mentioned; which can pave way for improvement in the subsequent research on this subject. The assumption was based on the contextual restraints of interviewing a relatively small sample from the health conditions emerged by COVID-19; and, the accuracy of secondary data may also be prone to error, especially the one sourced from governmental data. Still, these are all the limitations of this research while the authors tried as much as possible to bring this studies to higher level of consistencies and ensure the quality of the collected data to be useable.

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